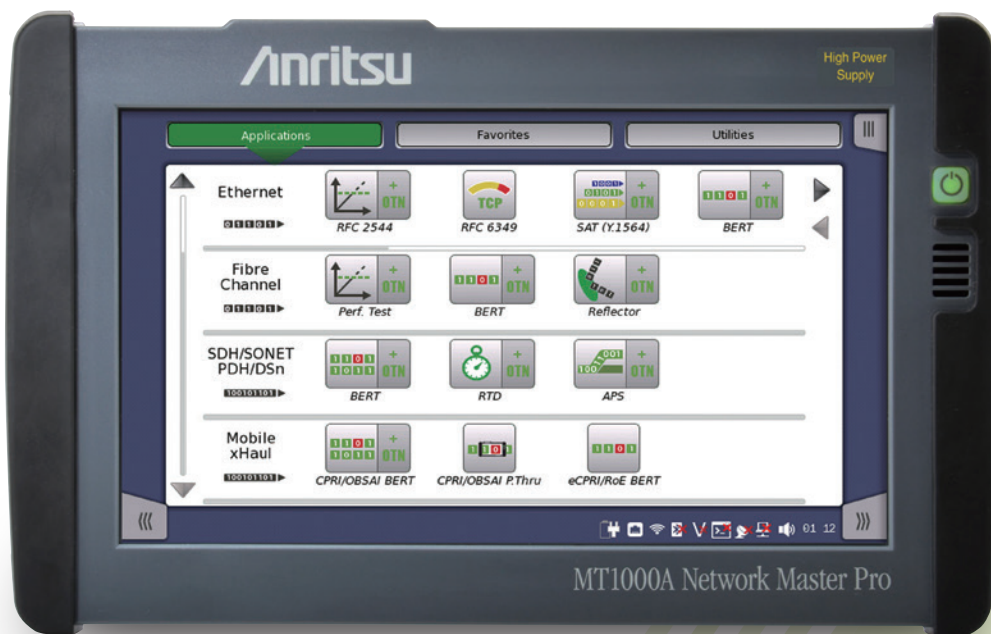


**Anritsu** Advancing beyond

# Network Master™ Series

## Network Master Pro MT1000A

|                                              |           |
|----------------------------------------------|-----------|
| 10G Multirate Module                         | MU100010A |
| 100G Multirate Module                        | MU100011A |
| High Performance GPS Disciplined Oscillator  | MU100090A |
| High Performance GNSS Disciplined Oscillator | MU100090B |



# Network Master Pro MT1000A Overview

## Redefining Transport Testing

Network standards for transport tests are becoming more diverse, such as Ethernet, OTN, SDH/SONET, eCPRI/RoE/CPRI/OBSAI, PTP, Fibre Channel, etc. Additionally, speeds are increasing with 100G/25G Ethernet and 16G Fibre Channel development, and networks are continuing to evolve. With an easily configured modular design to support changing network standards and an easy-to-use GUI, the Network Master Pro MT1000A is perfect for speedy I&M of wide-area networks.

### Evolving Networks and Required Test Equipment

Core and metro networks are progressing to 100G interfaces. In addition, operators are also examining adoption of new and more types of client interfaces. Onsite network I&M work requires cost-effective support for diversifying services at speeds from 1G to 100G with a field tester that improves work efficiency.

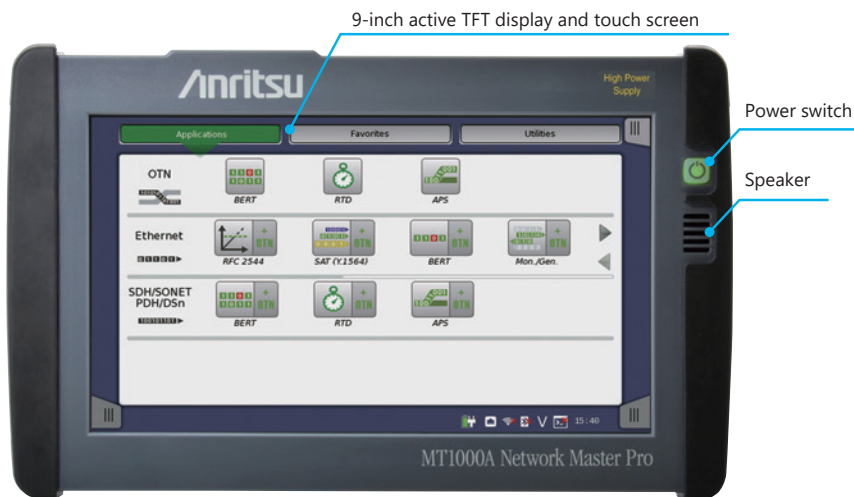
- All-in-one transport tester
  - supports testing from 1.5 Mbps to 100 Gbps
- Easy and intuitive GUI
- WLAN\*1/Bluetooth\*2/LAN connectivity
- PDF, CSV and XML report generation for documenting test results
- Remote operation
- Remote control
- Compact, lightweight design for maximum field portability
- Modular platform ensuring maximum return on investment

\*1: Available for certified countries and regions including USA, Canada, Japan and EU countries. Please visit the Anritsu web site for updated information.

\*2: Although this product has not been approved by Bluetooth SIG, the supported frequencies are in the range assigned to Bluetooth® communications.

## Connector Panel Overview

### Front View



Just a fraction larger than 9-inch screen

# Connector Panel Overview

## Top View

### 10G Multirate Module MU100010A



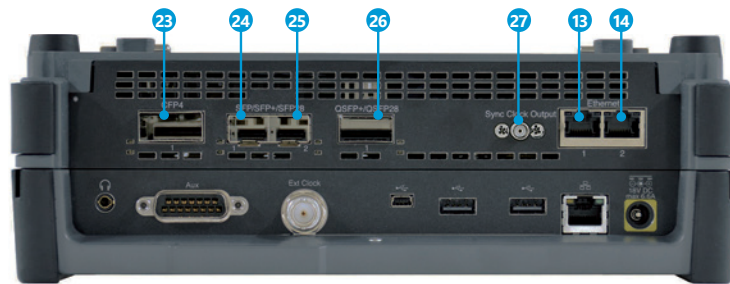
Module  
10G Multirate Module

MU100010A

Mainframe  
Network Master Pro

MT1000A

### 100G Multirate Module MU100011A



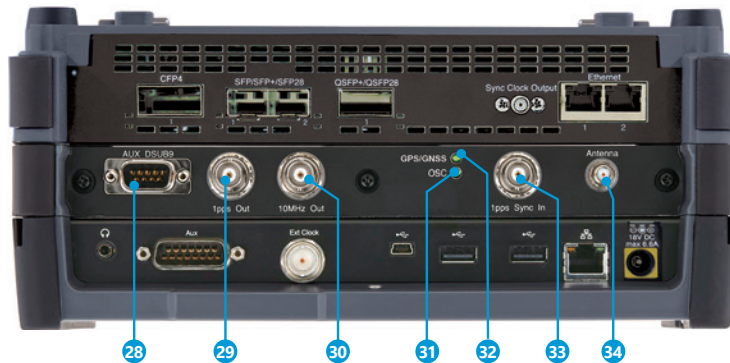
Module  
100G Multirate Module

MU100011A

Mainframe  
Network Master Pro

MT1000A

### High Performance GNSS Disciplined Oscillator Configuration



Module  
100G Multirate Module

MU100011A

Module  
High Performance GNSS Disciplined Oscillator

MU100090B

Mainframe  
Network Master Pro

MT1000A

- |                                                                                                   |                                                                                                   |
|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 1 Port 1, Tx Bantam (DS1)                                                                         | 18 USB Mini-B                                                                                     |
| 2 Port 1, Tx BNC (E1, E3, E4, DS3, STM-1e, STS-3)                                                 | 19 USB A                                                                                          |
| 3 Port 1, Rx Bantam (DS1)                                                                         | 20 USB A                                                                                          |
| 4 Port 1, Rx BNC (E1, E3, E4, DS3, STM-1e, STS-3)                                                 | 21 Ethernet Service Interface                                                                     |
| 5 Port 2, Tx Bantam (DS1)                                                                         | 22 DC Input (18 Vdc)                                                                              |
| 6 Port 2, Tx BNC (E1, E3, E4, DS3, STM-1e, STS-3)                                                 | 23 Port1, Tx/Rx CFP4 (OTN, Ethernet, eCPRI/RoE)                                                   |
| 7 Port 2, Rx Bantam (DS1)                                                                         | 24 Port1, Tx/Rx SFP/SFP+/SFP28<br>(OTN, Ethernet, eCPRI/RoE/CPRI/OBSAI, Fibre Channel, SDH/SONET) |
| 8 Port 2, Rx BNC (E1, E3, E4, DS3, STM-1e, STS-3)                                                 | 25 Port2, Tx/Rx SFP/SFP+/SFP28<br>(OTN, Ethernet, eCPRI/RoE/CPRI/OBSAI, Fibre Channel, SDH/SONET) |
| 9 Port 1, Tx/Rx RJ48 (E1 balanced)                                                                | 26 Port1, Tx/Rx QSFP+/QSFP28 (OTN, Ethernet, eCPRI/RoE)                                           |
| 10 Port 2, Tx/Rx RJ48 (E1 balanced)                                                               | 27 Port1, Sync. Clock Output                                                                      |
| 11 Port 1, Tx/Rx SFP/SFP+ (OTN, Ethernet, eCPRI/RoE/CPRI/OBSAI, Fibre Channel, SDH/SONET optical) | 28 AUX (D-SUB 9 pin)                                                                              |
| 12 Port 2, Tx/Rx SFP/SFP+ (OTN, Ethernet, eCPRI/RoE/CPRI/OBSAI, Fibre Channel, SDH/SONET optical) | 29 1 pps Output (REF)                                                                             |
| 13 Port 1, Tx/Rx RJ45 (Ethernet, eCPRI/RoE electrical)                                            | 30 10 MHz Output                                                                                  |
| 14 Port 2, Tx/Rx RJ45 (Ethernet, eCPRI/RoE electrical)                                            | 31 OCS LED                                                                                        |
| 15 Audio (3.5ø: CTIA Standard)                                                                    | 32 GNSS received LED                                                                              |
| 16 AUX (D-SUB 15 pin)                                                                             | 33 1 pps Sync In                                                                                  |
| 17 Clock Input                                                                                    | 34 GNSS Antenna Input                                                                             |

# Network Master Pro MT1000A Mainframe Specifications

|                     |                                                                               |
|---------------------|-------------------------------------------------------------------------------|
| User Interfaces     |                                                                               |
| Display             | 9-inch active TFT display (800 × 480 pixels) and touch screen                 |
| Supported Languages | English, Chinese, Japanese, French, Russian, Spanish, Finnish, Korean, German |

|                       |                                                                                                                |
|-----------------------|----------------------------------------------------------------------------------------------------------------|
| Service Interfaces    |                                                                                                                |
| USB Data Interface    | MT1000A operates as host: USB 2.0 type A (2 ports)<br>MT1000A operates as device: USB 2.0 type Mini-B (1 port) |
| Ethernet Interface    | Ethernet 10M/100M/1000M, Connector: RJ45                                                                       |
| WLAN Interface*1      | IEEE 802.11 b/g/n                                                                                              |
| Bluetooth Interface*2 | Bluetooth 2.1 +EDR                                                                                             |

\*1: Available for certified countries and regions including USA, Canada, Japan and EU countries. Please visit the Anritsu web site for updated information.

\*2: Although this product has not been approved by Bluetooth SIG, the supported frequencies are in the range assigned to Bluetooth® communications.

|                      |                                                                                                                                                                                                                                |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Other Interfaces     |                                                                                                                                                                                                                                |
| Audio Interface      | For connection of CTIA Standard head set<br>Connector: 3.5-mm diameter jack                                                                                                                                                    |
| AUX Connector        | For connecting optional G0325A GPS receiver<br>With MT1000A-005, following two interfaces are available using J1705A<br>1PPS Ref In: TTL 50Ω/DC<br>1PPS Test In: TTL 50Ω/DC                                                    |
| Built-in Loudspeaker | Monitors speech of voice channel<br>Output level: user-controlled from user interface                                                                                                                                          |
| Internal Clock       | Accuracy: ±4.6 ppm or less, STRATUM3 compliant                                                                                                                                                                                 |
| Ext. Clock Input     | For connection of external clock signals:<br>SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps) or 2.048 MHz TTL signal in accordance with ITU-T G.703,<br>10 MHz TTL signal in accordance with ITU-T G.703<br>Connector: BNC (50Ω) |

|                     |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Miscellaneous       |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Battery             |      | 10.8 V rechargeable and replaceable intelligent Li-ion battery<br>Operating time: 1.5 hours (typ., in case of 100 GbE)<br>Charging time: 6 hours (Max.)<br>Remaining capacity indication: %                                                                                                                                                                                                                                                                                        |
| Mains Adapter       |      | Input: 100 V(ac) to 240 V(ac), 50 Hz/60 Hz<br>Output: 18 V(dc), 3.62 A (max.)<br>Power Consumption: ≤65 W<br><br>With MT1000A-006*3<br>Input: 100 V(ac) to 240 V(ac), 50 Hz/60 Hz<br>Output: 18 V(dc), 6.6 A (max.)<br>Power Consumption: ≤120 W                                                                                                                                                                                                                                   |
| Dimensions and Mass |      | 257 (W) × 164 (H) × 82 (D) mm (Exclude Projection, MT1000A + MU100010A)<br>257 (W) × 164 (H) × 89 (D) mm (Exclude Projection, MT1000A + MU100011A)<br>2.7 kg (including MT1000A, MU100010A and battery)<br>2.7 kg (including MT1000A, MU100011A and battery)                                                                                                                                                                                                                       |
| Environmental       |      | Temperature<br>Operating : 0°C to +50°C (non-condensing)<br>Charging: 0°C to +40°C (non-condensing)<br>Storage: −30°C to +60°C (non-condensing, without battery or AC adapter)<br>−20°C to +50°C (non-condensing, with battery and AC adapter)<br><br>Humidity<br>Operating: ≤85% RH (non-condensing)<br>Storage and Transportation: ≤90% RH (non-condensing, without battery and AC adapter)<br>Storage and Transportation: ≤85% RH (non-condensing, with battery and AC adapter) |
| CE                  | EMC  | 2014/30/EU, EN61326-1, EN61000-3-2                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                     | LVD  | 2014/35/EU, EN61010-1                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                     | RoHS | 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018                                                                                                                                                                                                                                                                                                                                                                                                                                      |

\*3: MT1000A-006 is required for MU100011A.



Network Master Pro MT1000A with MT1000A-006  
(A yellow border is printed around DC Input.)



Network Master Pro MT1000A

# 10G Multirate Module MU100010A Specifications

| Test Interface |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|----------|------------|----------|-----------|------|------------|----------|------|------------|-----------|------|------------|----------|-----|-------------|-----------|-----|------------|--------------|------|------------|-------------|-----|-------------|-------------|-----|--------------|--------------|-----|---------------|--------------|------|------|------------------|-----|------|------------------|------|-------|------------------|------|-------|------------------|------|-------|------------------|------|-------|------------------|------|------|-------------|-----|------|------------|-----|------|-----------|-----|------|----------|------|-------|---------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|----------|----------|------------|----|------------|-----------|----|-------------|-----|----|--------------|-----|-----|------------|------------|-----|-------------|-----|--------------|-------------|-----|--------------|------------|-----|--------------|-------------|-----|--------------|-------------|-----------|--------------|-------------|-----------|--------------|-------------|------|--------------|-------------|------|--------------|-------------|------|--------------|--------------|------|----------|----------|-----|----------|-----------|-----------|----------|-----------|-----------|----------|-----------|------|
| Test Port      | SFP/SFP+: 2 slots<br>SFF-8431, SFF-8472 compliant, IEEE 802.3ae-2002, IEEE 802.3-2008 compliant<br>RJ45: 2 sockets<br>IEEE 802.3-2008 10BASE-T, 100BASE-TX, 1000BASE-T compliant<br>Auto MDI-X<br>10 Mbps/100 Mbps full/half duplex, 1000 Mbps full duplex<br>BNC: 2 ports (75Ω)<br>ITU-T G.703 compliant<br>RJ48: 2 sockets<br>ITU-T G.703 compliant<br>RTT Bantam: 2 ports<br>ANSI DS1.102 compliant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| Bit Rate*1     | <table><tr><th>Standard</th><th>Bit Rate</th><th>Interfaces</th></tr><tr><td>10BASE-T</td><td>12.5 Mbps</td><td>RJ45</td></tr><tr><td>100BASE-TX</td><td>125 Mbps</td><td>RJ45</td></tr><tr><td>1000BASE-T</td><td>1.25 Gbps</td><td>RJ45</td></tr><tr><td>100BASE-XX</td><td>125 Mbps</td><td>SFP</td></tr><tr><td>1000BASE-XX</td><td>1.25 Gbps</td><td>SFP</td></tr><tr><td>10GBASE-XX</td><td>10.3125 Gbps</td><td>SFP+</td></tr><tr><td>STM-1/OC-3</td><td>155.52 Mbps</td><td>SFP</td></tr><tr><td>STM-4/OC-12</td><td>622.08 Mbps</td><td>SFP</td></tr><tr><td>STM-16/OC-48</td><td>2.48832 Mbps</td><td>SFP</td></tr><tr><td>STM-64/OC-192</td><td>9.95328 Mbps</td><td>SFP+</td></tr><tr><td>OTU1</td><td>2.666057143 Gbps</td><td>SFP</td></tr><tr><td>OTU2</td><td>10.70922532 Gbps</td><td>SFP+</td></tr><tr><td>OTU1e</td><td>11.04910714 Gbps</td><td>SFP+</td></tr><tr><td>OTU2e</td><td>11.09572785 Gbps</td><td>SFP+</td></tr><tr><td>OTU1f</td><td>11.27008929 Gbps</td><td>SFP+</td></tr><tr><td>OTU2f</td><td>11.31764241 Gbps</td><td>SFP+</td></tr><tr><td>1GFC</td><td>1.0625 Gbps</td><td>SFP</td></tr><tr><td>2GFC</td><td>2.125 Gbps</td><td>SFP</td></tr><tr><td>4GFC</td><td>4.25 Gbps</td><td>SFP</td></tr><tr><td>8GFC</td><td>8.5 Gbps</td><td>SFP+</td></tr><tr><td>10GFC</td><td>10.51875 Gbps</td><td>SFP+</td></tr></table> |            | Standard | Bit Rate | Interfaces | 10BASE-T | 12.5 Mbps | RJ45 | 100BASE-TX | 125 Mbps | RJ45 | 1000BASE-T | 1.25 Gbps | RJ45 | 100BASE-XX | 125 Mbps | SFP | 1000BASE-XX | 1.25 Gbps | SFP | 10GBASE-XX | 10.3125 Gbps | SFP+ | STM-1/OC-3 | 155.52 Mbps | SFP | STM-4/OC-12 | 622.08 Mbps | SFP | STM-16/OC-48 | 2.48832 Mbps | SFP | STM-64/OC-192 | 9.95328 Mbps | SFP+ | OTU1 | 2.666057143 Gbps | SFP | OTU2 | 10.70922532 Gbps | SFP+ | OTU1e | 11.04910714 Gbps | SFP+ | OTU2e | 11.09572785 Gbps | SFP+ | OTU1f | 11.27008929 Gbps | SFP+ | OTU2f | 11.31764241 Gbps | SFP+ | 1GFC | 1.0625 Gbps | SFP | 2GFC | 2.125 Gbps | SFP | 4GFC | 4.25 Gbps | SFP | 8GFC | 8.5 Gbps | SFP+ | 10GFC | 10.51875 Gbps | SFP+ | <table><tr><th>Standard</th><th>Bit Rate</th><th>Interfaces</th></tr><tr><td>E1</td><td>2.048 Mbps</td><td>RJ48, BNC</td></tr><tr><td>E3</td><td>34.368 Mbps</td><td>BNC</td></tr><tr><td>E4</td><td>139.264 Mbps</td><td>BNC</td></tr><tr><td>DS1</td><td>1.544 Mbps</td><td>RTT Bantam</td></tr><tr><td>DS3</td><td>44.736 Mbps</td><td>BNC</td></tr><tr><td>STM-1e/STS-3</td><td>155.52 Mbps</td><td>BNC</td></tr><tr><td>CPRI Option1</td><td>614.4 Mbps</td><td>SFP</td></tr><tr><td>CPRI Option2</td><td>1228.8 Mbps</td><td>SFP</td></tr><tr><td>CPRI Option3</td><td>2457.6 Mbps</td><td>SFP, SFP+</td></tr><tr><td>CPRI Option4</td><td>3072.0 Mbps</td><td>SFP, SFP+</td></tr><tr><td>CPRI Option5</td><td>4915.2 Mbps</td><td>SFP+</td></tr><tr><td>CPRI Option6</td><td>6144.0 Mbps</td><td>SFP+</td></tr><tr><td>CPRI Option7</td><td>9830.4 Mbps</td><td>SFP+</td></tr><tr><td>CPRI Option8</td><td>10137.6 Mbps</td><td>SFP+</td></tr><tr><td>OBSAI 1x</td><td>768 Mbps</td><td>SFP</td></tr><tr><td>OBSAI 2x</td><td>1536 Mbps</td><td>SFP, SFP+</td></tr><tr><td>OBSAI 4x</td><td>3072 Mbps</td><td>SFP, SFP+</td></tr><tr><td>OBSAI 8x</td><td>6144 Mbps</td><td>SFP+</td></tr></table> |  |  | Standard | Bit Rate | Interfaces | E1 | 2.048 Mbps | RJ48, BNC | E3 | 34.368 Mbps | BNC | E4 | 139.264 Mbps | BNC | DS1 | 1.544 Mbps | RTT Bantam | DS3 | 44.736 Mbps | BNC | STM-1e/STS-3 | 155.52 Mbps | BNC | CPRI Option1 | 614.4 Mbps | SFP | CPRI Option2 | 1228.8 Mbps | SFP | CPRI Option3 | 2457.6 Mbps | SFP, SFP+ | CPRI Option4 | 3072.0 Mbps | SFP, SFP+ | CPRI Option5 | 4915.2 Mbps | SFP+ | CPRI Option6 | 6144.0 Mbps | SFP+ | CPRI Option7 | 9830.4 Mbps | SFP+ | CPRI Option8 | 10137.6 Mbps | SFP+ | OBSAI 1x | 768 Mbps | SFP | OBSAI 2x | 1536 Mbps | SFP, SFP+ | OBSAI 4x | 3072 Mbps | SFP, SFP+ | OBSAI 8x | 6144 Mbps | SFP+ |
| Standard       | Bit Rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Interfaces |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| 10BASE-T       | 12.5 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | RJ45       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| 100BASE-TX     | 125 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | RJ45       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| 1000BASE-T     | 1.25 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | RJ45       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| 100BASE-XX     | 125 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | SFP        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| 1000BASE-XX    | 1.25 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SFP        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| 10GBASE-XX     | 10.3125 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| STM-1/OC-3     | 155.52 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | SFP        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| STM-4/OC-12    | 622.08 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | SFP        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| STM-16/OC-48   | 2.48832 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | SFP        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| STM-64/OC-192  | 9.95328 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| OTU1           | 2.666057143 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SFP        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| OTU2           | 10.70922532 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| OTU1e          | 11.04910714 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| OTU2e          | 11.09572785 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| OTU1f          | 11.27008929 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| OTU2f          | 11.31764241 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| 1GFC           | 1.0625 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | SFP        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| 2GFC           | 2.125 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SFP        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| 4GFC           | 4.25 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SFP        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| 8GFC           | 8.5 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| 10GFC          | 10.51875 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| Standard       | Bit Rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Interfaces |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| E1             | 2.048 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | RJ48, BNC  |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| E3             | 34.368 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | BNC        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| E4             | 139.264 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | BNC        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| DS1            | 1.544 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | RTT Bantam |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| DS3            | 44.736 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | BNC        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| STM-1e/STS-3   | 155.52 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | BNC        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| CPRI Option1   | 614.4 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SFP        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| CPRI Option2   | 1228.8 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | SFP        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| CPRI Option3   | 2457.6 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | SFP, SFP+  |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| CPRI Option4   | 3072.0 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | SFP, SFP+  |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| CPRI Option5   | 4915.2 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| CPRI Option6   | 6144.0 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| CPRI Option7   | 9830.4 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| CPRI Option8   | 10137.6 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| OBSAI 1x       | 768 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | SFP        |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| OBSAI 2x       | 1536 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SFP, SFP+  |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| OBSAI 4x       | 3072 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SFP, SFP+  |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |
| OBSAI 8x       | 6144 Mbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SFP+       |          |          |            |          |           |      |            |          |      |            |           |      |            |          |     |             |           |     |            |              |      |            |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |             |     |      |            |     |      |           |     |      |          |      |       |               |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |          |          |            |    |            |           |    |             |     |    |              |     |     |            |            |     |             |     |              |             |     |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |          |          |     |          |           |           |          |           |           |          |           |      |

|                     |      |                                                                                                                                    |
|---------------------|------|------------------------------------------------------------------------------------------------------------------------------------|
| Miscellaneous       |      |                                                                                                                                    |
| Dimensions and Mass |      | 257 (W) × 163 (H) × 38.5 (D) mm, ≤1.1 kg                                                                                           |
| Environmental       |      | Temperature and Humidity<br>Operating: 0°C to +50°C, ≤80% RH (non-condensing)<br>Storage: -30°C to +60°C, ≤80% RH (non-condensing) |
| CE                  | EMC  | 2014/30/EU, EN61326-1, EN61000-3-2                                                                                                 |
|                     | LVD  | 2014/35/EU, EN61010-1                                                                                                              |
|                     | RoHS | 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018                                                                                      |
| Laser Safety*3      |      | IEC 60825-1: 2007 CLASS 1<br>21CFR1040.10 and 1040.11*2                                                                            |

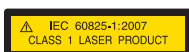
\*1: The frequency accuracy depends on the accuracy of the MT1000A internal clock or the external clock of MT1000A.

Refer to the external interfaces in MT1000A specifications.

\*2: Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

\*3: Safety measures for laser products

This product complies with optical safety standards in 21CFR1040.10, 1040.11 and IEC 60825-1; the following descriptive labels are affixed to the product.



THIS PRODUCT COMPLIES WITH 21 CFR 1040.10 AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO. 50, DATED JUNE 24, 2007



10G Multirate Module MU100010A

# 100G Multirate Module MU100011A\*1

| Test Interface    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
|-------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|----------|----------|------------|----------|-----------|------|------------|------------|------|------------|-----------|------|------------|------------|-----|-------------|-----------|-----|------------|---------------|------|------------|---------------|-------|-------------|------------------------|-------|--------------|------------------------|--------------|------------|-------------|-----|-------------|-------------|-----|-------------|-------------|-----|--------------|--------------|-----|---------------|--------------|------|------|------------------|-----|------|------------------|------|-------|------------------|------|-------|------------------|------|-------|------------------|------|-------|------------------|------|------|---------------------------|-------|--------|---------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|----------|----------|------------|--------|---------------------------|-------|------|---------------------------|--------------|------|-------------|-----|------|------------|-----------|------|-----------|-----------|------|----------|------|-------|---------------|------|-------|-------------|------|--------------|------------|-----|--------------|-------------|-----|--------------|-------------|-----------|--------------|-------------|-----------|--------------|-------------|------|--------------|-------------|------|--------------|-------------|------|--------------|--------------|------|--------------|---------------|------|---------------|---------------|-------|----------|----------|-----|----------|-----------|-----------|----------|------------|-----------|----------|------------|------|
| Test Port         |                           | RJ45: 2 sockets<br>IEEE 802.3-2008 10BASE-T, 100BASE-TX, 1000BASE-T compliant<br>Auto MDI-X<br>10 Mbps/100 Mbps Full/Half duplex, 1000 Mbps Full duplex<br>SFP/SFP+/SFP28: 2 slots<br>SFF-8431, SFF-8472 compliant, IEEE 802.3ae-2002, IEEE 802.3-2008, IEEE 802.3by compliant<br>QSFP+/QSFP28: 1 port<br>SFF-8436, SFF-8472, SFF-8665 compliant, IEEE 802.3ba-2010 compliant<br>CFP4: 1 port<br>CFP MSA CFP4 Hardware Specification, Rev. 1.1 compliant<br>CFP MSA Management Interface Specification V2.2 R06a compliant(However, MSA 100GLH is not support)<br>IEEE 802.3ba-2010 compliant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| Bit Rate*2        |                           | <table><thead><tr><th>Standard</th><th>Bit Rate</th><th>Interfaces</th></tr></thead><tbody><tr><td>10BASE-T</td><td>12.5 Mbps</td><td>RJ45</td></tr><tr><td>100BASE-TX</td><td>125.0 Mbps</td><td>RJ45</td></tr><tr><td>1000BASE-T</td><td>1.25 Gbps</td><td>RJ45</td></tr><tr><td>100BASE-XX</td><td>125.0 Mbps</td><td>SFP</td></tr><tr><td>1000BASE-XX</td><td>1.25 Gbps</td><td>SFP</td></tr><tr><td>10GBASE-XX</td><td>10.31250 Gbps</td><td>SFP+</td></tr><tr><td>25GBASE-XX</td><td>25.78125 Gbps</td><td>SFP28</td></tr><tr><td>40GBASE-XX4</td><td>10.31250 Gbps × 4 Lane</td><td>QSFP+</td></tr><tr><td>100GBASE-XX4</td><td>25.78125 Gbps × 4 Lane</td><td>CFP4, QSFP28</td></tr><tr><td>STM-1/OC-3</td><td>155.52 Mbps</td><td>SFP</td></tr><tr><td>STM-4/OC-12</td><td>622.08 Mbps</td><td>SFP</td></tr><tr><td>STM-4/OC-12</td><td>622.08 Mbps</td><td>SFP</td></tr><tr><td>STM-16/OC-48</td><td>2.48832 Gbps</td><td>SFP</td></tr><tr><td>STM-64/OC-192</td><td>9.95328 Gbps</td><td>SFP+</td></tr><tr><td>OTU1</td><td>2.666057143 Gbps</td><td>SFP</td></tr><tr><td>OTU2</td><td>10.70922532 Gbps</td><td>SFP+</td></tr><tr><td>OTU1e</td><td>11.04910714 Gbps</td><td>SFP+</td></tr><tr><td>OTU2e</td><td>11.09572785 Gbps</td><td>SFP+</td></tr><tr><td>OTU1f</td><td>11.27008929 Gbps</td><td>SFP+</td></tr><tr><td>OTU2f</td><td>11.31764241 Gbps</td><td>SFP+</td></tr><tr><td>OTU3</td><td>10.75460339 Gbps × 4 Lane</td><td>QSFP+</td></tr><tr><td>OTU3e1</td><td>11.14274364 Gbps × 4 Lane</td><td>QSFP+</td></tr></tbody></table> |  |  | Standard | Bit Rate | Interfaces | 10BASE-T | 12.5 Mbps | RJ45 | 100BASE-TX | 125.0 Mbps | RJ45 | 1000BASE-T | 1.25 Gbps | RJ45 | 100BASE-XX | 125.0 Mbps | SFP | 1000BASE-XX | 1.25 Gbps | SFP | 10GBASE-XX | 10.31250 Gbps | SFP+ | 25GBASE-XX | 25.78125 Gbps | SFP28 | 40GBASE-XX4 | 10.31250 Gbps × 4 Lane | QSFP+ | 100GBASE-XX4 | 25.78125 Gbps × 4 Lane | CFP4, QSFP28 | STM-1/OC-3 | 155.52 Mbps | SFP | STM-4/OC-12 | 622.08 Mbps | SFP | STM-4/OC-12 | 622.08 Mbps | SFP | STM-16/OC-48 | 2.48832 Gbps | SFP | STM-64/OC-192 | 9.95328 Gbps | SFP+ | OTU1 | 2.666057143 Gbps | SFP | OTU2 | 10.70922532 Gbps | SFP+ | OTU1e | 11.04910714 Gbps | SFP+ | OTU2e | 11.09572785 Gbps | SFP+ | OTU1f | 11.27008929 Gbps | SFP+ | OTU2f | 11.31764241 Gbps | SFP+ | OTU3 | 10.75460339 Gbps × 4 Lane | QSFP+ | OTU3e1 | 11.14274364 Gbps × 4 Lane | QSFP+ | <table><thead><tr><th>Standard</th><th>Bit Rate</th><th>Interfaces</th></tr></thead><tbody><tr><td>OTU3e2</td><td>11.14583889 Gbps × 4 Lane</td><td>QSFP+</td></tr><tr><td>OTU4</td><td>27.95249339 Gbps × 4 Lane</td><td>CFP4, QSFP28</td></tr><tr><td>1GFC</td><td>1.0625 Gbps</td><td>SFP</td></tr><tr><td>2GFC</td><td>2.125 Gbps</td><td>SFP, SFP+</td></tr><tr><td>4GFC</td><td>4.25 Gbps</td><td>SFP, SFP+</td></tr><tr><td>8GFC</td><td>8.5 Gbps</td><td>SFP+</td></tr><tr><td>10GFC</td><td>10.51875 Gbps</td><td>SFP+</td></tr><tr><td>16GFC</td><td>14.025 Gbps</td><td>SFP+</td></tr><tr><td>CPRI Option1</td><td>614.4 Mbps</td><td>SFP</td></tr><tr><td>CPRI Option2</td><td>1228.8 Mbps</td><td>SFP</td></tr><tr><td>CPRI Option3</td><td>2457.6 Mbps</td><td>SFP, SFP+</td></tr><tr><td>CPRI Option4</td><td>3072.0 Mbps</td><td>SFP, SFP+</td></tr><tr><td>CPRI Option5</td><td>4915.2 Mbps</td><td>SFP+</td></tr><tr><td>CPRI Option6</td><td>6144.0 Mbps</td><td>SFP+</td></tr><tr><td>CPRI Option7</td><td>9830.4 Mbps</td><td>SFP+</td></tr><tr><td>CPRI Option8</td><td>10137.6 Mbps</td><td>SFP+</td></tr><tr><td>CPRI Option9</td><td>12165.12 Mbps</td><td>SFP+</td></tr><tr><td>CPRI Option10</td><td>24330.24 Mbps</td><td>SFP28</td></tr><tr><td>OBSAI 1x</td><td>768 Mbps</td><td>SFP</td></tr><tr><td>OBSAI 2x</td><td>1536 Mbps</td><td>SFP, SFP+</td></tr><tr><td>OBSAI 4x</td><td>3,072 Mbps</td><td>SFP, SFP+</td></tr><tr><td>OBSAI 8x</td><td>6,144 Mbps</td><td>SFP+</td></tr></tbody></table> |  |  | Standard | Bit Rate | Interfaces | OTU3e2 | 11.14583889 Gbps × 4 Lane | QSFP+ | OTU4 | 27.95249339 Gbps × 4 Lane | CFP4, QSFP28 | 1GFC | 1.0625 Gbps | SFP | 2GFC | 2.125 Gbps | SFP, SFP+ | 4GFC | 4.25 Gbps | SFP, SFP+ | 8GFC | 8.5 Gbps | SFP+ | 10GFC | 10.51875 Gbps | SFP+ | 16GFC | 14.025 Gbps | SFP+ | CPRI Option1 | 614.4 Mbps | SFP | CPRI Option2 | 1228.8 Mbps | SFP | CPRI Option3 | 2457.6 Mbps | SFP, SFP+ | CPRI Option4 | 3072.0 Mbps | SFP, SFP+ | CPRI Option5 | 4915.2 Mbps | SFP+ | CPRI Option6 | 6144.0 Mbps | SFP+ | CPRI Option7 | 9830.4 Mbps | SFP+ | CPRI Option8 | 10137.6 Mbps | SFP+ | CPRI Option9 | 12165.12 Mbps | SFP+ | CPRI Option10 | 24330.24 Mbps | SFP28 | OBSAI 1x | 768 Mbps | SFP | OBSAI 2x | 1536 Mbps | SFP, SFP+ | OBSAI 4x | 3,072 Mbps | SFP, SFP+ | OBSAI 8x | 6,144 Mbps | SFP+ |
| Standard          | Bit Rate                  | Interfaces                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 10BASE-T          | 12.5 Mbps                 | RJ45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 100BASE-TX        | 125.0 Mbps                | RJ45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 1000BASE-T        | 1.25 Gbps                 | RJ45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 100BASE-XX        | 125.0 Mbps                | SFP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 1000BASE-XX       | 1.25 Gbps                 | SFP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 10GBASE-XX        | 10.31250 Gbps             | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 25GBASE-XX        | 25.78125 Gbps             | SFP28                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 40GBASE-XX4       | 10.31250 Gbps × 4 Lane    | QSFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 100GBASE-XX4      | 25.78125 Gbps × 4 Lane    | CFP4, QSFP28                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| STM-1/OC-3        | 155.52 Mbps               | SFP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| STM-4/OC-12       | 622.08 Mbps               | SFP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| STM-4/OC-12       | 622.08 Mbps               | SFP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| STM-16/OC-48      | 2.48832 Gbps              | SFP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| STM-64/OC-192     | 9.95328 Gbps              | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OTU1              | 2.666057143 Gbps          | SFP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OTU2              | 10.70922532 Gbps          | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OTU1e             | 11.04910714 Gbps          | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OTU2e             | 11.09572785 Gbps          | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OTU1f             | 11.27008929 Gbps          | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OTU2f             | 11.31764241 Gbps          | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OTU3              | 10.75460339 Gbps × 4 Lane | QSFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OTU3e1            | 11.14274364 Gbps × 4 Lane | QSFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| Standard          | Bit Rate                  | Interfaces                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OTU3e2            | 11.14583889 Gbps × 4 Lane | QSFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OTU4              | 27.95249339 Gbps × 4 Lane | CFP4, QSFP28                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 1GFC              | 1.0625 Gbps               | SFP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 2GFC              | 2.125 Gbps                | SFP, SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 4GFC              | 4.25 Gbps                 | SFP, SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 8GFC              | 8.5 Gbps                  | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 10GFC             | 10.51875 Gbps             | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| 16GFC             | 14.025 Gbps               | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| CPRI Option1      | 614.4 Mbps                | SFP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| CPRI Option2      | 1228.8 Mbps               | SFP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| CPRI Option3      | 2457.6 Mbps               | SFP, SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| CPRI Option4      | 3072.0 Mbps               | SFP, SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| CPRI Option5      | 4915.2 Mbps               | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| CPRI Option6      | 6144.0 Mbps               | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| CPRI Option7      | 9830.4 Mbps               | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| CPRI Option8      | 10137.6 Mbps              | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| CPRI Option9      | 12165.12 Mbps             | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| CPRI Option10     | 24330.24 Mbps             | SFP28                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OBSAI 1x          | 768 Mbps                  | SFP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OBSAI 2x          | 1536 Mbps                 | SFP, SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OBSAI 4x          | 3,072 Mbps                | SFP, SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| OBSAI 8x          | 6,144 Mbps                | SFP+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |
| Sync Clock Output |                           | Frequency<br>Select 1/8 or 1/16 against the bit rate of the data lane.<br>100 GigE: CAUI4<br>25 GigE: 25GAUI<br>OTU4: OTL 4.4<br>Level: 250 mVp-p (min.), 550 mVp-p (max.)<br>Termination: 50Ω/AC (Single ended)<br>Connector: SMA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |          |          |            |          |           |      |            |            |      |            |           |      |            |            |     |             |           |     |            |               |      |            |               |       |             |                        |       |              |                        |              |            |             |     |             |             |     |             |             |     |              |              |     |               |              |      |      |                  |     |      |                  |      |       |                  |      |       |                  |      |       |                  |      |       |                  |      |      |                           |       |        |                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |          |          |            |        |                           |       |      |                           |              |      |             |     |      |            |           |      |           |           |      |          |      |       |               |      |       |             |      |              |            |     |              |             |     |              |             |           |              |             |           |              |             |      |              |             |      |              |             |      |              |              |      |              |               |      |               |               |       |          |          |     |          |           |           |          |            |           |          |            |      |

|                     |      |                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Miscellaneous       |      |                                                                                                                                                                                                                                                                                                                                                                                                             |
| Dimensions and Mass |      | 257 (W) × 163 (H) × 48 (D) mm, ≤1.1 kg                                                                                                                                                                                                                                                                                                                                                                      |
| Environmental       |      | Temperature and Humidity<br>Operating: 0°C to +45°C, ≤85% RH (non-condensing)<br>Storage: -30°C to +60°C, ≤90% RH (non-condensing)                                                                                                                                                                                                                                                                          |
| CE                  | EMC  | 2014/30/EU, EN61326-1, EN61000-3-2                                                                                                                                                                                                                                                                                                                                                                          |
|                     | LVD  | 2014/35/EU, EN61010-1                                                                                                                                                                                                                                                                                                                                                                                       |
|                     | RoHS | 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018                                                                                                                                                                                                                                                                                                                                                               |
| Laser Safety*3      |      | IEC 60825-1:2007 Class 1M<br>CFP4: 100GBASE-SR4<br>QSFP+: 40GBASE-SR4<br>QSFP28: 100GBASE-SR4<br>SFP28: 25GBASE-SR<br>IEC 60825-1:2007 Class 1<br>CFP4: 100GBASE-LR4<br>QSFP+: 40GBASE-LR4<br>QSFP28: 100GBASE-LR4<br>SFP28: 25GBASE-LR<br>SFP+: 10GBASE-LR/ER/ZR<br>SFP: 4G FC (SX), 4G FC (LX), 4G FC (EX), OC-48 LR-1/STM L-16.1, OC-48 LR-2/STM L-16.2, 100BASE-FX/LX<br>FDA 21CFR1040.10 and 1040.11*4 |

\*1: MT1000A-006 is required for MU100011A.

\*2: The frequency accuracy depends on the accuracy of the MT1000A internal clock or the external clock of MT1000A.  
Refer to the external interfaces in MT1000A specifications.

\*3: Safety measures for laser products

This product complies with optical safety standards in 21CFR1040.10, 1040.11 and IEC 60825-1; the following descriptive labels are affixed to the product.

\*4: Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007



THIS PRODUCT COMPLIES WITH 21 CFR 1040.10 AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO. 50, DATED JUNE 24, 2007



100G Multirate Module MU100011A

# Sync Module MU100090A/MU100090B Specifications

| Test Interface                    |                              |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model                             |                              | MU100090A                                                                                                                                                                                                        | MU100090B                                                                                                                                                                                                                                                                                                                                                                           |
| Internal Oscillator               |                              | Rubidium atomic clock<br>Aging: $2.5 \times 10^{-11}/\text{day}$<br>$1 \times 10^{-10}/\text{month}$<br>$1 \times 10^{-9}/\text{year}$                                                                           |                                                                                                                                                                                                                                                                                                                                                                                     |
| Input/Output Interface            | 10 MHz External Clock Output | Connector: BNC Jack/50Ω (nom.)<br>Level: TTL                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                     |
|                                   | 1PPS Reference Output        | Connector: BNC Jack/50Ω (nom.)<br>Level: TTL                                                                                                                                                                     | Connector: BNC Jack/50Ω (nom.)<br>Level: TTL<br>Polarity: Positive/Negative                                                                                                                                                                                                                                                                                                         |
|                                   | 1PPS Sync Input              | Usage: Synchronize the internal oscillator with this 1PPS, ITU-T G.703<br>Connector: BNC Jack/50Ω (nom.)<br>Level: TTL<br>Input Frequency Range: $\pm 10$ ppb                                                    |                                                                                                                                                                                                                                                                                                                                                                                     |
|                                   | Antenna Input                | Connector: SMA Jack/50Ω (nom.)<br>Feeding Antenna: +3.5 V/5 V Slectable, 50 mA max.                                                                                                                              | Connector: SMA Jack/50Ω (nom.)<br>Feeding Antenna: Off/+3.5 V/5 V Slectable, 50 mA max.                                                                                                                                                                                                                                                                                             |
|                                   | AUX Output                   | Usage: Provide MT1000A with ToD (NMEA0183) with J1705 (AUX interface adaptor)<br>Connector: D-SUB 9 pin                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                     |
| GNSS Signal Receive Specification | Supported Signal             | GPS L1C/A                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>• GPS L1C/A, L2C</li> <li>• QZSS L1C/A, L2C</li> <li>• Beidou B1I, B2I</li> <li>• GLONASS L1OF, L2OF</li> <li>• Galileo E1B/C, E5B</li> </ul> * GPS L2C, QZSS L2C, GLONASS L2OF, Galileo E5B, Beidou B2I are available after MU100090B-001 is installed.<br>* QZSS, GLONASS, Galileo, Beidou are available after MU100090B-002 is installed. |
|                                   | Number of Receivable Channel | 50 channel                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                     |
| Time Accuracy to GNSS Time        |                              | $\pm 45$ ns rms* <sup>1</sup>                                                                                                                                                                                    | Without MU100090B-001: $\pm 45$ ns rms* <sup>1</sup><br>With MU100090B-001: $\pm 10$ ns rms* <sup>2</sup>                                                                                                                                                                                                                                                                           |
| Holdover                          |                              | 300 ns/10,000 second<br>* When OSC LED lit continuously for 3 hours or more and either GPS or external 1PPS signal synchronized for at least 30 minutes at constant ambient temperature while moving to Holdover | Without MU100090B-001: 300 ns/10,000 second<br>With MU100090B-001: 70 ns/3,600 second<br>190 ns/10,000 second<br>* When OSC LED lit continuously for 3 hours or more and either GNSS or external 1PPS signal Synchronized for at least 30 minutes at ambient temperature change within $\pm 3^\circ\text{C}$ while moving to Holdover                                               |

| Test Interface      |              |                                                                                                                                                                                                            |                                               |
|---------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Model               |              | MU100090A                                                                                                                                                                                                  | MU100090B                                     |
| Dimensions and Mass |              | 257 (W) × 163 (H) × 25 (D) mm<br>$\leq 0.8$ kg                                                                                                                                                             |                                               |
| Environmental       |              | Temperature and Humidity<br>Operating: $0^\circ\text{C}$ to $+50^\circ\text{C}$ , $\leq 85\%$ RH (non-condensing)<br>Storage: $-30^\circ\text{C}$ to $+60^\circ\text{C}$ , $\leq 90\%$ RH (non-condensing) |                                               |
| CE                  | RE Directive | 2014/53/EU, EN61010-1, EN301 489-1, EN301 489-19, EN303 413, EN61326-1, EN61000-3-2                                                                                                                        |                                               |
|                     | RoHS         | 2011/65/EU, EN IEC 63000: 2018                                                                                                                                                                             | 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018 |

\*1: When OSC LED lit continuously for 3 hours or more and using Anritsu antenna under open skies with GNSS signal synchronized for at least 30 minutes at constant ambient temperature

\*2: After OS LED lit and using Anritsu antenna under open skies with GNSS signal synchronized for at least 30 minutes at constant ambient temperature with multi-band setting and antenna position specified

## ⚠ CAUTION

Do not subject the equipment to mechanical vibration or shock and keep the equipment away from all magnets and magnetic objects. Otherwise, the built-in rubidium oscillator may be damaged or the performance degraded.



High Performance GPS Disciplined Oscillator MU100090A



High Performance GNSS Disciplined Oscillator MU100090B

## Ethernet Testing Specifications

| Common              |                                                                                                                                      |                                                                                                                                                                                                                                                                                               |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model No.           | MU100010A                                                                                                                            | MU100011A                                                                                                                                                                                                                                                                                     |
| Bit Rate            | 10 Mbps (RJ45), 100 Mbps (RJ45/SFP), 1 Gbps (RJ45/SFP), 10 Gbps (SFP+)                                                               | 10 Mbps (RJ45), 100 Mbps (RJ45/SFP), 1 Gbps (RJ45/SFP), 10 Gbps (SFP+), 25 Gbps (SFP28), 40 Gbps (QSFP+), 100 Gbps (CFP4/QSFP28)                                                                                                                                                              |
| Test Configuration  | RFC 2544, RFC 6349, Y.1564, BERT, Monitor/Generator, Pass-through, Reflector, Channel Stat., Ping, Traceroute, Cable Test, Sync Test |                                                                                                                                                                                                                                                                                               |
| Auto MDI-X          | On/Off                                                                                                                               |                                                                                                                                                                                                                                                                                               |
| Encapsulation       | Ether Type II (DIX v.2), IEEE 802.3 with 802.2 (LLC1), IEEE 802.3 with SNAP                                                          |                                                                                                                                                                                                                                                                                               |
| 100 GbE, 25 GbE FEC | —                                                                                                                                    | FEC enable : On/Off<br>FEC Code : RS (528, 514, 7, 10)<br>FEC status & counter<br>Loss of FEC alignment, Corrected CW, Uncorrectable CW, Corrected Symbol each lane<br>FEC related Error Injection<br>Bit error per CAUI4 lane or 25G CAUI encoded RS-FEC (Injection timing is Single/Burst.) |

| Configuration, Monitor/Generate |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model No.                       | MU100010A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | MU100011A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Traffic Generation              | <ul style="list-style-type: none"> <li>Transmitting mode: Normal, Burst</li> <li>Variable line rate traffic generation, up to full line rate</li> <li>Line load profile: Constant, Ramp</li> <li>Traffic duration: Continuous, Programmable number of seconds or frames</li> <li>Adjustable frame size: 44 bytes to 16000 bytes</li> <li>Frame sizes: Constant, Stepped, Random</li> <li>Payload profiles: Data, Video, Voice</li> <li>User-defined traffic mix of unicast and broadcast frames</li> <li>Fixed or incremented IP identifier</li> <li>User programmable DSCP/TOS byte</li> <li>Configurable IP and Ethernet source and destination addresses (supports IPv4 and IPv6 addressing)               <ul style="list-style-type: none"> <li>IPv4: Fixed, DHCP, DNS</li> <li>IPv6: Fixed, NDP</li> </ul> </li> <li>Address increment, Decrement and Random generation supported</li> <li>User programmable UDP/TCP address</li> <li>Automatic TCP connect (user selectable)</li> <li>UDP check sum: Automatic, Fixed (null); TCP check sum: Automatic</li> <li>Generate pause frames, Respond to pause frames</li> <li>Answer incoming ARP, Ping requests (On/Off)</li> <li>IGMP: Join/Leave (Support version: IGMPv1, IGMPv2, IGMPv3)</li> <li>MLD: Join/Leave (Support version: MLDv1, MLDv2)</li> </ul> | <ul style="list-style-type: none"> <li>Transmitting mode: Normal, Burst</li> <li>Variable line rate traffic generation, up to full line rate</li> <li>Line load profile: Constant, Ramp</li> <li>Traffic duration: Continuous, Programmable number of seconds or frames</li> <li>Adjustable frame size: 60 bytes to 16000 bytes</li> <li>Frame sizes: Constant, Stepped, Random</li> <li>Payload profiles: Data, Video, Voice</li> <li>User-defined traffic mix of unicast and broadcast frames</li> <li>Fixed or incremented IP identifier</li> <li>User programmable DSCP/TOS byte</li> <li>Configurable IP and Ethernet source and destination addresses (supports IPv4 and IPv6 addressing)               <ul style="list-style-type: none"> <li>IPv4: Fixed, DHCP, DNS</li> <li>IPv6: Fixed, NDP</li> </ul> </li> <li>Address increment, Decrement and Random generation supported</li> <li>User programmable UDP/TCP address</li> <li>Automatic TCP connect (user selectable)</li> <li>UDP check sum: Automatic, Fixed (null); TCP check sum: Automatic</li> <li>Generate pause frames, Respond to pause frames</li> <li>Answer incoming ARP, Ping requests (On/Off)</li> <li>IGMP: Join/Leave (Support version: IGMPv1, IGMPv2, IGMPv3)</li> <li>MLD: Join/Leave (Support version: MLDv1, MLDv2)</li> <li>Link Fault Signaling (LFS) Emulation (10 Gbps, 25 Gbps, 40 Gbps, 100 Gbps)</li> </ul> |
| Stacked VLAN                    | Up to 8 user-settable VLAN tags<br>Parameters per VLAN tag: <ul style="list-style-type: none"> <li>Ether-type 0x8100 (802.1Q), 0x88a8 (802.1ad), 0x9100 or 0x9200</li> <li>User-defined VLAN ID, CFI, VLAN priority</li> <li>Address increment, Decrement and Random generation supported</li> </ul> Only one VLAN level supported at traceroute and RFC 2544 router latency tests. Only two VLAN level supported at ping.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Multistream                     | Number of streams: Up to 16 streams per port can be activated                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Latency Resolution              | 5 ns                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Transmit Signal Clock Sources   | Internal, Received clock, 2-MHz signal, SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps), PTP (IEEE 1588 v2) recovered clock or signal from optional GPS receiver<br>Frequency deviation: ±100 ppm (1-ppm steps)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Internal, Received clock, 2-MHz signal, SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps), PTP (IEEE 1588 v2) recovered clock or signal from optional GPS receiver<br>Frequency deviation: ±200 ppm (0.1-ppm steps)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Receive Setting                 | <ul style="list-style-type: none"> <li>User-defined expected preamble length: 3 bytes to 15 bytes</li> <li>User-defined IFG lower threshold: 8 bytes to 15 bytes (RJ45 port only)</li> <li>User-defined Jumbo frame size upper limit: 1519 bytes to 16000 bytes</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Error Generation                | <ul style="list-style-type: none"> <li>LAN</li> <li>IFG for Ethernet (RJ45 port only), FCS, Preamble, Error symbol/block, Wrong IP check sum, Fragmented IP, Wrong layer 4 check sum, PRBS bit error, BER test sequence error</li> <li>PCS (10 Gbps)</li> <li>Invalid block type (0x00, 0x2d, 0x33, 0x66), Invalid sync header (00, 11), Invalid alignment marker, BIP error</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li>LAN</li> <li>IFG for Ethernet (RJ45 port only), FCS, Preamble, Error symbol/block, Wrong IP check sum, Fragmented IP, Wrong layer 4 check sum, PRBS bit error, BER test sequence error</li> <li>PCS (10 Gbps, 40 Gbps, 100 Gbps)</li> <li>Invalid block type (0x00, 0x2d, 0x33, 0x66), Invalid sync header (00, 11), Invalid alignment marker, BIP error</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

# Ethernet Testing Specifications

|                  |                                                                         |                                                                                                                                                           |
|------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alarm Generation | No link, Remote fault, Local fault (10 Gbps)<br>PCS (10 Gbps): High BER | No link, Remote fault, Local fault (10 Gbps, 40 Gbps, 100 Gbps)<br>PCS (10 Gbps, 40 Gbps, 100 Gbps) : High BER                                            |
| PCS Skew         | —                                                                       | 40 Gbps, 100 Gbps<br>• Insertion<br>100 Gbps Tx lane: 0 to 4224 bits<br>40 Gbps physical lane: 0 to 8448 bits<br>• Detection<br>Relative skew, Marker map |

| Result, Monitor/Generate      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model No.                     | MU100010A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | MU100011A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Status                        | <ul style="list-style-type: none"> <li>Link status, Interface type, Jabber detected, Frames present, MPLS/EoMPLS/VLAN, Speed, Full or half duplex, Local clock (Electrical 1000 Mbps), LFS LF/RF (10 Gbps), Signal present, Bit rate of incoming Ethernet signal, Auto negotiation complete</li> <li>Link partner abilities: <ul style="list-style-type: none"> <li>Pause capable and Asymmetric pause request (not Ethernet 10 Gbps and more), Remote fault, Speed/Duplex</li> </ul> </li> <li>Indicators for Utilization, Throughput and Errored frames</li> <li>Signal level indication for optical Ethernet interfaces</li> <li>LFS local fault, LFS remote fault, High BER, LOA (10 Gbps)</li> <li>Invalid sync header, Invalid alignment marker, BIP error, Invalid block (10 Gbps)</li> </ul>                                                                                   | <ul style="list-style-type: none"> <li>Link status, Interface type, Jabber detected, Frames present, MPLS/EoMPLS/VLAN, Speed, Full or half duplex, Local clock (Electrical 1000 Mbps), LFS LF/RF (10 Gbps), Signal present, Bit rate of incoming Ethernet signal, Auto negotiation complete</li> <li>Link partner abilities: <ul style="list-style-type: none"> <li>Pause capable and Asymmetric pause request (not Ethernet 10 Gbps and more), Remote fault, Speed/Duplex</li> </ul> </li> <li>Indicators for Utilization, Throughput and Errored frames</li> <li>Signal level indication for optical Ethernet interfaces</li> <li>LFS local fault, LFS remote fault, High BER, LOA (10 Gbps, 25 Gbps, 40 Gbps, 100 Gbps)</li> <li>Invalid sync header, Invalid alignment marker, BIP error, Invalid block (10 Gbps, 25 Gbps, 40 Gbps, 100 Gbps)</li> </ul> |
| Resolution                    | User-defined resolution for statistical measurements: 1, 2, 5, 10, 15, 30 s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 h<br>Event log: Major measurement events incl. errors and alarms are logged with 1-second resolution.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Performance Statistics        | • Utilization (Max./Min./Avg.), Throughput (Max./Min./Avg.), Frame rate (Max./Min./Avg.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Frame Statistics              | <ul style="list-style-type: none"> <li>Total frames, Total valid frames, Unicast/Multicast/Broadcast frames, Number of pause frames</li> <li>Number of VLAN tagged frames, Max. number of VLAN layers detected, Last received VLAN ID, Last received VLAN priority</li> <li>Number of MPLS frames and MPLS-TP frames. Max. number of MPLS layers detected. Last received MPLS Label, MPLS Priority and MPLS TTL.</li> <li>Number of PBB frames. Last received B/I-tag ID and B/I-tag priority.</li> <li>Total errored frames, Fragmented frames, Number of oversized and undersized (runts) frames, Number of FCS errored frames, Error symbol frames (not 10 Gbps)/Code violation frames (10 Gbps), Number of collisions (10 Mbps, 100 Mbps half duplex), Preamble violations, IFG violations (RJ45 port only), False carrier, LFS LF (local fault), LFS RF (remote fault)</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Burst Statistics              | Total frames, Total valid frames, Number of burst, Total frames in bursts, Burst size (Max./Min./Avg.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Frame Distribution Statistics | <ul style="list-style-type: none"> <li>Total valid/ frames, 64 to 127, 128 to 255, 256 to 511, 512 to 1023, 1024 to 1518 byte frames, Total number of jumbo frames</li> <li>Frame size (Max./Min./Avg.)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Multistream Statistics        | Available information per stream: <ul style="list-style-type: none"> <li>Frame loss count/rate, Throughput, Latency, Packet jitter, Frames and bytes received and transmitted</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Transmit Statistics           | Total frames, Total valid frames, Unicast/Multicast/Broadcast frames, FCS errors, Total errors<br>64 to 127, 128 to 255, 256 to 511, 512 to 1023, 1024 to 1518 byte frames, Total number of jumbo frames<br>Total number of frames (Tx (own port) – Rx (selectable port))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Filter                        | Up to 8 filter conditions can be defined.<br>Each condition can be applied as filter:<br>IP or MAC source address, IP or MAC destination address, Broadcast address, IEEE OUI value, Encapsulation type, VLAN ID and VLAN tag priority, MPLS, PBB source and destination MAC address, PBB B/I-tag, MPLS-TP source and destination MAC address, TPC/UDP source and destination port, User-defined pattern at defined offset                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| PCS Statistics                | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | LOBL, Invalid sync header, Invalid Block, High BER, LFS Local Fault, LFS Remote Fault, LOA, Invalid alignment marker, BIP error, LOAML, Marker Map, Relative skew                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Adjustable Threshold          | Utilization, Throughput, Errored frames, Collision rate, Unicast frames, Multicast frames, Broadcast frames, Pause frames, Fragmented frames, Undersized frames (runts), Oversized frames, FCS errored frames, IFG violations (RJ45 port only), Preamble violations, BER test pattern errors, Sequence errors, Diff.Tx-Rx                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| DHCP                          | <ul style="list-style-type: none"> <li>Display source IPv4 address assigned by DHCP</li> <li>Display current lease expire time</li> <li>Display IPv4 addresses of primary and secondary DNS server when obtained by DHCP</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| NDP                           | • Apply and show source IPv6 address assigned by NDP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

# Ethernet Testing Specifications

| BER Test and Service Disruption Measurement |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BER Test                                    | <p>Generation and detection of test patterns, Count of errors in received test pattern, Pattern generation: Unframed (Layer 1), Framed Ethernet (MAC) header (Layer 2), Framed Ethernet (MAC) header with IP header (Layer 3) or Framed Ethernet (MAC) header, Framed with IP header and TCP/UDP header (Layer 4), User-defined header pattern (14 byte to 256 byte), Detection of sequence errors, loss of sequence synchronization, Frame loss count and frame loss seconds</p> <p>Throughput measurement results are calculated for:</p> <ul style="list-style-type: none"> <li>Utilization layer, Physical layer, Physical layer excluding preamble, Link layer, Network layer and Data layer</li> <li>Min./Max./Avg. values</li> </ul> <p>Performance (M.2100 type) parameters: ES, SES, ALS, UAT, AVT, EFS</p> <p>Test patterns: PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, HF test pattern, CRPAT, JTPAT, SPAT, 55 Hex, Fox, 32-bit user programmable</p> <p>User-defined resolution: 1, 2, 5, 10, 15, 30 s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 h</p> <p>Event log: Major measurement events incl. errors and alarms are logged with 1-second resolution.</p> |
| Error Generation                            | FCS, Preamble, Error symbol, IFG for Ethernet (RJ45 port only), Wrong IP check sum, Fragmented IP, Wrong layer 4 check sum, PRBS bit error, BER test sequence error                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Alarm Generation                            | No link, Remote fault                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Service Disruption Measurement              | <p>Service disruption measurement activated as part of BER test</p> <ul style="list-style-type: none"> <li>Max./Avg. service disruption time, Resolution: 0.1 <math>\mu</math>s</li> <li>Number of service disruptions</li> <li>Disruption Type: Packet, LOS</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

| RFC 2544 Testing |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test modes       | <p>Switch/Router test and Single ended network test modes:</p> <ul style="list-style-type: none"> <li>Throughput, Frame loss, Latency or Packet jitter, Back-to-back frames (burstability)</li> </ul> <p>End-to-end network test mode (two MU100010A/MU100011A units in Local-remote setup):</p> <ul style="list-style-type: none"> <li>Throughput, Frame loss, Back-to-back frames (burstability)</li> </ul> <p>Router latency test mode: IP ping based latency test or packet jitter</p> |

| Service Activation Test (Y.1564) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Functions                        | <ul style="list-style-type: none"> <li>Up to 8 services per port</li> <li>Color-aware and non-color-aware in combinations (IP DSCP or VLAN PCP)</li> <li>Test modes: One-way (uni- or bi-directional, symmetrical or asymmetrical), Round-trip</li> <li>Verification against service acceptance criteria: Information rate, Frame transfer delay, Frame delay variation, Frame loss rate, Availability</li> <li>Optional GPS timing synchronization</li> </ul>  |
| Service Configuration Test       | <ul style="list-style-type: none"> <li>Subtests for: Committed information rate, Excess information rate, Traffic policing, Committed burst size, Excess burst size</li> <li>Step duration: 1 s to 60 s (user programmable)</li> <li>Number of steps: 1 to 10 (user programmable)</li> <li>Slope: Rising/Falling</li> <li>Results: Pass/Fail indication, IR (Min./Avg./Max.), FL (Count/FLR), FTD, FDV (Min./Avg./Max./Current (during measurement))</li> </ul> |
| Service Performance Test         | <ul style="list-style-type: none"> <li>All services tested simultaneously at CIR</li> <li>Duration 15 min, 2 h, 24 h, user programmable</li> <li>Results: Pass/Fail indication, IR (Min./Avg./Max.), FL (Count/FLR), FTD, FDV (Min./Avg./Max./Current (during measurement)), AVAIL (%), Unavail (s)</li> </ul>                                                                                                                                                  |

| RFC 6349 TCP Throughput Test |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Supported Bit Rate           | 10 Mbps, 100 Mbps, 1 Gbps, 10 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Function                     | <p>Test Direction Setup</p> <ul style="list-style-type: none"> <li>Local <math>\rightarrow</math> Remote</li> <li>Remote <math>\rightarrow</math> Local</li> <li>Simultaneous in both directions</li> </ul> <p>For RFC 6349 test sequence, user can choose to measure for:</p> <ul style="list-style-type: none"> <li>Path MTU</li> <li>Baseline RTT</li> <li>Window Scan and Throughput</li> <li>Multi-Service</li> </ul> <p>Multi-Service: DSCP or TOS can be set to each TCP connections</p> <p>Measurement results include:</p> <ul style="list-style-type: none"> <li>Auto-calculation of Bandwidth Delay Product (BDP)</li> <li>Transmitted and Retransmitted Bytes</li> <li>TCP Transfer Time Ratio</li> <li>TCP Efficiency</li> <li>Retransmitted Percentage</li> <li>Buffer Delay Percentage</li> </ul> <p>Supports connecting to iPerf server</p> |

# Ethernet Testing Specifications

| Ethernet Network Synchronization Test                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SyncE Protocol Emulation                                                                                                      | <ul style="list-style-type: none"> <li>• Support Interface: 10 Mbps (Electric/Optical), 100 Mbps (Electric/Optical), 1 Gbps (Electric/Optical), 10 Gbps (Optical), 25 Gbps (Optical)</li> <li>• Signal generation for Quality Level (QL) specified by SyncE function</li> <li>• Analysis of QL indicated in received Ethernet signal with alarm at missing QL indications.</li> <li>• SyncE results: SSM Rx count and rate, SSM Tx count, Indicated QL statistics, SSF seconds</li> <li>• ESMC messages captured and exported in Wireshark format.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| SyncE Wander Measurement (MU100011A-021 and MT1000A-005 are required)                                                         | <ul style="list-style-type: none"> <li>• Supported Interface: GigE, 10 GigE, 25 GigE (optical interface)</li> <li>• Reference: 10 MHz from MU100090B</li> <li>• Measurement Items: TIE, MTIE, TDEV</li> <li>• TIE Sampling Rate: 30 sample/s</li> <li>• Limit mask: G.8261, G.8262, G.8262.1</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| IEEE 1588 v2 Protocol Emulation                                                                                               | <ul style="list-style-type: none"> <li>• Support Interface: 10 Mbps (Electric/Optical), 100 Mbps (Electric/Optical), 1 Gbps (Electric/Optical), 10 Gbps (Optical), 25 Gbps (Optical)</li> <li>• Each port of the Ethernet interface can act as a timing master or a timing slave independently.</li> <li>• Supported profiles: G.8265.1, G.8275.1, G.8275.2, SMPTE 2059-2, User Defined</li> <li>• When acting as master in Unicast (G.8265.1) mode, one slave is accepted at a time.</li> <li>• Setting the profile to SMPTE 2059-2 sets IGMP/MLD join/leave.</li> <li>• If the slave requires 32, 64, or 128 Sync messages per second, IEEE 1588-2008 paragraph 7.7.2.1 specifying 90% confidence interval is not supported.</li> <li>• Configurable parameters <ul style="list-style-type: none"> <li>Domain: 0 to 255</li> <li>Step Mode: One-step, Two-step</li> <li>Delay Mechanism: Delay request/response, Peer delay</li> <li>Negotiation: On/Off (Unicast only)</li> <li>Clock Source: Internal or UTC locked with GPS</li> <li>Clock Identify</li> <li>Priority#1, #2, Class, Time Source, Accuracy Index: 0 to 255</li> <li>Announce Interval: 1/8 to 32 s</li> <li>Announce Timeout: 2 to 255 s</li> <li>Sync Interval: 1/128 to 32 s</li> <li>Minimum Delay Request Interval: 1/128 to 32 s</li> <li>Unicast Duration: 60 s to 1,000 s</li> </ul> </li> <li>• Protocol Stack <ul style="list-style-type: none"> <li>Layer2: Ethernet, Ethernet/VLAN, Ethernet/MPLS</li> <li>Layer3: None, IPv4, IPv6</li> </ul> </li> <li>• PTP Protocol Analysis <ul style="list-style-type: none"> <li>Statistics of IEEE 1588 messages and message rate.</li> <li>Logged IEEE 1588 events: Clock state transitions, State transition events, Faults and Changes in grand-master clock</li> <li>IEEE 1588 messages captured and exported in Wireshark format</li> </ul> </li> </ul> |
| Sync Test Application (MT1000A-005 and MU100090B are required)<br>When synchronized with reference time signal (GNSS or 1PPS) | <p>Time/Phase Synchronization Test</p> <p>Supported Interface: GigE, 10 GigE, 25 GigE (only optical interface)</p> <ul style="list-style-type: none"> <li>• Time Error is measured by a parameter set by protocol emulation. (However, the delay mechanism is supported only by Delay request.)</li> <li>• 1 PPS TE <ul style="list-style-type: none"> <li>Method: Comparing 1 PPS signal from the network with reference 1 PPS (error <math>\pm 5</math> ns (typ.))</li> <li>Test Items: max TE , cTE, dTE, MTIE, TDEV</li> </ul> </li> <li>• Packet TE <ul style="list-style-type: none"> <li>Method: The timestamp in the message packet is compared with either GNSS-synchronized UTC, or with the phase of the 1 PPS reference (time stamping error <math>\pm 30</math> ns (Without MU100090B-001 <math>\pm 35</math> ns))</li> <li>Test Items: max TE1 , max TE4 , cTE1, cTE4, Terr, max Terr , cTE, low-pass-filtered dTE, high-pass-filtered dTE, MTIE, pktSelected TE</li> </ul> </li> <li>• PDV measurement: Calculates FPP in compliance with G.8261.1</li> <li>• Frequency deviation measurement reference signal <ul style="list-style-type: none"> <li>Accuracy <ul style="list-style-type: none"> <li>GbE: <math>\pm 2</math> ppb, 10 GbE: <math>\pm 2</math> ppb, 25 GbE: <math>\pm 6</math> ppb</li> </ul> </li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

| IP Channel Statistics |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Supported Bit Rate    | 10 Mbps, 100 Mbps, 1 Gbps, 10 Gbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Statistics            | <p>Statistics for up to 230 channels, identified by user-defined combinations of:</p> <ul style="list-style-type: none"> <li>• IPv4, IPv6 or MAC address</li> <li>• VLAN ID or MPLS label</li> <li>• Protocol information</li> <li>• IP next header (protocol)</li> <li>• TCP/UDP ports</li> </ul> <p>Traffic capacity:</p> <ul style="list-style-type: none"> <li>• 10 Mbps, 100 Mbps, 1 Gbps, 10 Gbps, line speeds: 100% line load</li> </ul> <p>Available Information per channel:</p> <ul style="list-style-type: none"> <li>• Frame count/rate, Throughput, Byte count, MPLS frames, IP frame/packet size distribution, IP header bytes, IP fragments, TTL threshold violations, IP packet count/rate, IP bytes, IP throughput, IP header errors, TCP/UDP bytes, TCP/UDP packet count/rate, Throughput, TCP/UDP errored packets, Undersize frames, Oversize frames</li> </ul> |

## Ethernet Testing Specifications

| Ethernet Frame Capture     |                                                                                                                      |                                                                                                                                                  |
|----------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Model No.                  | MU100010A                                                                                                            | MU100011A                                                                                                                                        |
| Capture Buffer Size        | 1 Mbytes to 128 Mbytes (10 Mbps, 100 Mbps, 1 Gbps, 10 Gbps)<br>When capture buffer full: Stop or Wrap                | 1 Mbytes to 128 Mbytes (10 Mbps, 100 Mbps, 1 Gbps, 10 Gbps)<br>512 kbytes (25 Gbps, 40 Gbps, 100 Gbps)<br>When capture buffer full: Stop or Wrap |
| Capture Frame Slicing      | If activated capture frame is first 64 bytes or 128 bytes of each frame (ignores rest of the frame)                  |                                                                                                                                                  |
| Timestamp Resolution       | 100 ns                                                                                                               |                                                                                                                                                  |
| Include Tx Frame           | On/Off                                                                                                               |                                                                                                                                                  |
| Capture Trigger            | Manual, On error, Field match<br>Trigger position: Top, Middle                                                       |                                                                                                                                                  |
| Error Trigger              | Fragmented frames, Oversize frames, Undersized frames, Undersized and oversized frames, FCS errored frames, Any type |                                                                                                                                                  |
| Trigger Field Pattern Data | Enabled when capture trigger setting is "Field match"<br>• Offset: 0 to 15999 bytes<br>• Length: 1 bytes to 16 bytes |                                                                                                                                                  |
| Capture Data               | Pcap format for display in Wireshark                                                                                 |                                                                                                                                                  |

Wireshark® is a registered trademark of the Wireshark Foundation.

| Discovery |                                                                                                                                                                                                                                                                                 |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Function  | The Auto Discovery feature allows a local Network Master Pro user to discover other remote Network Master Pro units on the network to complete testing. The local user can manage multiple testers remotely without a dedicated network connection.<br>Support IP version: IPv4 |
| Setting   | Network: Src MAC Address, Src IP Address, Network Mask, Gateway, DHCP<br>Connection Security: Password<br>VLAN: OFF, 1, 2<br>Frame Capture: On/Off                                                                                                                              |

| MPLS/MPLS –TP              |                                                                                                                                                                                                                                                                                                    |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of MPLS Header      | Up to 8 MPLS headers set by user                                                                                                                                                                                                                                                                   |
| Parameters per MPLS Header | User-defined label, Exp and TTL fields in each MPLS header<br>• Address increment, Decrement and Random generation<br>An EoMPLS (Ethernet over MPLS) or PWE3 (Pseudo-wire emulation edge-to-edge) label (RFC 4448 control word) can be added.<br>MPLS can only transport VLAN if EoMPLS activated. |
| Statistics                 | • Number of labels (Max./Min.)<br>• Number of MPLS-TP frames<br>• Last received MPLS-TP label/priority/TTL                                                                                                                                                                                         |
| OAM (MPLS-TP)              | ITU-T G.8113.1 comply<br>Supported OAM messages<br>• ITU-T Y.1731: CCM, LBM, LBR, LTM, LTR, AIS, LCK, TST, MCC, LMM, LMR, 1DM, DMM, DMR, EXM, EXR, VSM, VSR, SLM, SLR<br>• IEEE 802.1ag: CCM, LBM, LBR, LTM, LTR                                                                                   |

| PBB (Mac-in-Mac MiM) |                                                                                                                                                                                         |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Programmable Field   | B-tag, I-tag, MAC destination and source addresses                                                                                                                                      |
| Result               | Number of PBB frames, Last received B-tag VLAN ID, Last received B-tag priority, Last received I-tag priority, Last received I-tag service ID                                           |
| OAM                  | Supported OAM messages<br>• ITU-T Y.1731: CCM, LBM, LBR, LTM, LTR, AIS, LCK, TST, MCC, LMM, LMR, 1DM, DMM, DMR, EXM, EXR, VSM, VSR, SLM, SLR<br>• IEEE 802.1ag: CCM, LBM, LBR, LTM, LTR |

## Ethernet Testing Specifications

|                         |                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ethernet OAM            |                                                                                                                                                                                                                                                                                                                                                                                      |
| OAM Standards Supported | <ul style="list-style-type: none"> <li>ITU-T Y.1731 (Service layer OAM)</li> <li>IEEE 802.1ag (Connectivity layer OAM)</li> <li>IEEE 802.3 (formerly IEEE 802.3ah) (Access link OAM)</li> </ul>                                                                                                                                                                                      |
| Messages Supported      | Generates and receives following OAM messages.<br>Supported OAM messages <ul style="list-style-type: none"> <li>ITU-T Y.1731: CCM, LBM, LBR, LTM, LTR, AIS, LCK, TST, MCC, LMM, LMR, 1DM, DMM, DMR, EXM, EXR, VSM, VSR, SLM, SLR</li> <li>IEEE 802.1ag: CCM, LBM, LBR, LTM, LTR</li> <li>IEEE 802.3ah: Information, Variable request, Variable response, Loopback control</li> </ul> |
| IEEE 802.3ah Function   | <ul style="list-style-type: none"> <li>Discovery</li> <li>Loopback activate</li> </ul>                                                                                                                                                                                                                                                                                               |
| Statistics              | <ul style="list-style-type: none"> <li>Number of each message generated/received</li> </ul>                                                                                                                                                                                                                                                                                          |

|           |                                                                                                                                                                                                             |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ping Test |                                                                                                                                                                                                             |
| Function  | For Connectivity and Configuration check <ul style="list-style-type: none"> <li>Round Trip Time (RTT)</li> <li>Supports IPv4 and IPv6 addressing</li> <li>Answer incoming ping requests (On/Off)</li> </ul> |

|           |                                                                                                                                                                                                                                                                                                                                                  |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reflector |                                                                                                                                                                                                                                                                                                                                                  |
| Function  | The following parameters are user selectable: <ul style="list-style-type: none"> <li>Reflector MAC/IP address</li> <li>Swap all MAC addresses or one specific MAC address</li> <li>Swap IPv4/IPv6 addresses</li> <li>Swap port numbers on UDP/TCP frames</li> <li>Force ACK on TCP frames</li> <li>Answer incoming ARP, Ping requests</li> </ul> |

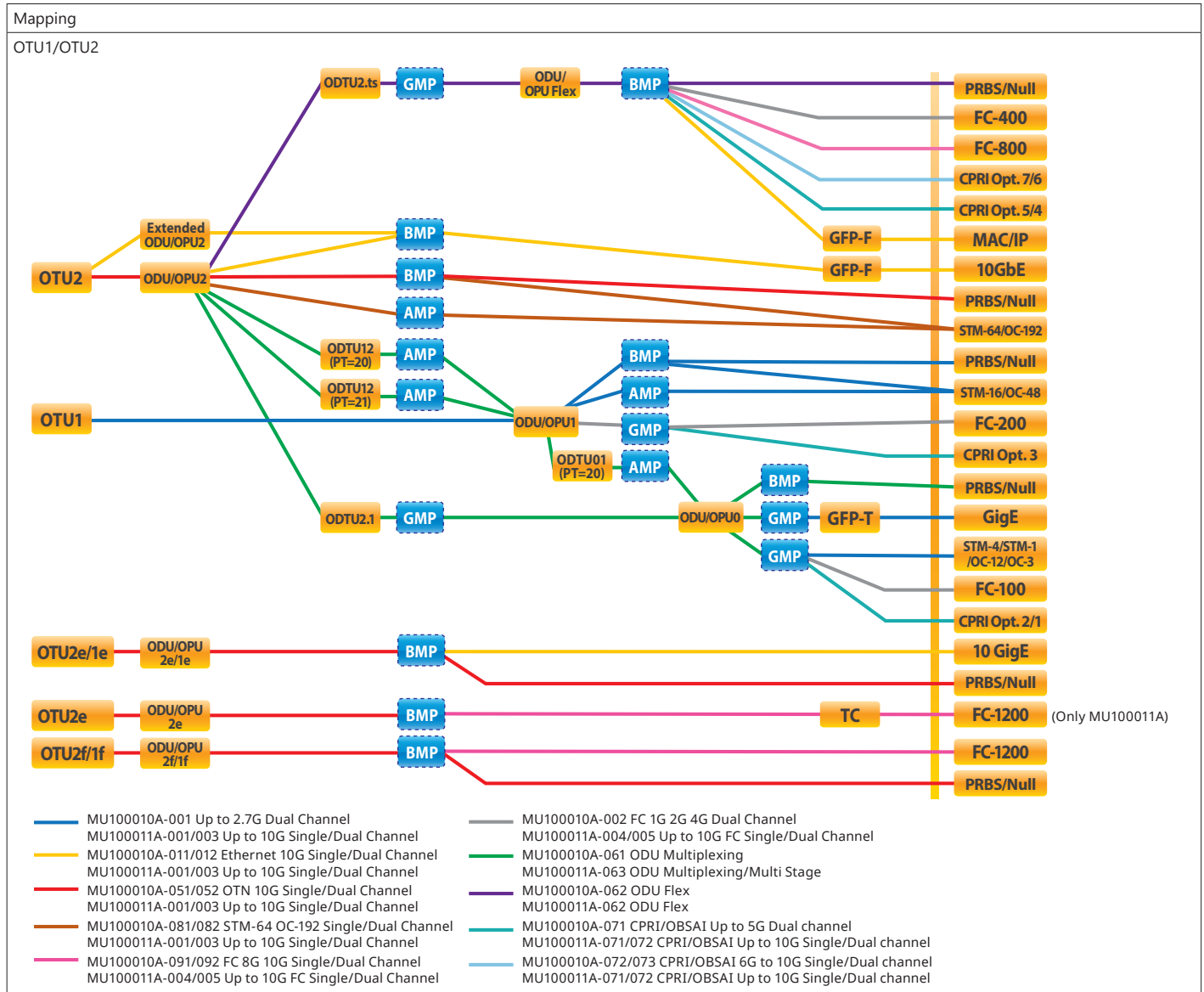
|            |                                                                                                                                                                                                       |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Traceroute |                                                                                                                                                                                                       |
| Function   | Trace IP route over IP network <ul style="list-style-type: none"> <li>User-defined Max. number of hops (1 to 255)</li> </ul> Information per hop: Ping time (Min./Max./Avg.), Number of ping timeouts |

|            |                                                                                                                                                                                                                            |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cable Test |                                                                                                                                                                                                                            |
| Function   | Required Options: MU100010A-001, MU100011A-001, MU100011A-003<br>Identifies cable faults like short circuits, or breaks in wire pair, and displays distance from instrument to fault<br>Support Cable: category 5/5e, 6/6a |

|                             |                                                                                                                                                                                                           |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10G WAN-PHY                 |                                                                                                                                                                                                           |
| WAN Mode                    | 10 Gbps Ethernet (normal)                                                                                                                                                                                 |
| Terminology                 | SDH or SONET                                                                                                                                                                                              |
| Error Generation            | SDH: A1A2, B1, B2, MS-REI, B3, HP-REI<br>SONET: A1A2, B1, B2, REI-L, B3, REI-P                                                                                                                            |
| Alarm Generation            | SDH: LOF, OOF, MS-AIS, MS-RDI, MS-TIM, AU-AIS, AU-LOP, HP-PLM, HP-UNEQ, HP-TIM, HP-RDI, LCD<br>SONET: LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, RDI-P                            |
| Error Measurement           | SDH: A1A2, B1, B2, MS-REI, B3, HP-REI<br>SONET: A1A2, B1, B2, REI-L, B3, REI-P<br>G.826, G.828+G.829 or M.2101.1 (M.2100) error performance parameters are calculated                                     |
| Alarm Detection             | SDH: LOS, LOF, OOF, MS-AIS, MS-RDI, MS-TIM, AU-AIS, AU-LOP, HP-PLM, HP-UNEQ, HP-TIM, HP-RDI, LCD, LSS<br>SONET: LOS, LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, RDI-P, LCD-P, LSS |
| Overhead Byte Functionality | Generation of user-defined overhead bytes<br>Capture and display of current overhead bytes                                                                                                                |

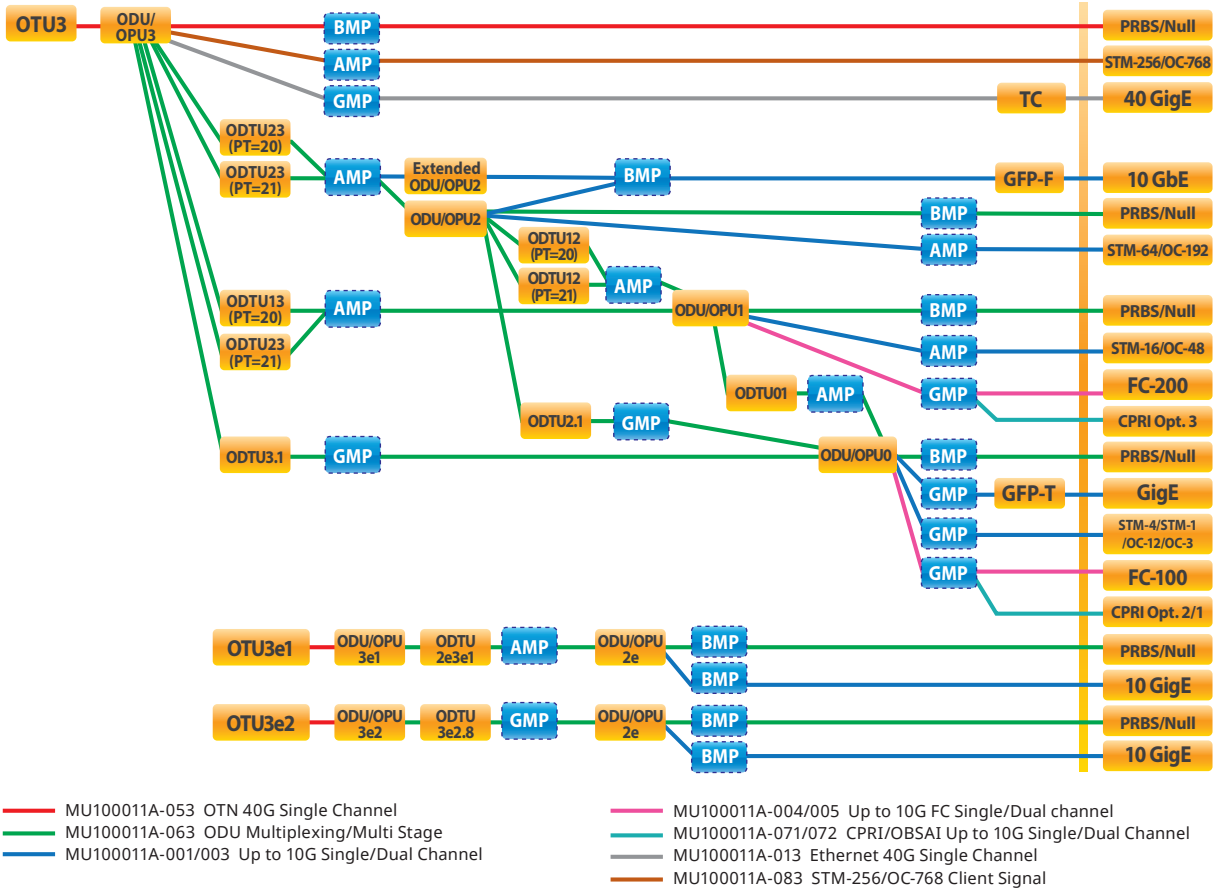
## OTN Testing Specifications

|                     |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                               |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common              |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                               |
| Model No.           | MU100010A                                                                                                                                                                                                                                                                                                                  | MU100011A                                                                                                                                                                                                                                                                                                                     |
| Framing             | OTU2, OTU2e, OTU1e, OTU2f, OTU1f, OTU1                                                                                                                                                                                                                                                                                     | OTU4, OTU3, OTU3e1, OTU3e2, OTU2, OTU2e, OTU1e, OTU2f, OTU1f, OTU1                                                                                                                                                                                                                                                            |
| Test Configuration  | BERT, RTD, APS                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                               |
| Transmitter Clock   | <ul style="list-style-type: none"> <li>Internal clock accuracy: <math>\pm 4.6</math> ppm, Clock offset: <math>\pm 50</math> ppm (1-ppm steps)</li> <li>Received clock</li> <li>TTL level external 2 MHz clock</li> <li>SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps)</li> <li>Signal from optional GPS receiver</li> </ul> | <ul style="list-style-type: none"> <li>Internal clock accuracy: <math>\pm 4.6</math> ppm, Clock offset: <math>\pm 200</math> ppm (0.1-ppm steps)</li> <li>Received clock</li> <li>TTL level external 2 MHz clock</li> <li>SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps)</li> <li>Signal from optional GPS receiver</li> </ul> |
| Receive Signal Rate | $\pm 50$ ppm<br>Frequency deviation indication resolution: $\pm 1$ ppm                                                                                                                                                                                                                                                     | $\pm 200$ ppm<br>Frequency deviation indication resolution: $\pm 0.1$ ppm                                                                                                                                                                                                                                                     |
| Scrambling          | Complies with ITU-T G.709                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                               |

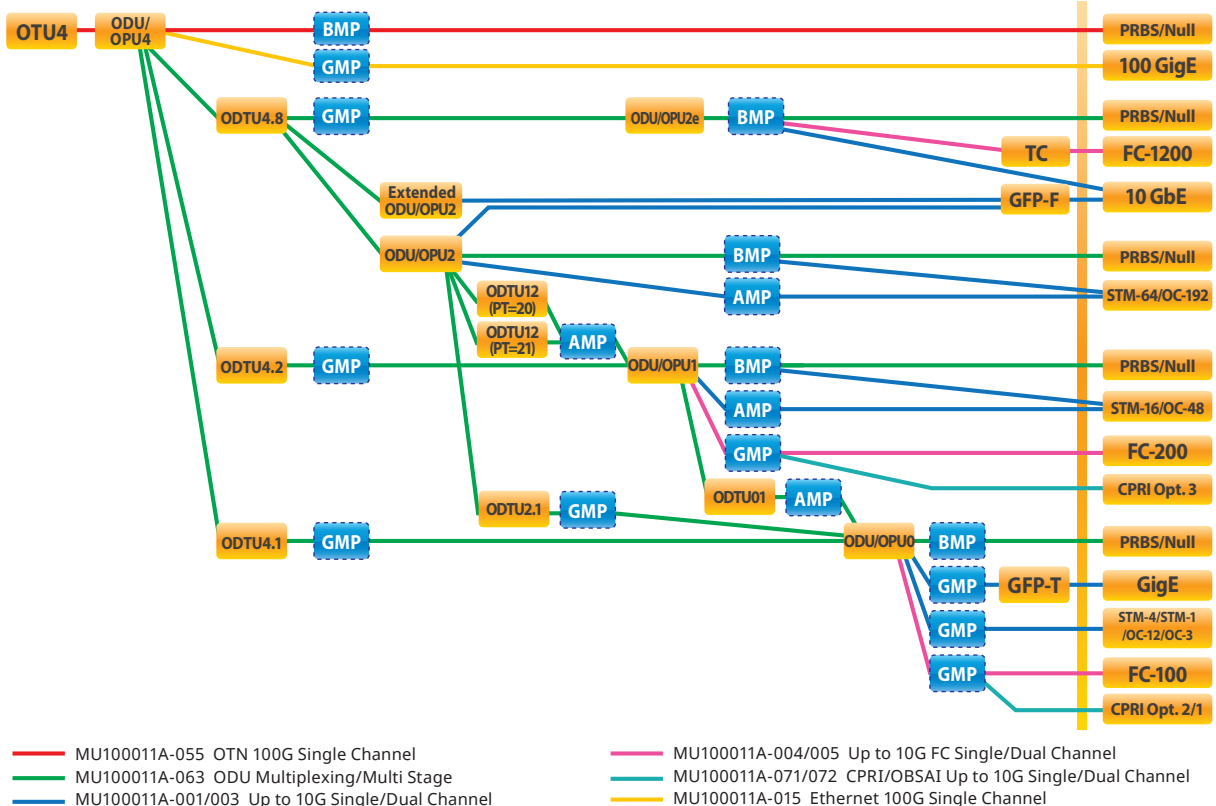


# OTN Testing Specifications

## OTU3



## OTU4



| OTN Configuration      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model No.              | MU100010A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | MU100011A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| OTN Alarms             | <p>Detected alarms</p> <ul style="list-style-type: none"> <li>• OTU layer: OTU-AIS, LOF, OOF, LOM, OOM, SM-TIM, SM-BIAE, SM-BDI, SM-IAE</li> <li>• ODU layer: LOS, ODU-AIS, ODU-OCI, ODU-LCK, PM-TIM, PM-BDI, FSF, FSD, BSF, BSD</li> <li>• ODU multiplexing: ODU-LOFLOM, ODU-OOF, OOM, ODU-AIS, ODU-OCI, ODU-LCK, PM-TIM, PM-BDI, MSIM</li> <li>• OPU layer: PLM, OPU-MSIM, Client-AIS, CSF, LSS</li> <li>• TCM: TCMi-TIM, TCMi-BIAE, TCMi-BDI, TCMi-IAE, TCMi-LTC (i = 1 to 6)</li> </ul> <p>Generated alarms</p> <ul style="list-style-type: none"> <li>• OTU layer: OTU-AIS, OTU-OOF/LOF, OOM/LOM, SM-TIM, SM-BIAE, SM-BDI, SM-IAE</li> <li>• ODU layer: ODU-AIS, ODU-OCI, ODU-LCK, PM-TIM, PM-BDI, FSF, FSD, BSF, BSD</li> <li>• ODU multiplexing: OOF/LOF, OOM/LOM, ODU-AIS, ODU-LCK, PM-TIM, PM-BDI, FSF, FSD, BSF, BSD</li> <li>• OPU layer: Client-AIS, CSF</li> <li>• TCM: TCMi-TIM, TCMi-BIAE, TCMi-IAE, TCMi-BDI, TCMi-LTC (i = 1 to 6)</li> </ul>                                                          | <p>Detected alarms</p> <ul style="list-style-type: none"> <li>• OTU layer: OTU-AIS, LOF, OOF, LOM, OOM, SM-TIM, SM-BIAE, SM-BDI, SM-IAE</li> <li>• ODU layer: LOS, ODU-AIS, ODU-OCI, ODU-LCK, PM-TIM, PM-BDI, FSF, FSD, BSF, BSD</li> <li>• ODU multiplexing: ODU-LOFLOM, ODU-OOF, OOM, ODU-AIS, ODU-OCI, ODU-LCK, PM-TIM, PM-BDI, MSIM</li> <li>• OPU layer: PLM, OPU-MSIM, Client-AIS, CSF, LSS</li> <li>• TCM: TCMi-TIM, TCMi-BIAE, TCMi-BDI, TCMi-IAE, TCMi-LTC (i = 1 to 6)</li> <li>• OTL: LOF, OOF, OOR, LOR, ILA/OLA (OTU4, OTU3, OTU3e1, OTU3e2)</li> </ul> <p>Generated alarms</p> <ul style="list-style-type: none"> <li>• OTU layer: OTU-AIS, OTU-OOF/LOF, OOM/LOM, SM-TIM, SM-BIAE, SM-BDI, SM-IAE</li> <li>• ODU layer: ODU-AIS, ODU-OCI, ODU-LCK, PM-TIM, PM-BDI, FSF, FSD, BSF, BSD</li> <li>• ODU multiplexing: OOF/LOF, OOM/LOM, ODU-AIS, ODU-LCK, PM-TIM, PM-BDI, FSF, FSD, BSF, BSD</li> <li>• OPU layer: Client-AIS, CSF</li> <li>• TCM: TCMi-TIM, TCMi-BIAE, TCMi-IAE, TCMi-BDI, TCMi-LTC (i = 1 to 6)</li> <li>• OTL: LOF, OOF, OOR, LOR (OTU4, OTU3, OTU3e1, OTU3e2)</li> </ul>                               |
| OTN Errors             | <p>Detected errors</p> <ul style="list-style-type: none"> <li>• OTU layer: FAS, MFAS, SM-BEI, SM-BIP8, FEC-Correctable, FEC-Uncorrectable</li> <li>• ODU layer: PM-BIP8, PM-BEI</li> <li>• OPU layer: Pattern error</li> <li>• GMP error: CRC8 error, CRC5 error</li> <li>• GFP errors: cHEC corrected, cHEC uncorrectable, tHEC corrected, tHEC uncorrectable, CSF Signal, CSF Sync, Invalid GFP Frame, Superblock CRC, eHEC corrected, eHEC uncorrectable, FCS, CMF Sync, CMF Signal, SSF, PTI Mismatch, UPI Mismatch</li> <li>• TCM: TCMi-BEI, TCMi-BIP-8 (i = 1 to 6)</li> </ul> <p>Generated errors</p> <ul style="list-style-type: none"> <li>• OTU layer: Bit all, FAS, OTU-FAS, MFAS, SM-BIP8, SM-BEI</li> <li>• ODU layer: PM-BIP8, PM-BEI, ODU-FAS</li> <li>• TCMi-BIP8, TCMi-BEI (i = 1 to 6)</li> <li>• Pattern error</li> <li>• GMP: CRC8, CRC5, Invalid JC1, Invalid JC2, Invalid JC1&amp;JC2</li> <li>• GFP: cHEC, tHEC, Superblock CRC, eHEC, FCS, CMF<br/>Inserted Error bits are editable.</li> </ul> | <p>Detected errors</p> <ul style="list-style-type: none"> <li>• OTU layer: FAS, MFAS, SM-BEI, SM-BIP8, FEC-Correctable, FEC-Uncorrectable</li> <li>• ODU layer: PM-BIP8, PM-BEI</li> <li>• OPU layer: Pattern error</li> <li>• GMP error: CRC8 error, CRC5 error</li> <li>• GFP errors: cHEC corrected, cHEC uncorrectable, tHEC corrected, tHEC uncorrectable, CSF Signal, CSF Sync, Invalid GFP Frame, Superblock CRC, eHEC corrected, eHEC uncorrectable, FCS, CMF Sync, CMF Signal, SSF, PTI Mismatch, UPI Mismatch</li> <li>• TCM: TCMi-BEI, TCMi-BIP-8 (i = 1 to 6)</li> <li>• OTL: MFAS, LLM (OTU4, OTU3, OTU3e1, OTU3e2)</li> </ul> <p>Generated errors</p> <ul style="list-style-type: none"> <li>• OTU layer: Bit all, FAS, OTU-FAS, MFAS, SM-BIP8, SM-BEI</li> <li>• ODU layer: PM-BIP8, PM-BEI, ODU-FAS</li> <li>• TCMi-BIP8, TCMi-BEI (i = 1 to 6)</li> <li>• Pattern error</li> <li>• GMP: CRC8, CRC5, Invalid JC1, Invalid JC2, Invalid JC1&amp;JC2</li> <li>• GFP: cHEC, tHEC, Superblock CRC, eHEC, FCS, CMF<br/>Inserted Error bits are editable.</li> <li>• OTL: MFAS, LLM (OTU4, OTU3, OTU3e1, OTU3e2)</li> </ul> |
| Error Performance      | • G.8201/M.2401 analysis of received signal based on detected errors and alarms: BBE, BBER, SES, SESR, UNAV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Justification Analysis | <p>Count</p> <ul style="list-style-type: none"> <li>• AMP: Positive (+1), Positive (+2), Negative (–1), Offset (ppm)</li> <li>• GMP: CRC8 Error, CRC5 Error, Inc, Inc &gt; 1, Inc &gt; 2, Inc Over, Dec, Dec &gt; 1, Dec &gt; 2, Dec Over, Offset (ppm), Cm (t) Max., Cm (t) Min.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| BER Test Pattern       | <p>Pattern generation and detection for bulk test patterns:</p> <ul style="list-style-type: none"> <li>• Test patterns: PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, Null</li> </ul> <p>PRBS patterns can be inverted.</p> <ul style="list-style-type: none"> <li>• User-defined patterns (Pattern length: 2048 bits, 32 bits)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| FEC Test               | ITU-T O.182 Random error insertion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Overhead               | <p>User-editable header bytes</p> <ul style="list-style-type: none"> <li>• OTU layer: FAS, SM, GCC0, RES</li> <li>• ODU layer: PM, FTFL, APS/PCC, GCC1, GCC2, RES, EXP, TCMi (i = 1 to 6)</li> <li>• OPU layer(s): PSI</li> </ul> <p>Capture and display current overhead bytes</p> <ul style="list-style-type: none"> <li>• The following signals are decoded: TTI (SM, PM, TCMi (i = 1 to 6) of high-order, FTFL, PT)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## OTN Testing Specifications

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OTL Skew      | —                                                                                                                                                                                                                                                                                                                                                                                                                                                              | OTU4, OTU3, OTU3e1, OTU3e2<br>• Insertion<br>Bits: 0 to 32000 (LLD)<br>• Detection<br>Relative skew, Marker map                                                                                                                                                                                                                                                                                                                                                |
| Client Signal | Ethernet functionality is supported for Ethernet signals embedded in selected ODU-n<br>(Requires MU100010A-061, MU100010A-062 and MU100010A-001/011/012)<br>SDH/SONET functionality is supported for SDH/SONET signals embedded in selected ODU-n<br>(Requires MU100010A-061 and MU100010A-001/081/082)<br>Fibre Channel functionality is supported for Fibre Channel signals embedded in selected ODU-n<br>(Requires MU100010A-061 and MU100010A-002/091/092) | Ethernet functionality is supported for Ethernet signals embedded in selected ODU-n<br>(Requires MU100011A-062, MU100011A-063 and MU100011A-001/003/013/015)<br>SDH/SONET functionality is supported for SDH/SONET signals embedded in selected ODU-n<br>(Requires MU100011A-063 and MU100011A-001/003/083)<br>Fibre Channel functionality is supported for Fibre Channel signals embedded in selected ODU-n<br>(Requires MU100011A-063 and MU100011A-004/005) |
| Through Mode  | <ul style="list-style-type: none"> <li>• Transparent mode</li> <li>• OH overwrite mode</li> </ul> <p>The OTU, ODU and OPU overhead can be changed.</p> <p>The FEC encoder and decoder can be set On/Off in any mode</p>                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

| OTN Results                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Status                                          | Current information on: <ul style="list-style-type: none"> <li>• Alarms and errors on monitored line</li> <li>• Input level indication for optical signals</li> <li>• Frequency</li> <li>• Frequency deviation</li> </ul>                                                                                                                                                                                                                                                                                                                                                 |
| Statistics                                      | User-defined measurement resolution: 1, 2, 5, 10, 15, 30 s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 h<br>Logged information: Alarms (s), Errors (count or count and ratio), Client Frequency, Deviation                                                                                                                                                                                                                                                                                                                                                                      |
| APS                                             | APS (Automatic Protection Switching) test and analysis <ul style="list-style-type: none"> <li>• APS switching time is measured. A switching time exceeding the user-defined threshold is highlighted.</li> <li>• Start and stop triggers can be selected independently.</li> <li>• Trigger events can be selected from the high-order OTU and ODU, Pattern bit error, LOS (Loss of Signal).</li> <li>• Switching time, Switching count, Pass/Fail, Minimum, Maximum and Average can be displayed.</li> <li>• APS switching time measurement resolution: 0.1 ms</li> </ul> |
| Round Trip Delay (Propagation Time) Measurement | Resolution: 0.1 $\mu$ s<br>Measured Max. time: 10.0 s<br>Interval: 0.5, 1, 2, 5, 10 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Tributary Scan                                  | Supports up to 10 Gbps<br>Detected alarms: OTU-AIS, LOF, OOF, LOM, OOM, SM-BIAE, SM-BDI, SM-IAE, ODU-AIS, ODU-OCI, ODU-LCK, PM-BDI, LOFLOM                                                                                                                                                                                                                                                                                                                                                                                                                                |

## Mobile xHaul Testing Specifications

|                    |                                                                                                                                                                                      |                                                                                                                                                                                                                                      |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common             |                                                                                                                                                                                      |                                                                                                                                                                                                                                      |
| Model No.          | MU100010A                                                                                                                                                                            | MU100011A                                                                                                                                                                                                                            |
| Bit Rate           | CPRI: 614.4, 1228.8, 2457.6, 3072.0, 4915.2, 6144.0, 9830.4, 10137.6 Mbps<br>OBSAI: 768, 1536, 3072.0, 6144.0 Mbps<br>eCPRI/RoE (IEEE1914.3):<br>10M/100M/1000 Mbps, 1 Gbps, 10 Gbps | CPRI: 614.4, 1228.8, 2457.6, 3072.0, 4915.2, 6144.0, 9830.4, 10137.6, 12165.12, 24330.24 Mbps<br>OBSAI: 768, 1536, 3072.0, 6144.0 Mbps<br>eCPRI/RoE (IEEE1914.3):<br>10M/100M/1000 Mbps, 1 Gbps, 10 Gbps, 25 Gbps, 40 Gbps, 100 Gbps |
| Test Configuration | CPRI/OBSAI BERT, CPRI Pass Through, eCPRI/RoE BERT                                                                                                                                   |                                                                                                                                                                                                                                      |

|                     |                                                                                                                                                                                                                                                                                                   |                                                                                         |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| CPRI/OBSAI BER Test |                                                                                                                                                                                                                                                                                                   |                                                                                         |
| Model No.           | MU100010A                                                                                                                                                                                                                                                                                         | MU100011A                                                                               |
| Port Mode           | Off, Normal, Through (CPRI Link)                                                                                                                                                                                                                                                                  |                                                                                         |
| Transmitter Clock   | Reference Clock <ul style="list-style-type: none"><li>• Internal clock</li><li>• External clock</li><li>• BITS</li><li>• SETS</li><li>• 2 MHz</li><li>• 10 MHz</li><li>• GPS</li><li>• Received clock</li></ul>                                                                                   |                                                                                         |
| Frequency Offset    | ±100 ppm, 1-ppm steps                                                                                                                                                                                                                                                                             | ±200 ppm, 0.1-ppm steps                                                                 |
| Content             | Unframed, CPRI Link, OBSAI Link                                                                                                                                                                                                                                                                   |                                                                                         |
| Pattern             | PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, User 32 bits*, Off<br>*: Option 9 and Option 10 can be set in 8-bit units                                                                                                                                                                            |                                                                                         |
| CPRI                |                                                                                                                                                                                                                                                                                                   |                                                                                         |
| Bit Rate            | 614.4, 1228.8, 2457.6, 3072.0, 4915.2, 6144.0, 9830.4, 10137.6 Mbps                                                                                                                                                                                                                               | 614.4, 1228.8, 2457.6, 3072.0, 4915.2, 6144.0, 9830.4, 10137.6, 12165.12, 24330.24 Mbps |
| FEC                 | Not supported                                                                                                                                                                                                                                                                                     | Not supported: CPRI Option 1, 2, 3, 4, 5, 6, 7, 8<br>Supported: CPRI Option 9, 10       |
| CPRI Link           | Start up: Enabled, Disabled<br>Role: Master, Slave<br>Protocol version: 1, 2<br>HDLC rate: no HDLC, 240, 480, 960, 1920, 2400 kbit/s, Highest possible<br>Ethernet: On, Off; Pointer: 20 to 63                                                                                                    |                                                                                         |
| Alarm Insertion     | Signal Loss, LOS, LOF, LSS, Remote-LOS, Remote-LOF, RAI, SDI, Reset                                                                                                                                                                                                                               |                                                                                         |
| Error Insertion     | Item: LCV, SHV, K30.7, Pattern error, FEC Symbol Error<br>Insertion timing: Manual, Rate                                                                                                                                                                                                          |                                                                                         |
| Alarm Detection     | Signal loss, LOS, LOF, LSS                                                                                                                                                                                                                                                                        |                                                                                         |
| Error Detection     | LCV, SHV, K30.7, Pattern error, FEC Symbol Error                                                                                                                                                                                                                                                  |                                                                                         |
| FEC Error Detection | LOFA, Corr. CW, Uncorr. CW, FEC Symbol Error                                                                                                                                                                                                                                                      |                                                                                         |
| Remote Status       | Remote LOS, Remote LOF, RAI, SDI, Reset                                                                                                                                                                                                                                                           |                                                                                         |
| Link                | Rx: Protocol version, HDLC rate, Pointer P<br>Tx: Protocol version, HDLC rate, Pointer P                                                                                                                                                                                                          |                                                                                         |
| Statistics          | Alarms: Signal loss, LOS, LOF, LSS, Remote LOS, Remote LOF, RAI, SDI, Reset<br>Errors: LCV, SHV, K30.7, Pattern error, FEC Symbol Error<br>Frames count: Rx hyper frame, Rx code words, Tx hyper frame, Tx code words<br>Delay: Delay, Average Delay, Min. Delay, Max. Delay<br>Measurement count |                                                                                         |
| OBSAI               |                                                                                                                                                                                                                                                                                                   |                                                                                         |
| Bit Rate            | 768, 1536, 3072.0, 6144.0 Mbps                                                                                                                                                                                                                                                                    |                                                                                         |
| OBSAI Link          | Tx: Force idle, Scramble seed, RP3 address, RP3 type<br>Rx: Forced scrambler seed, Rx Filter, Scramble seed, RP3 address, RP3 type                                                                                                                                                                |                                                                                         |
| Alarm Insertion     | Signal Loss, LOF, No message, LSS                                                                                                                                                                                                                                                                 |                                                                                         |
| Error Insertion     | Item: LCV, K30.7, Pattern error<br>Insertion timing: Manual, Rate                                                                                                                                                                                                                                 |                                                                                         |
| Alarm Detection     | Signal Loss, LOF, No message, LSS                                                                                                                                                                                                                                                                 |                                                                                         |
| Error Detection     | LCV, K30.7, Pattern error                                                                                                                                                                                                                                                                         |                                                                                         |
| Link                | Rx: Sync state                                                                                                                                                                                                                                                                                    |                                                                                         |
| Statistics          | Alarms: Signal loss, LOF, LSS<br>Errors: LCV, K30.7, Pattern error<br>Frames count: Tx/Rx Message Groups<br>Delay: Delay, Average Delay, Min. Delay, Max. Delay<br>Measurement count                                                                                                              |                                                                                         |

# Mobile xHaul Testing Specifications

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| CPRI/OBSAI APS | APS (Automatic Protection Switching) test and analysis <ul style="list-style-type: none"> <li>• APS switching time is measured. A switching time exceeding the user-defined threshold is highlighted.</li> <li>• Trigger events (user selectable)</li> <li>• Alarm: Signal Loss, LOS(CPRI), LOF</li> <li>• Error: LCV, SHV(CPRI), Pattern error</li> <li>• Remote Alarm(CPRI): Remote LOS, Remote LOF, RAI, SDI, Reset</li> <li>• Switching time, Switching count, Pass/Fail, Minimum, Maximum and Average can be displayed.</li> <li>• APS switching time measurement resolution: 1 <math>\mu</math>s</li> </ul> |  |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

|                   |                                                                                                                       |           |
|-------------------|-----------------------------------------------------------------------------------------------------------------------|-----------|
| CPRI Pass Through |                                                                                                                       |           |
| Model No.         | MU100010A                                                                                                             | MU100011A |
| Port Mode         | Off, Normal                                                                                                           |           |
| Bit Rate          | 614.4, 1228.8, 2457.6, 3072.0, 4915.2, 6144.0, 9830.4, 10137.6 Mbps                                                   |           |
| Statistics        | Alarms: Signal loss, LOS, LOF, LSS, Remote LOS, Remote LOF, RAI, SDI, Reset<br>Errors: LCV, SHV, K30.7, Pattern error |           |

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                      |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| eCPRI/RoE (IEEE1914.3) BER Test (Setting) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                      |
| Model No.                                 | MU100010A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | MU100011A                                                                                                                                                                                                            |
| Frame Length                              | eCPRI: 50 byte to 16000 byte<br>RoE: 51 byte to 16000 byte                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                      |
| eCPRI Frame Configuration                 | <ul style="list-style-type: none"> <li>• Transmitting mode: Normal, Burst</li> <li>• Variable line rate traffic generation, up to full line rate</li> <li>• Line load profile: Constant, Ramp</li> <li>• Traffic duration: Continuous, Programmable number of seconds or frames</li> <li>• Frame sizes: Constant</li> <li>• Protocol Stack               <ul style="list-style-type: none"> <li>Ethernet-eCPRI, Ethernet-IPv4-UDP-eCPRI, Ethernet-IPv6-UDP-eCPRI, Ethernet-VLAN-eCPRI, Ethernet-VLAN-IPv4-UDP-eCPRI, Ethernet-VLAN-IPv6-UDP-eCPRI,</li> </ul> </li> <li>• eCPRI frame parameter               <ul style="list-style-type: none"> <li>• Common Header: Following the Message Type can be chosen                   <ul style="list-style-type: none"> <li>IQ Data, Bit Sequence, Real-Time Control Data, Generic Data Transfer, Remote Memory Access, One-way Delay Measurement, Remote Reset, Event Indication, User Defined, None</li> </ul> </li> <li>• Message Header: Change of Message Type</li> <li>• Payload: PRBS31</li> <li>• Increment, Decrement and Random: PC_ID, SEQ_ID, RTC_ID, RESET_ID</li> </ul> </li> </ul>                                                                        |                                                                                                                                                                                                                      |
| RoE (IEEE1914.3) Frame Configuration      | <ul style="list-style-type: none"> <li>• Transmitting mode: Normal, Burst</li> <li>• Variable line rate traffic generation, up to full line rate</li> <li>• Line load profile: Constant, Ramp</li> <li>• Traffic duration: Continuous, Programmable number of seconds or frames</li> <li>• Frame sizes: Constant</li> <li>• Protocol Stack               <ul style="list-style-type: none"> <li>Ethernet-RoE, Ethernet-VLAN-RoE</li> </ul> </li> <li>• RoE Frame setting               <ul style="list-style-type: none"> <li>• Common Header: Following the Sub Type can be chosen                   <ul style="list-style-type: none"> <li>RoE Control sub type, RoE Structure-agnostic data sub type, RoE Structure-aware CPRI data sub type, RoE Slow C&amp;M CPRI sub type, RoE Native time domain data sub type, RoE Native frequency domain data sub type, RoE Native PRACH data sub type, User Defined, None</li> </ul> </li> </ul> </li> <li>• Flow ID: Fixed, Increment, Decrement and Random</li> <li>• Ordering info: Fixed, Increment, Decrement and Random               <ul style="list-style-type: none"> <li>• Sub Header: Choice of the Sub Type</li> </ul> </li> <li>• Payload: PRBS31</li> </ul> |                                                                                                                                                                                                                      |
| VLAN, ARP, IP/UDP Address Setting         | <ul style="list-style-type: none"> <li>• Two VLAN tags supported</li> <li>• Generate pause frames, Respond to pause frames</li> <li>• Answer incoming ARP, Ping requests (On/Off)</li> </ul> <p>The following items can also be set only when eCPRI is selected.</p> <ul style="list-style-type: none"> <li>• Configurable IP and Ethernet source and destination addresses (supports IPv4 and IPv6 addressing)               <ul style="list-style-type: none"> <li>IPv4: Fixed, DHCP, DNS</li> <li>IPv6: Fixed, NDP</li> </ul> </li> <li>• Address increment, Decrement and Random generation supported</li> <li>• User programmable UDP port number</li> <li>• UDP check sum: Automatic</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                      |
| Transmit Signal Clock Sources             | Internal, Received clock, 2-MHz signal, SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps), PTP (IEEE 1588 v2) recovered clock or signal from optional GPS receiver<br>Frequency deviation: $\pm 100$ ppm (1-ppm steps)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Internal, Received clock, 2-MHz signal, SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps), PTP (IEEE 1588 v2) recovered clock or signal from optional GPS receiver<br>Frequency deviation: $\pm 200$ ppm (0.1-ppm steps) |

## Mobile xHaul Testing Specifications

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|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Receive Setting                      | User-defined expected preamble length: 3 bytes to 15 bytes<br>User-defined IFG lower threshold: 8 bytes to 15 bytes (RJ45 port only)<br>User-defined Jumbo frame size upper limit: 1519 bytes to 16000 bytes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     |
| Error Generation                     | IFG for Ethernet (RJ45 port only), FCS, Preamble, Error symbol/block, Wrong IP check sum, Fragmented IP, Wrong layer 4 check sum, PRBS bit error, BER test sequence error                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                     |
| Alarm Generation                     | No link, Remote fault                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                     |
| Link Fault Signaling (LFS) Emulation | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 10 Gbps, 25 Gbps, 40 Gbps, 100 Gbps |
| SyncE Protocol Emulation             | <ul style="list-style-type: none"> <li>• Support Interfaces: 10 Mbps (Electric), 100 Mbps (Electric/Optical), 1 Gbps (Electric/Optical), 10 Gbps (Optical), 25 Gbps (Optical)</li> <li>• Signal generation for Quality Level (QL) specified by SyncE function</li> <li>• Analysis of QL indicated in received Ethernet signal with alarm at missing QL indications.</li> <li>• SyncE results: SSM Rx count and rate, SSM Tx count, Indicated QL statistics, SSF seconds</li> <li>• ESMC messages captured and exported in Wireshark format.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                     |
| IEEE 1588 v2 Protocol Emulation      | <ul style="list-style-type: none"> <li>• Support Interface: 10 Mbps (Electric), 100 Mbps (Electric/Optical), 1 Gbps (Electric/Optical), 10 Gbps (Optical), 25 Gbps (Optical)</li> <li>• Each port of the Ethernet interface can act as a timing master or a timing slave independently.</li> <li>• Supported profiles: G.8265.1, G.8275.1, G.8275.2, User Defined</li> <li>• When acting as master in Unicast (G.8265.1) mode, one slave is accepted at a time.</li> <li>• If the slave requires 32, 64, or 128 Sync messages per second, IEEE 1588-2008 paragraph 7.7.2.1 specifying 90% confidence interval is not supported.</li> </ul> Configurable parameters<br>Domain: 0 to 255<br>Step Mode: One-step, Two-step<br>Delay Mechanism: Delay request/response, Peer delay<br>Negotiation: On/Off (Unicast only)<br>Clock Source: Internal or UTC locked with GPS<br>Clock Identify<br>Priority#1, #2, Class, Time Source, Accuracy Index: 0 to 255<br>Announce Interval: 1/8 to 32 s<br>Announce Timeout: 2 to 255 s<br>Sync Interval: 1/128 to 32 s<br>Minimum Delay Request Interval: 1/128 to 32 s<br>Unicast Duration: 60 s to 1,000 s <ul style="list-style-type: none"> <li>• Protocol Stack<br/>               Layer2: Ethernet, Ethernet/VLAN, Ethernet/MPLS<br/>               Layer3: None, IPv4, IPv6</li> <li>• PTP Protocol Analysis<br/>               Statistics of IEEE 1588 messages and message rate.<br/>               Logged IEEE 1588 events: Clock state transitions, State transition events, Faults and Changes in grand-master clock<br/>               IEEE 1588 messages captured and exported in Wireshark format</li> </ul> |                                     |
| E-OAM                                | Standards Supported <ul style="list-style-type: none"> <li>• ITU-T Y.1731 (Service layer OAM)</li> <li>• IEEE 802.1ag (Connectivity layer OAM)</li> <li>• IEEE 802.3 (formerly IEEE 802.3ah) (Access link OAM)</li> </ul> Generates and receives following OAM messages. <ul style="list-style-type: none"> <li>• ITU-T Y.1731: CCM, LBM, LBR, LTM, LTR, AIS, LCK, TST, MCC, LMM, LMR, 1DM, DMM, DMR, EXM, EXR, VSM, VSR, SLM, SLR</li> <li>• IEEE 802.1ag: CCM, LBM, LBR, LTM, LTR</li> <li>• IEEE 802.3ah: Information, Variable request, Variable response, Loopback control</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                     |
| IEEE 802.3ah Function                | <ul style="list-style-type: none"> <li>• Discovery</li> <li>• Loopback activate</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                     |

## Mobile xHaul Testing Specifications

| eCPRI/RoE (IEEE1914.3) BER Test (Counter, Monitor) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model No.                                          | MU100010A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | MU100011A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Status                                             | <ul style="list-style-type: none"> <li>Link status, Interface type, Jabber detected, Frames present, MPLS/EoMPLS/VLAN, Speed, Full or half duplex, Local clock (Ethernet 1000 Mbps), LFS LF/RF (Ethernet 10 Gbps), Signal present, Bit rate of incoming Ethernet signal, Auto negotiation complete</li> <li>Link partner abilities: <ul style="list-style-type: none"> <li>Pause capable and Asymmetric pause request (not Ethernet 10 Gbps and more), Remote fault, Speed/Duplex</li> </ul> </li> <li>Indicators for Utilization, Throughput and Errored frames</li> <li>Signal level indication for optical Ethernet interfaces</li> <li>LFS local fault, LFS remote fault, High BER, LOA (10 Gbps)</li> <li>Invalid sync header, Invalid alignment marker, BIP error, Invalid block (10 Gbps)</li> </ul> | <ul style="list-style-type: none"> <li>Link status, Interface type, Jabber detected, Frames present, MPLS/EoMPLS/VLAN, Speed, Full or half duplex, Local clock (Ethernet 1000 Mbps), LFS LF/RF (Ethernet 10 Gbps), Signal present, Bit rate of incoming Ethernet signal, Auto negotiation complete</li> <li>Link partner abilities: <ul style="list-style-type: none"> <li>Pause capable and Asymmetric pause request (not Ethernet 10 Gbps and more), Remote fault, Speed/Duplex</li> </ul> </li> <li>Indicators for Utilization, Throughput and Errored frames</li> <li>Signal level indication for optical Ethernet interfaces</li> <li>LFS local fault, LFS remote fault, High BER, LOA (10 Gbps, 25 Gbps)</li> <li>Invalid sync header, Invalid alignment marker, BIP error, Invalid block (10 Gbps, 25 Gbps)</li> </ul> |
| Resolution                                         | <ul style="list-style-type: none"> <li>User-defined resolution for statistical measurements: 1, 2, 5, 10, 15, 30 s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 h</li> <li>Event log: Major measurement events incl. errors and alarms are logged with 1-second resolution.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Performance Statistics                             | <ul style="list-style-type: none"> <li>Utilization (Max./Min./Avg.), Throughput (Max./Min./Avg.), Frame rate (Max./Min./Avg.)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Frame Statistics                                   | <ul style="list-style-type: none"> <li>Total frames, Total valid frames, Unicast/Multicast/Broadcast frames, Number of pause frames</li> <li>Number of VLAN tagged frames, Max. number of VLAN layers detected, Last received VLAN ID, Last received VLAN priority</li> <li>Total errored frames, Fragmented frames, Number of oversized and undersized (runt) frames, Number of FCS errored frames</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Burst Statistics                                   | <ul style="list-style-type: none"> <li>Total frames, Total valid frames, Number of burst, Total frames in bursts, Burst size (Max./Min./Avg.)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Frame Distribution Statistics                      | <ul style="list-style-type: none"> <li>Total valid/ frames, 64 to 127, 128 to 255, 256 to 511, 512 to 1023, 1024 to 1518 byte frames, Total number of jumbo frames</li> <li>Frame size (Max./Min./Avg.)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Adjustable Threshold                               | Utilization, Throughput, Errored frames, Collision rate, Unicast frames, Multicast frames, Broadcast frames, Pause frames, Fragmented frames, Undersized frames (runt), Oversized frames, FCS errored frames, IFG violations (RJ45 port only), Preamble violations, BER test pattern errors, Sequence errors, Diff.Tx-Rx                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| BER Test                                           | Generation and detection of test patterns, Count of errors in received test pattern, Detection of sequence errors, loss of sequence synchronization, Frame loss count and frame loss seconds<br>Throughput measurement results are calculated for: <ul style="list-style-type: none"> <li>Utilization layer, Physical layer, Physical layer excluding preamble, Link layer, Network layer and Data layer</li> <li>Min./Max./Avg. values</li> </ul> Performance (M.2100 type) parameters: ES, SES, ALS, UAT, AVT, EFS<br>Test patterns: PRBS 31<br>User-defined resolution: 1, 2, 5, 10, 15, 30 s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 h<br>Event log: Major measurement events incl. errors and alarms are logged with 1-second resolution.                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| eCPRI/RoE (IEEE1914.3) BER Test (Frame Capture) |                                                                                                                                                                     |                                                                                                                                                  |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Model No.                                       | MU100010A                                                                                                                                                           | MU100011A                                                                                                                                        |
| Capture Buffer Size                             | 1 Mbytes to 128 Mbytes (10 Mbps, 100 Mbps, 1 Gbps, 10 Gbps)<br>When capture buffer full: Stop or Wrap                                                               | 1 Mbytes to 128 Mbytes (10 Mbps, 100 Mbps, 1 Gbps, 10 Gbps)<br>512 kbytes (25 Gbps, 40 Gbps, 100 Gbps)<br>When capture buffer full: Stop or Wrap |
| Capture Frame Slicing                           | If activated capture frame is first 64 bytes or 128 bytes of each frame (ignores rest of the frame)                                                                 |                                                                                                                                                  |
| Timestamp Resolution                            | 100 ns                                                                                                                                                              |                                                                                                                                                  |
| Include Tx Frame                                | On/Off                                                                                                                                                              |                                                                                                                                                  |
| Capture Trigger                                 | Manual, On error, Field match<br>Trigger position: Top, Middle                                                                                                      |                                                                                                                                                  |
| Error Trigger                                   | Fragmented frames, Oversize frames, Undersized frames, Undersized and oversized frames, FCS errored frames, Any type                                                |                                                                                                                                                  |
| Trigger Field Pattern Data                      | Enabled when capture trigger setting is Field match <ul style="list-style-type: none"> <li>Offset: 0 to 15999 bytes</li> <li>Length: 1 bytes to 16 bytes</li> </ul> |                                                                                                                                                  |
| Capture Data                                    | Pcap format for display in Wireshark                                                                                                                                |                                                                                                                                                  |

## Fibre Channel Testing Specifications

|                    |                                                                                                                                  |                                                                                                                                                               |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Common             |                                                                                                                                  |                                                                                                                                                               |
| Model No.          | MU100010A                                                                                                                        | MU100011A                                                                                                                                                     |
| Bit Rate           | 1.0625 Gbps (FC-100/1GFC), 2.125 Gbps (FC-200/2GFC), 4.25 Gbps (FC-400/4GFC), 8.5 Gbps (FC-800/8GFC), 10.52 Gbps (FC-1200/10GFC) | 1.0625 Gbps (FC-100/1GFC), 2.125 Gbps (FC-200/2GFC), 4.25 Gbps (FC-400/4GFC), 8.5 Gbps (FC-800/8GFC), 10.52 Gbps (FC-1200/10GFC), 14.025 Gbps (FC-1600/16GFC) |
| Test Configuration | FC-Performance Test, FC-BERT, FC-Reflector                                                                                       |                                                                                                                                                               |

|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                           |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| FC-BERT                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                           |
| Model No.                   | MU100010A                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | MU100011A                                 |
| Port mode                   | Off, 1GFC, 2GFC, 4GFC, 8GFC, 10GFC                                                                                                                                                                                                                                                                                                                                                                                                                                              | Off, 1GFC, 2GFC, 4GFC, 8GFC, 10GFC, 16GFC |
| Timing source               | Internal, External, GPS, Received                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                           |
| Topology                    | Point-to-point, Fabric, E-Port                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                           |
| Flow Control                | Credit based transmitter: On/Off<br>Buffer-to-buffer credit configuration: 1 to 65535, Buffer-to-buffer credit and R_RDY counters, R_RDY injection                                                                                                                                                                                                                                                                                                                              |                                           |
| Source                      | Port WWN: User define or Default<br>ID: 000000 to FFFFFFFF                                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |
| Destination                 | Port WWN: User define or Default<br>ID: 000000 to FFFFFFFF                                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |
| Primitive Sequence Protocol | Count and transmit primitive sequence: LR, LRR, NOS, OLS                                                                                                                                                                                                                                                                                                                                                                                                                        |                                           |
| Traffic Generation          | <ul style="list-style-type: none"> <li>1GFC (with SOF and EOF frame delimiters and 2GFC frames), Class-3 service frames</li> <li>Traffic shaping: Constant, Ramp, Burst, 2GFC frame header configuration</li> <li>Frame length configuration: 3240 bytes (max.)</li> </ul>                                                                                                                                                                                                      |                                           |
| BER test                    | <ul style="list-style-type: none"> <li>Test modes: Unframed BER test, Layer 1 BER test, Layer 2 BER test</li> <li>Test patterns: PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, HF test pattern, CSPAT, CJPAT, CRPAT, JTPAT, SPAT, 55 Hex, Fox, 32-bit user programmable, ZERO</li> <li>Error injection: Bit, CRC, Symbol</li> <li>Results: Pattern loss seconds, Traffic loss seconds, Bit error count, BER</li> </ul>                                          |                                           |
| Measurement                 | <ul style="list-style-type: none"> <li>Alarm detection: LOS, Link down, Pattern loss</li> <li>Service disruption measurement: Average/Max service disruption, Number of service disruptions</li> <li>Traffic statistics: Bandwidth utilization, Data rate, Frame count, Byte count, Frame size distribution, Buffer-to-buffer credit count, R_RDY count, Frame loss count, Round trip delay, Packet jitter, Bit errors, CRC errors, Symbol errors, LR, LRR, NOS, OLS</li> </ul> |                                           |

|               |                                                                                                                                                    |                                           |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| FC-Reflector  |                                                                                                                                                    |                                           |
| Model No.     | MU100010A                                                                                                                                          | MU100011A                                 |
| Port mode     | Off, 1GFC, 2GFC, 4GFC, 8GFC, 10GFC                                                                                                                 | Off, 1GFC, 2GFC, 4GFC, 8GFC, 10GFC, 16GFC |
| Timing source | Internal, External, GPS, Received                                                                                                                  |                                           |
| Topology      | Point-to-point, Fabric, E-Port                                                                                                                     |                                           |
| Flow Control  | Credit based transmitter: On/Off<br>Buffer-to-buffer credit configuration: 1 to 65535, Buffer-to-buffer credit and R_RDY counters, R_RDY injection |                                           |
| Source        | Port WWN: User define or Default                                                                                                                   |                                           |
| Frame Setup   | Framing: SOF:Data:EOF or SOF:Header:Data:CRC:EOF                                                                                                   |                                           |

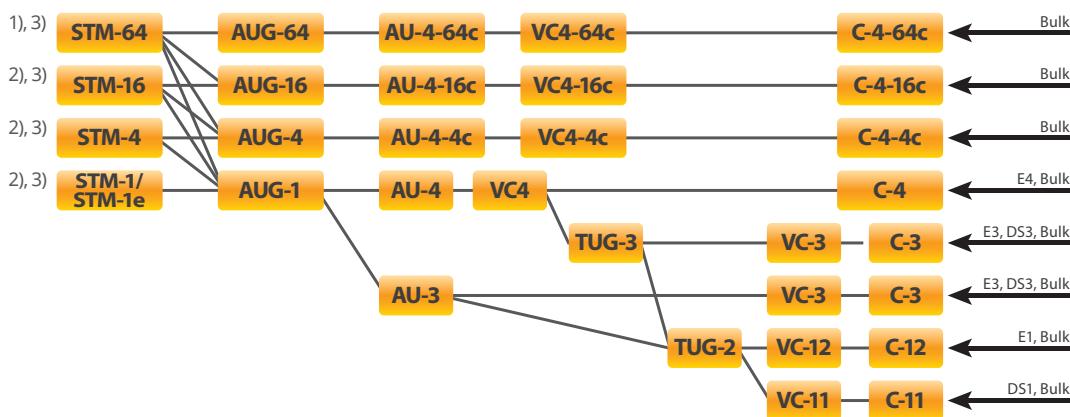
|                     |                                                                                                                                                                                                                            |                                           |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| FC-Performance Test |                                                                                                                                                                                                                            |                                           |
| Model No.           | MU100010A                                                                                                                                                                                                                  | MU100011A                                 |
| Port mode           | Off, 1GFC, 2GFC, 4GFC, 8GFC, 10GFC                                                                                                                                                                                         | Off, 1GFC, 2GFC, 4GFC, 8GFC, 10GFC, 16GFC |
| Timing source       | Internal, External, GPS, Received                                                                                                                                                                                          |                                           |
| Topology            | Point-to-point, Fabric, E-Port                                                                                                                                                                                             |                                           |
| Flow Control        | Credit based transmitter: On/Off<br>Buffer-to-buffer credit configuration: 1 to 65535, Buffer-to-buffer credit and R_RDY counters, R_RDY injection                                                                         |                                           |
| Source              | Port WWN: User define or Default<br>ID: 000000 to FFFFFFFF                                                                                                                                                                 |                                           |
| Destination         | Port WWN: User define or Default<br>ID: 000000 to FFFFFFFF                                                                                                                                                                 |                                           |
| Configuration       | Test Mode: Port-to-Port, Loopback<br>Kinds of test: Throughput, Traffic Profile, Latency, Burst, Credit<br>Frame Size: User Defined (64, 128, 256, 512, 768, 2014, 1280, 2140, up to 3240), Stepped (40 to 3240), Constant |                                           |

## SDH/SONET Testing Specifications

|                    |                                                                                                             |                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Common             |                                                                                                             |                                                                             |
| Model No.          | MU100010A                                                                                                   | MU100011A                                                                   |
| Bit Rate           | Optical (SFP/SFP+):<br>STM-1/OC-3, STM-4/OC12, STM-16/OC48, STM-64/OC192<br>Electrical (BNC): STM-1e, STS-3 | Optical (SFP/SFP+):<br>STM-1/OC-3, STM-4/OC-12, STM-16/OC-48, STM-64/OC-192 |
| Test Configuration | BERT, RTD, APS                                                                                              |                                                                             |

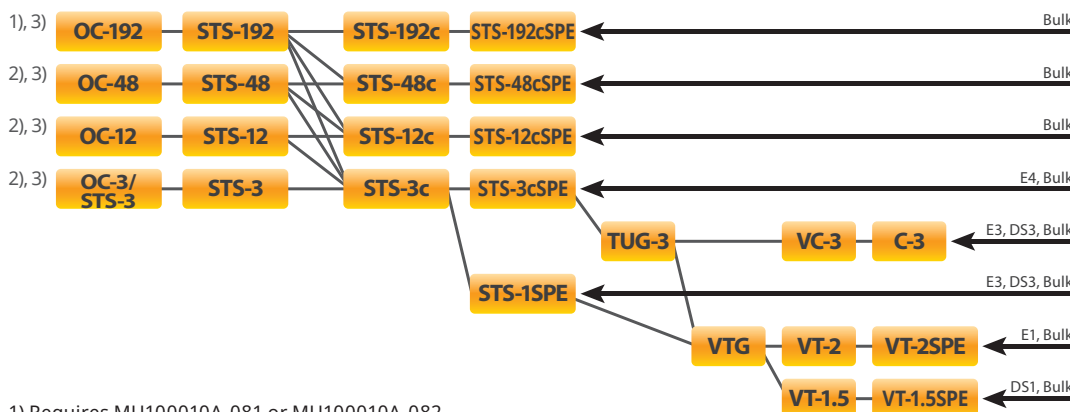
|                             |                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SDH and SONET Configuration |                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                    |
| Model No.                   | MU100010A                                                                                                                                                                                                                                                       | MU100011A                                                                                                                                                                                                                                                          |
| Framing                     | SDH: Complies with ITU-T G.707, SONET: Complies with Telcordia GR-253                                                                                                                                                                                           |                                                                                                                                                                                                                                                                    |
| Transmitter Clock           | <ul style="list-style-type: none"> <li>Internal clock accuracy: 4.6 ppm, Clock offset: <math>\pm 50</math> ppm (1-ppm steps)</li> <li>Recovered clock</li> <li>TTL level external 2 MHz clock</li> <li>SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps)</li> </ul> | <ul style="list-style-type: none"> <li>Internal clock accuracy: 4.6 ppm, Clock offset: <math>\pm 200</math> ppm (0.1-ppm steps)</li> <li>Recovered clock</li> <li>TTL level external 2 MHz clock</li> <li>SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps)</li> </ul> |
| Receive Signal Rate         | $\pm 50$ ppm<br>Frequency deviation indication resolution: $\pm 1$ ppm                                                                                                                                                                                          | $\pm 200$ ppm<br>Frequency deviation indication resolution: $\pm 0.1$ ppm                                                                                                                                                                                          |
| TCM Frame Format            | ITU-T G.783, G.707 Annex D (TCM option 2) and Annex E, POH bytes:<br>N1 (VC-4, VC-3), Z5 (STS-3c, STS-1), N2 (VC-12, VC-11), Z6 (VT-2, VT-1.5)<br>TCM Access Point Identifier (Apid): 15 bytes ASCII sequence, CRC-7                                            |                                                                                                                                                                                                                                                                    |
| Scrambling                  | SDH: Complies with ITU-T G.707, SONET: Complies with Telcordia GR-253                                                                                                                                                                                           |                                                                                                                                                                                                                                                                    |

### SDH Mapping



- 1) Requires MU100010A-081 or MU100010A-082  
 2) Requires MU100010A-001  
 3) Requires MU100011A-001 or MU100011A-003

### SONET Mapping



- 1) Requires MU100010A-081 or MU100010A-082  
 2) Requires MU100010A-001  
 3) Requires MU100011A-001 or MU100011A-003

## SDH/SONET Testing Specifications

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alarms           | <p>Detected and generated alarms</p> <ul style="list-style-type: none"> <li>SDH: LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-PLM, HP-UNEQ, HP-TIM, HP-RDI, TU-LOM, TU-AIS, TU-LOP, LP-PLM, LP-UNEQ, LP-TIM, LP-RDI, LSS</li> <li>SONET: LOS, LOF, OOF, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, RDI-P, LOM-V, AIS-V, LOP-V, PLM-V, UNEQ-V, RDI-V, TIM-V, LSS</li> <li>TCM: TC-LTC, TC-TIM, TC-UNEQ, TC-AIS, TC-RDI, TC-ODI</li> </ul> <p>Inserted alarms</p> <ul style="list-style-type: none"> <li>Permanent</li> <li>Alternate: 1 to 8000 consecutive alarm frames, 1 to 8000 consecutive normal frames</li> </ul>                                                                                                                                                                                                                                                                                                                                                                               |
| Errors           | <p>Detected and generated errors</p> <ul style="list-style-type: none"> <li>SDH: A1/A2, B1, B2, MS-REI, B3, HP-REI, V5/B3, LP-REI, Pattern error, ERR trans</li> <li>SONET: A1/A2, B1, B2, REI-L, B3, REI-P, V5/B3, REI-V, Pattern error, ERR trans</li> <li>TCM: TC-IEC, TC-BIP2, TC-REI, TC-OEI</li> </ul> <p>Error insertion</p> <ul style="list-style-type: none"> <li>Manual: 1 to 8000 consecutive errors (excluding Pattern error)<br/>1 to 4000 consecutive errors (for Pattern error)</li> <li>Continuous: <math>10^{-3}</math>, <math>10^{-4}</math>, <math>10^{-5}</math>, <math>10^{-6}</math>, <math>10^{-7}</math>, <math>10^{-8}</math>, <math>10^{-9}</math>, <math>10^{-10}</math> (The available highest rate varies depending on the error item.)</li> <li>Alternate: 1 to 8000 consecutive error frames, 1 to 8000 consecutive normal frames (excluding Pattern error and ERR trans)<br/>1 to 4000 consecutive error bits, 100 to 4000 consecutive normal bits (for Pattern error)</li> </ul> |
| BER Test Pattern | <p>Pattern generation and detection for O.181 bulk test pattern</p> <ul style="list-style-type: none"> <li>Test patterns supported: PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31</li> </ul> <p>PRBS patterns can be inverted.</p> <p>All 0 s, All 1 s, Alternating 1:1, Alternating 1:3, Alternating 1:7, 2 in 8</p> <p>User-defined patterns (Pattern length: up to 2048, Length step: 8-bit)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Pointer          | <ul style="list-style-type: none"> <li>Support pointer events monitoring and generation</li> <li>Pointer test sequences: None, Single alternating, Regular + Double, Regular + Missing, Double alternating</li> <li>Display pointer value of receiver side</li> <li>Graphical display of pointer movements</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Overhead         | <ul style="list-style-type: none"> <li>Generation of section/transport and path overhead bytes</li> <li>Display of current section/transport and path overhead bytes</li> </ul> <p>All overhead can be decoded, including decoded J0, J1, J2 byte.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Through Mode     | <ul style="list-style-type: none"> <li>Transparent mode</li> <li>OH overwrite mode: Can be changed SOH (SDH), TOH (SONET)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SDH and SONET Results                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Status                                             | <p>Current information on</p> <ul style="list-style-type: none"> <li>Alarms and errors on monitored line</li> <li>Input level indication for optical signals</li> <li>Input level indication for electrical signals</li> <li>Actual bit rate</li> <li>Frequency deviation</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Statistics                                         | <p>User-defined measurement resolution: 1, 2, 5, 10, 15, 30 s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 h</p> <p>Logged information: Alarms (seconds and ratio), Errors (count or count and ratio), Pointer operations</p> <p>Event log: Major measurement events incl. errors, alarms and pointer operations are logged with 1-second resolution.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Error Performance                                  | G.826/G.828/G.829/M.2100 analysis of received signal based on detected errors and alarms: ES, SES, BBE (not M.2100), UNAV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| APS                                                | <p>APS (Automatic Protection Switching) test and analysis</p> <ul style="list-style-type: none"> <li>APS switching time is measured. A switching time exceeding the user-defined threshold is highlighted. <ul style="list-style-type: none"> <li>Trigger events (user selectable): <ul style="list-style-type: none"> <li>SDH: SDH alarms and errors, pattern bit error, APS switchover</li> <li>SONET: SONET alarms and errors, pattern bit error, APS switchover</li> </ul> </li> </ul> </li> <li>Number of switchovers indicated by APS protocol</li> <li>K1/K2 bytes set and displayed</li> </ul> <p>Resolution of APS switching time measurement, SDH</p> <ul style="list-style-type: none"> <li>SDH events excluding VC-12 and VC-11 events, LOS (Loss of Signal): 1 <math>\mu</math>s</li> <li>VC-12 and VC-11 events: 0.5 ms</li> </ul> <p>Resolution of APS switching time measurement, SONET</p> <ul style="list-style-type: none"> <li>SONET events excluding VT-1.5 and VT-2 events, LOS (Loss of Signal): 1 <math>\mu</math>s</li> <li>VT-1.5 and VT-2 events: 0.5 ms</li> </ul> |
| Round Trip Delay<br>(Propagation Time) Measurement | <p>Resolution: 0.1 <math>\mu</math>s</p> <p>Measured Max. time: 10.0 s</p> <p>Interval: 0.5, 1, 2, 5, 10 s</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

## PDH/DSn Testing Specifications

|           |                                                                                            |
|-----------|--------------------------------------------------------------------------------------------|
| E1 Common |                                                                                            |
| Model No. | MU100010A                                                                                  |
| Test Port | Electrical line interfaces: 2 ports (MU100010A-001)<br>Connector: BNC or RJ48 (selectable) |
| General   | Complies with ITU-T G.703 for 2048 kbps                                                    |
| Impedance | Supported input impedances<br>• 75Ω (unbalanced), 120Ω (balanced), High (>10 × nominal)    |
| Line Code | HDB3 or AMI                                                                                |

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E1 Configuration                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Framing                                 | Unframed or Framed: FAS/nFAS, Transmitter: Sa-bits (non-FAS), user-programmable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Transmitter Clock                       | <ul style="list-style-type: none"> <li>Internal 2.048 Mbps clock accuracy: 4.6 ppm, Clock offset: ±125 ppm (1-ppm steps)</li> <li>Recovered from receiver</li> <li>TTL level external 2.048 MHz clock</li> <li>SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps)</li> </ul>                                                                                                                                                                                                                                                                                                                                                             |
| Receive Signal Rate                     | <ul style="list-style-type: none"> <li>2048 kbps ±150 ppm</li> <li>Frequency deviation indication accuracy: ±1 ppm</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Receiver Attenuation and Impedance Mode | <p><u>TERMINATE</u></p> <ul style="list-style-type: none"> <li>Up to 40 dB cable attenuation, Nominal impedance</li> </ul> <p><u>MONITOR</u></p> <ul style="list-style-type: none"> <li>20 to 26 dB linear attenuation and up to 6 dB cable attenuation, Nominal impedance</li> <li>20 to 30 dB linear attenuation, 0 dB cable attenuation, Nominal impedance</li> </ul> <p><u>BRIDGED</u></p> <ul style="list-style-type: none"> <li>Up to 40 dB cable attenuation, High impedance</li> </ul>                                                                                                                                      |
| Drop and Insert                         | Supports drop & insert of one or multiple 64 kbps timeslots (TS) within E1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Alarms                                  | <p>Detected and generated alarms:</p> <p>No signal, AIS, No frame, Distant (RDI) alarm, Pattern sync. loss, No CAS, MFAS, Distant (RDI) MF alarms</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Errors                                  | <p>Detected: FAS/nFAS, CRC4, E-bit, Code, Pattern, Pattern slips, Frame slips</p> <p>Generated: FAS bit, FAS word, CRC-4, E-bit, Code, Pattern, Transparent</p> <p>Error insertion</p> <ul style="list-style-type: none"> <li>Manual: 1 to 255 consecutive errors (1 to 16 consecutive FAS word errors)</li> <li>Continuous: <math>10^{-2}</math>, <math>10^{-3}</math>, <math>10^{-4}</math>, <math>10^{-5}</math>, <math>10^{-6}</math>, <math>10^{-7}</math></li> <li>Provoking of G.821, G.826 or M.2100 events (ES, SES etc.) (FAS, Pattern, CRC-4, E-bit)</li> </ul> <p>Manual slip insertion: Frame slips, Pattern slips</p> |
| BER Test Pattern                        | <p>Pattern generation</p> <ul style="list-style-type: none"> <li>Unframed or Framed: <math>n \times 64</math> kbps in contiguous or non-contiguous channel access</li> </ul> <p>Supported test patterns</p> <ul style="list-style-type: none"> <li>PRBS 6, PRBS 7, PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, QRSS 11, QRSS 20</li> <li>Fox pattern, Fox (CMA 3000), All 0, All 1, Alternating (1:1), (1:3), (1:7), (3:24)</li> <li>User-defined up to 32 bits (Length: 1-bit steps)</li> <li>User-defined up to 2048 bits (Length: 8-bit steps)</li> </ul> <p>All patterns can be inverted, except user-defined</p>               |
| CAS                                     | CAS signaling bits can be set.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Tone and Speech Signal Insertion        | <p>Tone in one speech channel on one transmitter</p> <ul style="list-style-type: none"> <li>Frequency: 1 Hz to 4 kHz (1-Hz steps)</li> <li>Level: -70 to +3 dBm (1-dBm steps)</li> <li>Artificial speech signal</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                          |
| Speech Decode                           | 64 kbps (ITU-T G.703): A-law according to ITU-T G.711                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

|                                                 |                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E1 Results                                      |                                                                                                                                                                                                                                                                                                                                                                                                       |
| Status                                          | <p>Current Information on</p> <ul style="list-style-type: none"> <li>Alarms and errors on monitored line</li> <li>Input level indication</li> <li>Actual bit rate</li> <li>Frequency deviation</li> <li>FAS/non-FAS and CAS bits</li> <li>Traffic overview: Busy/Idle indication from all 31 channels</li> </ul>                                                                                      |
| Time Slot Monitoring                            | <p>Contents of single time slot including positive/negative peak values.</p> <ul style="list-style-type: none"> <li>Frequency for encoded tone: 1 Hz to 4 kHz (1-Hz steps)</li> <li>Level for encoded tone: -66 to +3 dBm (1-dBm steps)</li> </ul>                                                                                                                                                    |
| Statistics                                      | <p>User-defined measurement resolution: 1, 2, 5, 10, 15, 30 s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 h</p> <p>Logged information: Alarms (seconds and ratio), Errors (count or count and ratio), Frequency deviation information</p> <p>Event log: Major measurement events incl. errors and alarms are logged with 1-second resolution.</p>                                                           |
| Error Performance                               | <p>G.821, G.826 or M.2100 analysis of PRBS in received signal, or based on CRC-4, E-bit or FAS: ES, SES, BBE (G.826), UAT, EFS, AT % or count.</p> <p>Error performance evaluation for total measurement:</p> <ul style="list-style-type: none"> <li>HR% for user-defined error performance parameter or programmable OK and not-OK limits for FAS, Pattern, CRC-4 or E-bit count or ratio</li> </ul> |
| APS                                             | <p>APS switching time is measured. A switching time exceeding the user-defined threshold is highlighted.</p> <p>Number of switchovers.</p> <p>Trigger events (User selectable): 2 Mbps alarms (LOF or AIS; pattern bit error)</p> <p>Resolution of APS switching time measurement: LOF and AIS: 0.25 ms</p>                                                                                           |
| Round Trip Delay (Propagation Time) Measurement | <p>Resolution: 1 μs</p> <p>Measured Max. time: 10.0 s</p> <p>Interval: 0.5, 1, 2, 5, 10 s</p>                                                                                                                                                                                                                                                                                                         |

## PDH/DSn Testing Specifications

|            |                                                                          |
|------------|--------------------------------------------------------------------------|
| DS1 Common |                                                                          |
| Model No.  | MU100010A                                                                |
| Test Port  | Electrical line interfaces: 2 ports (MU100010A-001)<br>Connector: Bantam |
| General    | Complies with ANSI T1.102 for 1544 kbps.                                 |
| Pulse Mask | ITU-T G.703 compliant                                                    |
| Impedance  | 100Ω or High (10 × nominal; Receiver only) and DSX MON 100Ω ±1%          |
| Line Code  | B8ZS, AMI                                                                |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DS1 Configuration                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Framing                          | Unframed or Framed, Framed: SF, ESF, J-ESF (J1)                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Transmitter Clock                | <ul style="list-style-type: none"> <li>Internal 1.544 Mbps clock accuracy: 4.6 ppm, Clock offset: ±125 ppm (1-ppm steps)</li> <li>Recovered from receiver</li> <li>TTL level external 2.048 MHz clock</li> <li>SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps)</li> </ul>                                                                                                                                                                                                                              |
| Line Build Out                   | 0, -7.5, -15, -22.5 dB<br>0 to 133 ft, 133 to 266 ft, 266 to 399 ft, 399 to 533 ft, 533 to 655 ft                                                                                                                                                                                                                                                                                                                                                                                                    |
| Receive Signal Rate              | 1544 kbps ±150 ppm<br>Frequency deviation indication resolution: ±1 ppm                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Receiver Sensitivity             | <u>DS1 Short Haul</u> <ul style="list-style-type: none"> <li>15 dB linear attenuation, 0 dB cable attenuation, Nominal impedance</li> </ul> <u>TERMINATE</u> <ul style="list-style-type: none"> <li>Up to 36 dB cable attenuation, Nominal impedance</li> </ul> <u>DSX MONITOR</u> <ul style="list-style-type: none"> <li>15 to 25 dB linear attenuation, Nominal impedance</li> </ul> <u>BRIDGE</u> <ul style="list-style-type: none"> <li>Up to 36 dB cable attenuation, High impedance</li> </ul> |
| Drop and Insert                  | Drop & Insert of one or multiple 56 kbps or 64 kbps timeslots (TS) within DS1                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Alarms                           | Generated and detected: LOS, OOF, AIS (Blue), RAI (Yellow), LSS                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Errors                           | Generated or detected: Pattern, F-bit, S-bit, Pattern slips, BPV (Code), CRC-6, EXZ<br>Error insertion <ul style="list-style-type: none"> <li>Manual: 1 to 255 consecutive errors</li> <li>Continuous: <math>10^{-2}</math>, <math>10^{-3}</math>, <math>10^{-4}</math>, <math>10^{-5}</math>, <math>10^{-6}</math>, <math>10^{-7}</math></li> <li>For performance: ES, SES</li> </ul>                                                                                                               |
| BER Test Pattern                 | Supported test patterns <ul style="list-style-type: none"> <li>PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, QRSS 20</li> <li>All 0, All 1, Alternating (1:1), (1:3), (1:7), (3:24), Fox pattern, Fox (CMA 3000)</li> <li>User-defined up to 32 bits (Length: 1-bit steps)</li> <li>User-defined up to 2048 bits (Length: 8-bit steps)</li> </ul> All patterns can be inverted, except User-defined                                                                                  |
| Loopback Code                    | Supported loopback codes: LLA, LLD, PLA, PLD, ULB, NLA, USR, ACS, DCS, AN1, DN1, AN2, DN2, 100K, USER_INBAND (User-defined FDL/in-band code)<br><br>Insertion: On/Off                                                                                                                                                                                                                                                                                                                                |
| CAS                              | CAS signaling bits can be set.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Tone and Speech Signal Insertion | Tone in one speech channel on one transmitter <ul style="list-style-type: none"> <li>Frequency: 1 Hz to 4 kHz (1-Hz steps)</li> <li>Level: -70 to +3 dBm (1-dBm steps)</li> <li>Artificial speech signal</li> </ul>                                                                                                                                                                                                                                                                                  |
| Speech Decode                    | 64 kbps or 56 kbps: $\mu$ -law                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|                                                 |                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DS1 Results                                     |                                                                                                                                                                                                                                                                                                                                          |
| Status                                          | Current Information on <ul style="list-style-type: none"> <li>Alarms and errors on monitored line</li> <li>Input level indication</li> <li>Actual bit rate</li> <li>Frequency deviation</li> <li>Contents of one time slot</li> <li>Framing and CAS bits</li> <li>Traffic overview: Busy/Idle indication from all 24 channels</li> </ul> |
| Time Slot Monitoring                            | Contents of single time slot including positive/negative peak values. <ul style="list-style-type: none"> <li>Frequency for encoded tone: 1 Hz to 4 kHz (1-Hz steps)</li> <li>Level for encoded tone: -66 to +3 dBm (1-dBm steps)</li> </ul>                                                                                              |
| Statistics                                      | User-defined measurement resolution: 1, 2, 5, 10, 15, 30 s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 h<br>Logged information: Alarms (seconds and ratio), Errors (count or count and ratio), Frequency deviation information<br>Event log: Major measurement events incl. errors and alarms are logged with 1-second resolution.             |
| Error Performance                               | G.821, G.826, or M.2100 analysis of PRBS in received signal, or based on detected errors: ES, SES, ALS, UAT, AVT, EFS, BBE (G.826)                                                                                                                                                                                                       |
| APS                                             | APS switching time is measured. A switching time exceeding the user-defined threshold is highlighted.<br>Number of switchovers.<br>Trigger events (User selectable): 1.5 Mbps alarms (OOF, AIS; pattern bit error)<br>APS switching time measurement resolution: No frame, AIS: 0.25 ms                                                  |
| Round Trip Delay (Propagation Time) Measurement | Resolution: 1 $\mu$ s<br>Measured Max. time: 10.0 s<br>Interval: 0.5, 1, 2, 5, 10 s                                                                                                                                                                                                                                                      |

## PDH/DSn Testing Specifications

|           |                                                                       |
|-----------|-----------------------------------------------------------------------|
| E3 Common |                                                                       |
| Model No. | MU100010A                                                             |
| Test Port | Electrical line interfaces: 2 ports (MU100010A-001)<br>Connector: BNC |
| General   | Complies with ITU-T G.703 for 34368 kbps                              |
| Impedance | 75Ω                                                                   |
| Line Code | HDB3                                                                  |

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E3 Configuration               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Framing                        | Unframed or Framed: Complies with ITU-T G.751 for E3 signals                                                                                                                                                                                                                                                                                                                                                                                                         |
| Transmitter Clock              | <ul style="list-style-type: none"> <li>Internal clock accuracy: 4.6 ppm, Clock offset: ±125 ppm (1-ppm steps)</li> <li>Recovered from receiver</li> <li>TTL level external 2.048 MHz clock</li> <li>SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps)</li> </ul>                                                                                                                                                                                                         |
| Receive Signal Rate            | 34368 kbps ±150 ppm<br>Frequency deviation indication resolution: ±1 ppm                                                                                                                                                                                                                                                                                                                                                                                             |
| Attenuation and Impedance Mode | <p><u>TERMINATE</u></p> <ul style="list-style-type: none"> <li>Up to 12 dB cable attenuation, Nominal impedance</li> </ul> <p><u>MONITOR</u></p> <ul style="list-style-type: none"> <li>20 dB linear attenuation and up to 12 dB cable attenuation, Nominal impedance</li> <li>20 to 30 dB linear attenuation, 0 dB cable attenuation, Nominal impedance</li> </ul>                                                                                                  |
| Alarms                         | Detected and generated alarms: No signal, AIS, No frame, RDI, Pattern sync. loss                                                                                                                                                                                                                                                                                                                                                                                     |
| Errors                         | <p>Detected and generated errors: Frame, Code, Pattern, Pattern slip</p> <p>Error insertion</p> <ul style="list-style-type: none"> <li>Manual: 1 to 255 consecutive errors</li> <li>Continuous: 10<sup>-2</sup>, 10<sup>-3</sup>, 10<sup>-4</sup>, 10<sup>-5</sup>, 10<sup>-6</sup>, 10<sup>-7</sup></li> <li>For performance: ES, SES</li> </ul>                                                                                                                    |
| BER Test Pattern               | <p>Pattern Generation and Detection, Supported test patterns</p> <ul style="list-style-type: none"> <li>PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23</li> <li>Fox pattern, Fox (CMA 3000), All 0, All 1, Alternating 1:1, Alternating 1:3, Alternating 1:7, Alternating 3:24</li> <li>User-defined up to 32 bits (Length: 1-bit steps)</li> <li>User-defined up to 2048 bits (Length: 8-bit steps)</li> </ul> <p>All patterns can be inverted, except user-defined</p> |

|                                                    |                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E3 Results                                         |                                                                                                                                                                                                                                                                                                                                             |
| Status                                             | <p>Current Information on</p> <ul style="list-style-type: none"> <li>Alarms and errors on monitored line</li> <li>Input level indication</li> <li>Actual bit rate</li> <li>Frequency deviation</li> </ul>                                                                                                                                   |
| Statistics                                         | <p>User-defined measurement resolution: 1, 2, 5, 10, 15, 30 s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 h</p> <p>Logged information: Alarms (seconds and ratio), Errors (count or count and ratio), Frequency deviation information</p> <p>Event log: Major measurement events incl. errors and alarms are logged with 1-second resolution.</p> |
| Error Performance                                  | G.826/M.2100 analysis of received signal, or based on detected errors ES, SES, ALS, UAT, AVT, EFS, BBE (G.826)                                                                                                                                                                                                                              |
| Round Trip Delay<br>(Propagation Time) Measurement | <p>Resolution: 1 μs</p> <p>Measured Max. time: 10.0 s</p> <p>Interval: 0.5, 1, 2, 5, 10 s</p>                                                                                                                                                                                                                                               |

|            |                                                                       |
|------------|-----------------------------------------------------------------------|
| DS3 Common |                                                                       |
| Model No.  | MU100010A                                                             |
| Test Port  | Electrical line interfaces: 2 ports (MU100010A-001)<br>Connector: BNC |
| General    | Complies with ANSI for 44736 kbps                                     |
| Impedance  | 75Ω                                                                   |
| Line Code  | B3ZS                                                                  |

|                                |                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DS3 Configuration              |                                                                                                                                                                                                                                                                                                                                                                     |
| Framing                        | Unframed or Framed, Framed: C-bit parity, M13 in accordance with ANSI T1.107                                                                                                                                                                                                                                                                                        |
| Transmitter Clock              | <ul style="list-style-type: none"> <li>Internal clock accuracy: 4.6 ppm, Clock offset: ±125 ppm (1-ppm steps)</li> <li>Recovered from receiver</li> <li>TTL level external 2.048 MHz clock</li> <li>SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps)</li> </ul>                                                                                                        |
| Line Build Out                 | 0 ft, 225 ft                                                                                                                                                                                                                                                                                                                                                        |
| Receive Signal Rate            | 44736 kbps ±150 ppm<br>Frequency deviation indication resolution: ±1 ppm                                                                                                                                                                                                                                                                                            |
| Attenuation and Impedance Mode | <p><u>TERMINATE</u></p> <ul style="list-style-type: none"> <li>Up to 12 dB cable attenuation, Nominal impedance</li> </ul> <p><u>MONITOR</u></p> <ul style="list-style-type: none"> <li>20 dB linear attenuation and up to 12 dB cable attenuation, Nominal impedance</li> <li>20 to 30 dB linear attenuation, 0 dB cable attenuation, Nominal impedance</li> </ul> |
| Alarms                         | Detected and generated alarms: LOS, LOF, AIS (Blue), RAI (Yellow), DS3 idle, LSS                                                                                                                                                                                                                                                                                    |

## PDH/DSn Testing Specifications

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Errors           | Detected and generated errors: Pattern, C-bit, F-bit, P-bit, Code (BPV), FEBE (detect only), EXZ (detect only)<br>Error insertion<br><ul style="list-style-type: none"> <li>Manual: 1 to 255 consecutive errors</li> <li>Continuous: <math>10^{-2}</math>, <math>10^{-3}</math>, <math>10^{-4}</math>, <math>10^{-5}</math>, <math>10^{-6}</math>, <math>10^{-7}</math></li> </ul>                                                                                                   |
| BER Test Pattern | Pattern generation and detection, Supported test patterns<br><ul style="list-style-type: none"> <li>PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, QRSS 20</li> <li>Fox pattern, Fox (CMA 3000), All 0, All 1, Alternating 1:1, Alternating 1:3, Alternating 1:7, Alternating 3:24</li> <li>User-defined up to 32 bits (Length: 1-bit steps)</li> <li>User-defined up to 2048 bits (Length: 8-bit steps)</li> </ul> All patterns can be inverted, except user-defined |
| Loopback Code    | Supports FEAC and C-bits loopback (ANSI T1.404 & T1.107a)                                                                                                                                                                                                                                                                                                                                                                                                                            |

|                                                 |                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DS3 Results                                     |                                                                                                                                                                                                                                                                                                                  |
| Status                                          | Current information on<br><ul style="list-style-type: none"> <li>Alarms and errors on monitored line</li> <li>Input level indication</li> <li>Actual bit rate</li> <li>Frequency deviation</li> </ul>                                                                                                            |
| Statistics                                      | User-defined measurement resolution: 1, 2, 5, 10, 15, 30 s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 h<br>Logged information: Alarms (seconds and ratio), Errors (count or count and ratio), Frequency deviation<br>Event log: Major measurement events incl. errors and alarms are logged with 1-second resolution. |
| Error Performance                               | G.826/M.2100 analysis of received signal, or based on detected errors ES, SES, ALS, UAT, AVT, EFS, BBE (G.826)                                                                                                                                                                                                   |
| Round Trip Delay (Propagation Time) Measurement | Resolution: 1 $\mu$ s<br>Measured Max. time: 10.0 s<br>Interval: 0.5, 1, 2, 5, 10 s                                                                                                                                                                                                                              |

|           |                                                                       |
|-----------|-----------------------------------------------------------------------|
| E4 Common |                                                                       |
| Model No. | MU100010A                                                             |
| Test Port | Electrical line interfaces: 2 ports (MU100010A-001)<br>Connector: BNC |
| General   | Complies with ITU-T G.703 for 139264 kbps interfaces                  |
| Impedance | 75 $\Omega$                                                           |
| Line Code | CMI                                                                   |

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E4 Configuration               |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Framing                        | Unframed or Framed: Complies with ITU-T G.751 for E4 signals                                                                                                                                                                                                                                                                                                                                                                                            |
| Transmitter Clock              | <ul style="list-style-type: none"> <li>Internal clock accuracy: 4.6 ppm, Clock offset: <math>\pm 125</math> ppm (1-ppm steps)</li> <li>Recovered from receiver</li> <li>TTL level external 2.048 MHz clock</li> <li>SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps)</li> </ul>                                                                                                                                                                            |
| Receive Signal Rate            | 139264 kbps $\pm 150$ ppm<br>Frequency deviation indication resolution: $\pm 1$ ppm                                                                                                                                                                                                                                                                                                                                                                     |
| Attenuation and Impedance Mode | TERMINATE<br><ul style="list-style-type: none"> <li>Up to 12 dB cable attenuation, Nominal impedance</li> </ul> MONITOR<br><ul style="list-style-type: none"> <li>20 dB linear attenuation and up to 12 dB cable attenuation, Nominal impedance</li> </ul>                                                                                                                                                                                              |
| Alarms                         | Detected and generated alarms: No signal, AIS, No frame, RDI, Pattern sync. loss                                                                                                                                                                                                                                                                                                                                                                        |
| Errors                         | Detected and generated errors: Frame, Pattern error, Pattern slips<br>Error insertion<br><ul style="list-style-type: none"> <li>Manual: 1 to 255 consecutive errors</li> <li>Continuous: <math>10^{-2}</math>, <math>10^{-3}</math>, <math>10^{-4}</math>, <math>10^{-5}</math>, <math>10^{-6}</math>, <math>10^{-7}</math></li> <li>For performance: ES, SES</li> </ul>                                                                                |
| BER Test Pattern               | Pattern generation and detection, Supported test patterns<br><ul style="list-style-type: none"> <li>PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, QRSS 20</li> <li>All 0, All 1, Alternating 1:1, Alternating 1:3, Alternating 1:7, Alternating 3:24</li> <li>User-defined up to 32 bits (Length: 1-bit steps)</li> <li>User-defined up to 2048 bits (Length: 8-bit steps)</li> </ul> All patterns can be inverted, except user-defined |

|                                                 |                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E4 Results                                      |                                                                                                                                                                                                                                                                                                                  |
| Status                                          | Current information on<br><ul style="list-style-type: none"> <li>Alarms and errors on monitored line</li> <li>Input level indication</li> <li>Actual bit rate</li> <li>Frequency deviation</li> </ul>                                                                                                            |
| Statistics                                      | User-defined measurement resolution: 1, 2, 5, 10, 15, 30 s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 h<br>Logged information: Alarms (seconds and ratio), Errors (count or count and ratio), Frequency deviation<br>Event log: Major measurement events incl. errors and alarms are logged with 1-second resolution. |
| Error Performance                               | G.826/M.2100 analysis of received signal, or based on detected errors ES, SES, ALS, UAT, AVT, EFS, BBE (G.826)                                                                                                                                                                                                   |
| Round Trip Delay (Propagation Time) Measurement | Resolution: 1 $\mu$ s<br>Measured Max. time: 10.0 s<br>Interval: 0.5, 1, 2, 5, 10 s                                                                                                                                                                                                                              |

## Device Testing Specification

|                    |                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Device Test        |                                                                                                                                                     |
| Model No.          | MU100011A                                                                                                                                           |
| Interface Type     | QSFP+, SFP28, CFP4, QSFP28                                                                                                                          |
| Supported Bit Rate | 25.78 Gbps (25 GigE), 41.25 Gbps (40 GigE), 103.12 Gbps (100 GigE), 43.01 Gbps (OTU3), 44.57 Gbps (OTU3e1), 44.58 Gbps (OTU3e2), 111.80 Gbps (OUT4) |
| Lane Select        | 1 Lane (SFP28), 4 Lane (QSFP+, CFP4*, QSFP28*), 20 Lane (CFP4, QSFP28)                                                                              |
| Timing Source      | Internal clock, External clock                                                                                                                      |
| Test Pattern       | PRBS 7, PRBS 9, PRBS 15, PRBS 23, PRBS 31, Logic Inverted                                                                                           |
| Frequency Offset   | ±200 ppm (0.1 ppm step)                                                                                                                             |
| Error Insertion    | Item: Bit error<br>Insertion timing: Single                                                                                                         |
| Monitor            | Signal level: dBm<br>Frequency: Hz, ppm<br>LOS, LSS, CDR lock, Bit error                                                                            |
| Measurement        | Bit error, Frequency                                                                                                                                |

\*: The CFP4 and QSFP28 can select test patterns for each lane.

## Optical Transceivers Interface List

| MU110010A | MU110011A | Model/<br>Order No. | Name                              | Form<br>Factor | 100 Meg Ethernet  | 156 Meg STM-1      | 614 Meg CPRI | 622 Meg STM-4 | 768 Meg OBSAI | 1GFC               | 1.23 Gig CPRI | 1.25 Gig Ethernet | 1.54 Gig OBSAI | 2GFC | 2.46 Gig CPRI | 2.488 Gig STM-16 | 2.67 Gig OTU1 | 3.07 Gig CPRI OBSAI | 4GFC | 4.92 Gig CPRI | 6.14 Gig CPRI OBSAI | 8GFC               | 9.83 Gig CPRI      | 9.95 Gig STM-64 | 10.1 Gig CPRI      | 10.3 Gig Ethernet | 10GFC | 10.7 Gig OTU2 | 11.05 Gig OTU1e | 11.09 Gig OTU2e | 11.27 Gig OTU1f | 11.3 Gig OTU2f | 16GFC | 25G Ethernet | 40G Ethernet       | 40G OTN            | 100G Ethernet | 100G OTN           |                    |  |  |  |  |
|-----------|-----------|---------------------|-----------------------------------|----------------|-------------------|--------------------|--------------|---------------|---------------|--------------------|---------------|-------------------|----------------|------|---------------|------------------|---------------|---------------------|------|---------------|---------------------|--------------------|--------------------|-----------------|--------------------|-------------------|-------|---------------|-----------------|-----------------|-----------------|----------------|-------|--------------|--------------------|--------------------|---------------|--------------------|--------------------|--|--|--|--|
| ✓         | ✓         | G0332A              | 100M FX 1310 nm MM SFP            | SFP            | 1310 nm, MM, 2 km |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    |                    |  |  |  |  |
| ✓         | ✓         | G0319A              | Up to 2.7G 1310 nm 15 km SFP      | SFP            |                   | 1310 nm, SM, 15 km |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    |                    |  |  |  |  |
| ✓         | ✓         | G0320A              | Up to 2.7G 1310 nm 40 km SFP      | SFP            |                   | 1310 nm, SM, 40 km |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    |                    |  |  |  |  |
| ✓         | ✓         | G0321A              | Up to 2.7G 1550 nm 80 km SFP      | SFP            |                   | 1550 nm, SM, 80 km |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    |                    |  |  |  |  |
| ✓         | ✓         | G0328A              | 1G/2G/4G FC 850 nm SFP            | SFP            |                   |                    |              |               |               | 850 nm, MM, 0.5 km |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    |                    |  |  |  |  |
| ✓         | ✓         | G0322A              | 1G/2G/4G FC 1310 nm SFP           | SFP            |                   |                    |              |               |               | 1310 nm, SM, 10 km |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    |                    |  |  |  |  |
| ✓         | ✓         | G0323A              | 1G/2G/4G FC 1550 nm SFP           | SFP            |                   |                    |              |               |               | 1550 nm, SM, 40 km |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    |                    |  |  |  |  |
| ✓         | ✓         | G0315A              | 10G LR/LW 1310 nm SFP+            | SFP+           |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     | 1310 nm, SM, 10 km |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    |                    |  |  |  |  |
| ✓         | ✓         | G0316A              | 10G ER/EW 1550 nm 40 km SFP+      | SFP+           |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     | 1550 nm, SM, 40 km |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    |                    |  |  |  |  |
| ✓         | ✓         | G0318A              | 10G ZR/ZW 1550 nm 80 km SFP+      | SFP+           |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     | 1550 nm, SM, 80 km |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    |                    |  |  |  |  |
| ✓         | ✓         | G0329A              | 10G LR 1310 nm SFP+               | SFP+           |                   |                    |              |               |               | 1310 nm, SM, 10 km |               |                   |                |      |               |                  |               |                     |      |               |                     |                    | 1310 nm, SM, 10 km |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    |                    |  |  |  |  |
| ✓         | ✓         | G0356A              | 8G FC/10G SR 850 nm SFP+          | SFP+           |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     | 850 nm, MM, 0.3 km |                    |                 | 1310 nm, SM, 10 km |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    |                    |  |  |  |  |
| ✓         | ✓         | G0386A              | 16GFC SR 850 nm SFP+              | SFP+           |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              | 850 nm, MM, 0.5 km |                    |               |                    |                    |  |  |  |  |
|           | ✓         | G0387A              | 16GFC LR 1310 nm SFP+             | SFP+           |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              | 1310 nm, SM, 10 km |                    |               |                    |                    |  |  |  |  |
|           | ✓         | G0388A              | 25G SR 850 nm SFP28               | SFP28          |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    | 850 nm, MM, 0.5 km |               |                    |                    |  |  |  |  |
|           | ✓         | G0389A              | 25G LR 1310 nm SFP28              | SFP28          |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    | 1310 nm, SM, 10 km |               |                    |                    |  |  |  |  |
|           | ✓         | G0359A              | 40G SR4 850 nm QSFP+              | QSFP+          |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               | 850 nm, MM, 0.1 km |                    |  |  |  |  |
|           | ✓         | G0334A              | 40G LR4 1310 nm QSFP+             | QSFP+          |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               | 1310 nm, SM, 10 km |                    |  |  |  |  |
|           | ✓         | G0366A              | 100G SR4 850 nm QSFP28            | QSFP28         |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    | 850 nm, MM, 0.1 km |  |  |  |  |
|           | ✓         | G0364A              | 100G LR4 1310 nm QSFP28           | QSFP28         |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    | 1310 nm, SM, 10 km |  |  |  |  |
|           | ✓         | G0365A              | 100G LR4 Dual Rate 1310 nm QSFP28 | QSFP28         |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    | 1310 nm, SM, 10 km |  |  |  |  |
|           | ✓         | G0369A              | 100G LR4 Dual Rate 1310 nm CFP4   | CFP4           |                   |                    |              |               |               |                    |               |                   |                |      |               |                  |               |                     |      |               |                     |                    |                    |                 |                    |                   |       |               |                 |                 |                 |                |       |              |                    |                    |               |                    | 1310 nm, SM, 10 km |  |  |  |  |

# Optical Transceivers Specification

| Model/Order No.                             | Description (Approx. Distance)                       | Max. Input Power    | Input Sensitivity    | Input Wavelength                                                                                             | Output Power                                            | Output Wavelength                                                                                            | Loop Back  |
|---------------------------------------------|------------------------------------------------------|---------------------|----------------------|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|------------|
| G0332A<br>100M FX 1310 nm MM SFP            | 100BASE - FX 1310 nm multi mode (2 km)               | -14 dBm             | -31 dBm              | 1270 nm to 1600 nm                                                                                           | -20 to -15 dBm                                          | 1280 nm to 1380 nm                                                                                           | OK         |
| G0319A<br>Up to 2.7G 1310 nm 15 km SFP      | STM-1/4/16 short haul 1310 nm single mode (15 km)    | 0 dBm               | -18 dBm              | 1270 nm to 1580 nm                                                                                           | -5 to 0 dBm                                             | 1260 nm to 1360 nm                                                                                           | OK         |
| G0320A<br>Up to 2.7G 1310 nm 40 km SFP      | STM-1/4/16 long haul 1310 nm single mode (40 km)     | -9 dBm              | -27 dBm              | 1270 nm to 1580 nm                                                                                           | -2 to +3 dBm                                            | 1280 nm to 1335 nm                                                                                           | >12 dB ATT |
| G0321A<br>Up to 2.7G 1550 nm 80 km SFP      | STM-1/4/16 long haul 1550 nm single mode (80 km)     | -9 dBm              | -28 dBm              | 1270 nm to 1580 nm                                                                                           | -2 to +3 dBm                                            | 1500 nm to 1580 nm                                                                                           | >12 dB ATT |
| G0328A<br>1G/2G/4G FC 850 nm SFP            | 1GFC, 2GFC, 4GFC 850 nm multi mode (0.5 km)          | -3 dBm              | -15 dBm              | 830 nm to 860 nm                                                                                             | -9 to 0 dBm                                             | 830 nm to 860 nm                                                                                             | >3 dB ATT  |
| G0322A<br>1G/2G/4G FC 1310 nm SFP           | 1GFC, 2GFC, 4GFC 1310 nm single mode (10 km)         | -3 dBm              | -18 dBm              | 1260 nm to 1360 nm                                                                                           | -8 to 0 dBm                                             | 1260 nm to 1360 nm                                                                                           | >3 dB ATT  |
| G0323A<br>1G/2G/4G FC 1550 nm SFP           | 1GFC, 2GFC, 4GFC 1550 nm single mode (40 km)         | -3 dBm              | -18 dBm              | 1470 nm to 1600 nm                                                                                           | 0 to +5 dBm                                             | 1510 nm to 1590 nm                                                                                           | >8 dB ATT  |
| G0315A<br>10G LR/LW 1310 nm SFP+            | 10GBASE - LR 1310 nm single mode (10 km)             | +0.5 dBm            | -14.4 dBm            | 1260 nm to 1565 nm                                                                                           | -6 to -1 dBm                                            | 1290 nm to 1330 nm                                                                                           | OK         |
| G0316A<br>10G ER/EW 1550 nm 40 km SFP+      | 10GBASE - ER 1550 nm single mode (40 km)             | -1 dBm              | -15.8 dBm            | 1260 nm to 1565 nm                                                                                           | -3 to +3 dBm                                            | 1530 nm to 1560 nm                                                                                           | >4 dB ATT  |
| G0318A<br>10G ZR/ZW 1550 nm 80 km SFP+      | 10GBASE - ER 1550 nm single mode (80 km)             | -8 dBm              | -22 dBm              | 1260 nm to 1565 nm                                                                                           | 0 to +5 dBm                                             | 1525 nm to 1565 nm                                                                                           | >13 dB ATT |
| G0329A<br>10G LR 1310 nm SFP+               | 10GBASE - LR 1310 nm single mode (10 km)             | +0.5 dBm            | -14 dBm              | 1260 nm to 1355 nm                                                                                           | -8.2 to +0.5 dBm                                        | 1260 nm to 1355 nm                                                                                           | OK         |
| G0356A<br>8G FC/10G SR 850 nm SFP+          | 8GFC, 10GFC, 10GBASE - SR 850 nm multi mode (0.3 km) | -1 dBm              | -11.1 dBm            | 840 nm to 860 nm                                                                                             | -7.3 to -1 dBm                                          | 840 nm to 860 nm                                                                                             | OK         |
| G0386A<br>16GFC SR 850 nm SFP+              | 16GFC 850 nm multi mode (0.035 km)                   | 0 dBm               | -10.5 dBm            | 840 nm to 860 nm                                                                                             | -7.5 dBm ~                                              | 840 nm to 860 nm                                                                                             | OK         |
| G0387A<br>16GFC LR 1310 nm SFP+             | 16GFC 1310 nm single mode (10 km)                    | +2 dBm              | -12 dBm              | 1295 nm to 1325 nm                                                                                           | -5 to +2 dBm                                            | 1295 nm to 1325 nm                                                                                           | OK         |
| G0388A<br>25G SR 850 nm SFP28               | 25GBASE - SR 850 nm multi mode (0.1 km)              | +2.4 dBm            | -10.3 dBm            | 840 nm to 860 nm                                                                                             | -8.4 to +2.4 dBm                                        | 840 nm to 860 nm                                                                                             | OK         |
| G0389A<br>25G LR 1310 nm SFP28              | 25GBASE - LR 1310 nm single mode (10 km)             | +2 dBm              | -13.3 dBm            | 1260 nm to 1350 nm                                                                                           | -7 to +2 dBm                                            | 1295 nm to 1325 nm                                                                                           | OK         |
| G0359A<br>40G SR4 850 nm QSFP+              | 40GBASE - SR4 850 nm multi mode (0.1 km)             | +2.4 dBm (per Lane) | -9.9 dBm             | 840 nm to 860 nm                                                                                             | -8 to +2.4 dBm                                          | 840 nm to 860 nm                                                                                             | OK         |
| G0334A<br>40G LR4 1310nm QSFP+              | 40G Ethernet/OTN 1310 nm single mode (10 km)         | +2.3 dBm (per Lane) | -11.5 dBm (per Lane) | 1264.5 nm to 1277.5 nm<br>1284.5 nm to 1297.5 nm<br>1304.5 nm to 1317.5 nm<br>1324.5 nm to 1337.5 nm         | +8.3 dBm (max.) (Total)<br>-2 to +2.3 dBm (per Lane)    | 1264.5 nm to 1277.5 nm<br>1284.5 nm to 1297.5 nm<br>1304.5 nm to 1317.5 nm<br>1324.5 nm to 1337.5 nm         | OK         |
| G0366A<br>100G SR4 850 nm QSFP28            | 100G Ethernet 850 nm multi mode (0.1 km)             | +2.4 dBm (per Lane) | -9.9 dBm (per Lane)  | 840 nm to 860 nm                                                                                             | +8.9 dBm (max.) (Total)<br>-9.1 to +2.4 dBm (per Lane)  | 840 nm to 860 nm                                                                                             | OK         |
| G0364A<br>100G LR4 1310 nm QSFP28           | 100G Ethernet 1310 nm single mode (10 km)            | +4.5 dBm (per Lane) | -8.6 dBm (per Lane)  | 1294.53 nm to 1296.59 nm<br>1299.02 nm to 1301.09 nm<br>1303.54 nm to 1305.63 nm<br>1308.09 nm to 1310.19 nm | +10.5 dBm (max.) (Total)<br>-4.3 to +4.5 dBm (per Lane) | 1294.53 nm to 1296.59 nm<br>1299.02 nm to 1301.09 nm<br>1303.54 nm to 1305.63 nm<br>1308.09 nm to 1310.19 nm | OK         |
| G0365A<br>100G LR4 Dual Rate 1310 nm QSFP28 | 100G Ethernet /OTN 1310 nm single mode (10 km)       | +4 dBm (per Lane)   | -8.4 dBm (per Lane)  | 1294.53 nm to 1296.59 nm<br>1299.02 nm to 1301.09 nm<br>1303.54 nm to 1305.63 nm<br>1308.09 nm to 1310.19 nm | +10 dBm (max.) (Total)<br>-0.6 to +4 dBm (per Lane)     | 1294.53 nm to 1296.59 nm<br>1299.02 nm to 1301.09 nm<br>1303.54 nm to 1305.63 nm<br>1308.09 nm to 1310.19 nm | OK         |
| G0369A<br>100G LR4 Dual Rate 1310 nm CFP4   | 100G Ethernet /OTN 1310 nm single mode (10 km)       | +4.5 dBm (per Lane) | -8.6 dBm (per Lane)  | 1294.53 nm to 1296.59 nm<br>1299.02 nm to 1301.09 nm<br>1303.54 nm to 1305.63 nm<br>1308.09 nm to 1310.19 nm | +10.5 dBm (max.) (Total)<br>-4.3 to +4.5 dBm (per Lane) | 1294.53 nm to 1296.59 nm<br>1299.02 nm to 1301.09 nm<br>1303.54 nm to 1305.63 nm<br>1308.09 nm to 1310.19 nm | OK         |

## Ordering Information

Please specify the model/order number, name and quantity when ordering.

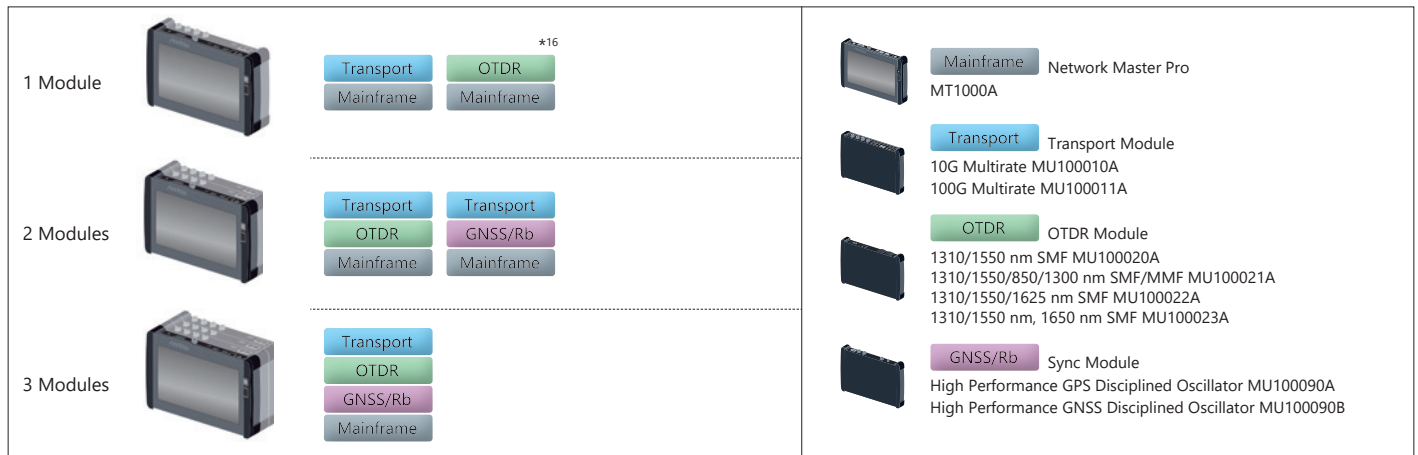
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

### Mainframe

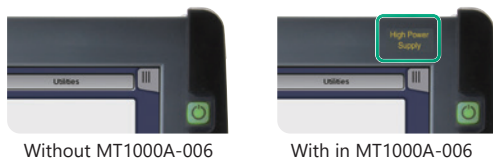
| Model/Order No.             | Name                            |
|-----------------------------|---------------------------------|
| MT1000A                     | Network Master Pro              |
| <b>Standard Accessories</b> |                                 |
| MT1000A-006*1               | High Power Supply: Installed    |
|                             | Line Cord*2: 1 pc               |
| B0745A                      | Softcase: 1 pc                  |
| B0728A*3                    | Rear Panel kit: 1 pc            |
| G0385A*4                    | High Power AC Adaptor: 1 pc     |
| G0310A                      | Li-ion Battery: 1 pc            |
| Z1746A                      | Stylus: 1 pc                    |
| Z1747A*5                    | Carrying Strap: 1 pc            |
| Z1748A*6                    | Handle: 1 pc                    |
| Z1817A*7                    | Utilities ROM: 1 pc             |
| <b>Options</b>              |                                 |
| MT1000A-003*8               | Connectivity for WLAN/Bluetooth |
| MT1000A-005*9               | AUX I/O                         |

| Model/Order No.             | Name                             |
|-----------------------------|----------------------------------|
| <b>Optional Accessories</b> |                                  |
| B0691B*10                   | Hard Case                        |
| B0720A                      | Rear Panel                       |
| B0729A*11                   | Screw 1U                         |
| B0730A*11                   | Screw 2U                         |
| B0731A*11                   | Screw 3U                         |
| B0732A*12                   | Screw Kit                        |
| G0382A*13                   | Autofocus Video Inspection Probe |
| G0306B*13                   | Video Inspection Probe           |
| G0309A*4                    | AC Adapter                       |
| G0324A                      | Battery Charger                  |
| G0325A                      | GPS Receiver                     |
| J1569B                      | Car 12 Vdc Adapter               |
| J1891A                      | Coaxial Adaptor (BNC-J, SMA-P)   |
| J1892A                      | Coaxial Adaptor (BNC-P, SMA-J)   |
| Z1821A*14                   | Utilities in USB Stick           |

### Module Configuration\*15



\*1: The presence of the MT1000A-006 option can be recognized at the top right of the front panel. To retrofit to the already shipped item, please contact us.



Without MT1000A-006

With in MT1000A-006

\*2: One line cord is attached to the area to shipment.

\*3: Composed of B0720A, B0729A, B0730A and B0731A.

Refer to Module Composition for the module combination.

\*4: The MT1000A with MT1000A-006 can be used. Use the AC adapter when using the MT1000A without MT1000A-006 installed.

\*5: Shoulder strap for MT1000A.

\*6: Hand strap for MT1000A.

\*7: This DVD includes PDF files and formatting tools of each product's instruction manual (such as W3933AE, W3810AE, W3736AE, W3946AE).

\*8: WLAN is available for certified countries and regions including USA, Canada, Japan and EU countries. Please visit the Anritsu web site for updated information.

\*9: MT1000A-005 is required for MU100090B. To retrofit to the already shipped item, please contact us.

\*10: Can use module 1 to 2 in combination

\*11: Includes 4 bolts of same length

\*12: Includes B0729A, B0730A and B0731A

\*13: This fiberscope uses the VIP function in the MT1000A Utility menu. Different tip types are used by the G0382A and G0306B.



G0382A



G0306B

\*14: Include MT1000A Operation Manual and the Remote Script Manual.

\*15: Any modular combination as shown in a figure.

\*16: Required if the transport module is not used rear cover.

## Ordering Information

### Measurement Module

#### 10G Multirate Module MU100010A

| Model/Order No.             | Name                                                    |
|-----------------------------|---------------------------------------------------------|
| MU100010A                   | 10G Multirate Module                                    |
| <b>Standard accessories</b> |                                                         |
| W3935AE                     | MT1000A Transport Module<br>Quick Reference Guide: 1 pc |
| B0692A*1                    | ESD Box (for optical modules)                           |

\*1: Up to four SFP+/SFPs can be stored.

#### Module Options\*2

| Model/Order No. | Name                        |
|-----------------|-----------------------------|
| <b>Low Rate</b> |                             |
| MU100010A-001*3 | Up to 2.7G Dual Channel     |
| <b>Ethernet</b> |                             |
| MU100010A-011   | Ethernet 10G Single Channel |
| MU100010A-012   | Ethernet 10G Dual Channel   |
| MU100010A-020*4 | TCP Throughput              |
| <b>OTN</b>      |                             |
| MU100010A-051   | OTN 10G Single Channel      |
| MU100010A-052   | OTN 10G Dual Channel        |
| MU100010A-061*5 | ODU Multiplexing            |
| MU100010A-062*5 | ODU Flex                    |

| Model/Order No.      | Name                                |
|----------------------|-------------------------------------|
| <b>CPRI/OBSAI</b>    |                                     |
| MU100010A-071        | CPRI/OBSAI Up to 5G Dual Channel    |
| MU100010A-072        | CPRI/OBSAI 6G to 10G Single Channel |
| MU100010A-073        | CPRI/OBSAI 6G to 10G Dual Channel   |
| <b>Fibre Channel</b> |                                     |
| MU100010A-002        | FC 1G 2G 4G Dual Channel            |
| MU100010A-091        | FC 8G 10G Single Channel            |
| MU100010A-092        | FC 8G 10G Dual Channel              |
| <b>SDH/SONET</b>     |                                     |
| MU100010A-081        | STM-64 OC-192 Single Channel        |
| MU100010A-082        | STM-64 OC-192 Dual Channel          |

\*2: These options can be retrofitted.

The Model/Order No. of retrofit options is "-3\*\*".

Example

MU100010A-001 Up to 2.7G Dual Channel becomes MU100010A-301 Up to 2.7G Dual Channel Retrofit.

In addition, specify one of the following media along with the required option.

Z1849A: DVD-ROM for Retrofit Options

Z1850A: USB Stick for Retrofit Options

\*3: Includes OTN (OTU1), Ethernet (10 Mbps, 100 Mbps, 1 Gbps), SDH up to STM-16, SONET up to OC-48, PDH (E1, E3, E4), and DSn (DS1, DS3)

\*4: Requires that at least one of the following options is installed:

MU100010A-001, MU100010A-011, MU100010A-012

\*5: Requires that at least one of the following options is installed:

MU100010A-001, MU100010A-051, MU100010A-052

### Correspondence Ports by MU100010A Options

| Standard (Bit Rate)     |                                     | Interface  | The Number Of Correspondence Ports by MU100010A Options |        |        |        |        |        |        |        |     |        |        |        |        |  |
|-------------------------|-------------------------------------|------------|---------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|-----|--------|--------|--------|--------|--|
|                         |                                     |            | 001                                                     | 002    | 011    | 012    | 051    | 052    | 071    | 072    | 073 | 081    | 082    | 091    | 092    |  |
| Ethernet                | 10/100/1000M (Electrical)           | RJ45       | 2 Port                                                  |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | 100BASE-FX (125M)                   |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | 1000BASE-X (1.25G)                  | SFP        | 2 Port                                                  |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | 10GBASE-XR (10.3125G)               |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | 10GBASE-XW (9.953G)                 | SFP+       |                                                         |        | 1 Port | 2 Port |        |        |        |        |     |        |        |        |        |  |
| OTN                     | OTU1 (2.666G)                       | SFP        | 2 Port                                                  |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | OTU2 (10.709G)                      |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | OTU1e (11.049G)                     |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | OTU2e (11.096G)                     | SFP+       |                                                         |        |        |        | 1 Port | 2 Port |        |        |     |        |        |        |        |  |
|                         | OTU1f (11.270G)                     |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
| OTU2f (11.318G)         |                                     |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
| Mobile X Haul           | eCPRI/RoE 10/100/1000M (Electrical) | RJ45       | 2 Port                                                  |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | eCPRI/RoE 1000BASE-x                | SFP        | 2 Port                                                  |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | eCPRI/RoE 10GBASE-x                 | SFP+       |                                                         |        | 1 Port | 2 Port |        |        |        |        |     |        |        |        |        |  |
|                         | CPRI Option1 (614.4M)               |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | OBSAI 1x (768.0M)                   |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | CPRI Option2 (1228.8M)              |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | OBSAI 2x (1536.0M)                  |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | CPRI Option3 (2457.6M)              |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | CPRI Option4 (3072.0M)              |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | OBSAI 4x (3072.0M)                  |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | CPRI Option5 (4915.2M)              |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | CPRI Option6 (6144.0M)              |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
| OBSAI 8x (6144.0M)      |                                     |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
| CPRI Option7 (9830.4M)  | SFP+                                |            |                                                         |        |        |        |        |        | 1 Port | 2 Port |     |        |        |        |        |  |
| CPRI Option8 (10137.6M) |                                     |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
| Fibre Channel           | 1GFC (1.063G)                       |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | 2GFC (2.125G)                       |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | 4GFC (4.250G)                       | SFP        |                                                         | 2 Port |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | 8GFC (8.500G)                       |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | 10GFC (10.520G)                     | SFP+       |                                                         |        |        |        |        |        |        |        |     |        |        | 1 Port | 2 Port |  |
| SDH/SONET               | STM-1e/STS-3 (155.52M)              | BNC        | 2 Port                                                  |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | STM-1/OC-3 (155.52M)                |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | STM-4/OC-12 (622.08M)               | SFP        | 2 Port                                                  |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | STM-64/OC-192 (9.953G)              | SFP+       |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
| PDH                     | E1 (2.048M)                         | RJ48, BNC  | 2 Port                                                  |        |        |        |        |        |        |        |     | 1 Port | 2 Port |        |        |  |
|                         | E3 (34.368M)                        |            |                                                         |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | E4 (139.264M)                       | BNC        | 2 Port                                                  |        |        |        |        |        |        |        |     |        |        |        |        |  |
| DSn                     | DS1 (1.544M)                        | RTT Bantam | 2 Port                                                  |        |        |        |        |        |        |        |     |        |        |        |        |  |
|                         | DS3 (44.736M)                       | BNC        | 2 Port                                                  |        |        |        |        |        |        |        |     |        |        |        |        |  |

# Ordering Information

## Measurement Module

### 100G Multirate Module MU100011A

| Model/Order No.             | Name                                                 |
|-----------------------------|------------------------------------------------------|
| MU100011A*6                 | 100G Multirate Module                                |
| <b>Standard accessories</b> |                                                      |
| W3935AE                     | MT1000A Transport Module Quick Reference Guide: 1 pc |
| B0763A*7                    | ESD Box (for Optical modules): 1 pc                  |

\*6: MT1000A-006 is required for MU100011A.

\*7: One CFP4 plus either up to two QSFP28s or up to four SFP/SFP+s can be stored.

#### Module Options\*2

| Model/Order No.  | Name                         |
|------------------|------------------------------|
| <b>Standard</b>  |                              |
| MU100011A-001*8  | Up to 10G Single Channel     |
| MU100011A-003*8  | Up to 10G Dual Channel       |
| <b>Ethernet</b>  |                              |
| MU100011A-013*9  | Ethernet 40G Single Channel  |
| MU100011A-015*9  | Ethernet 100G Single Channel |
| MU100011A-017*10 | Ethernet 25G Single Channel  |
| MU100011A-020*11 | TCP Throughput               |
| MU100011A-021*12 | SyncE Wander                 |
| MU100011A-023*13 | RS-FEC for 100GBASE-SR4      |
| <b>OTN</b>       |                              |
| MU100011A-053    | OTN 40G Single Channel       |
| MU100011A-055    | OTN 100G Single Channel      |
| MU100011A-062*14 | ODU Flex                     |
| MU100011A-063*14 | ODU Multiplexing/Multi Stage |

| Model/Order No.             | Name                                |
|-----------------------------|-------------------------------------|
| <b>Fibre Channel</b>        |                                     |
| MU100011A-004               | Up to 10G FC Single Channel         |
| MU100011A-005               | Up to 10G FC Dual Channel           |
| MU100011A-091               | FC 16G Single Channel               |
| <b>eCPRI/RoE/CPRI/OBSAI</b> |                                     |
| MU100011A-071               | CPRI/OBSAI Up to 10G Single Channel |
| MU100011A-072               | CPRI/OBSAI Up to 10G Dual Channel   |
| MU100011A-073               | CPRI 12/25G Single Channel          |
| MU100011A-074               | CPRI 12/25G Dual Channel            |
| MU100011A-075*10            | eCPRI/RoE 25G Dual Channel          |
| <b>SDH/SONET</b>            |                                     |
| MU100011A-083*15            | STM-256/OC-768 Client Signal        |

\*8: Only one of these option can be installed.

Included OTN(OTU1, OTU1e, OTU1f, OTU2, OTU2e, OTU2f), Ethernet up to 10 Gbps, SDH up to STM-64 and SONET up to OC-192.

\*9: FEC is always Off.

\*10: FEC selectable On/Off.

\*11: Requires that at least one of the following option is installed:

MU100011A-001, MU100011A-003

\*12: In addition to the MT1000A-005, at least one of the following options is required: MU100011A-001, MU100011A-003, MU100011A-017

\*13: Requires to MU100011A-015

\*14: Requires that at least one of the following option is installed:

MU100011A-001, MU100011A-003, MU100011A-053, MU100011A-055

\*15: MU100011A does not have a physical interface of the option.

In combination with MU100011A-053, can be used as a client signal by OTN.

### Correspondence Ports by MU100011A Options

| Standard (Bit Rate)    |                                     | Interface    | The Number Of Correspondence Ports by MU100011A Options |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|------------------------|-------------------------------------|--------------|---------------------------------------------------------|--------|--------|--------|--------|--------|--------|-----|--------|--------|--------|--------|--------|--------|--------|
|                        |                                     |              | 001                                                     | 003    | 013    | 015    | 017    | 053    | 055    | 004 | 005    | 091    | 071    | 072    | 073    | 074    | 075    |
| Ethernet               | 10/100/1000M (Electrical)           | RJ45         | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | 100BASE-FX (125M)                   | SFP          | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | 1000BASE-X (1.25G)                  | SFP          | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | 10GBASE-XR (10.3125G)               | SFP+         | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | 10GBASE-XW (9.953G)                 | SFP+         | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | 25GBASE-XX (25.781G)                | SFP28        |                                                         |        |        |        | 1 Port |        |        |     |        |        |        |        |        |        |        |
|                        | 40GBASE-XX4 (41.250G)               | QSFP+        |                                                         |        | 1 Port |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | 100GBASE-XX4 (103.125G)             | CFP4, QSFP28 |                                                         |        |        | 1 Port |        |        |        |     |        |        |        |        |        |        |        |
| OTN                    | OTU1 (2.666G)                       | SFP          | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | OTU2 (10.709G)                      |              |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | OTU1e (11.049G)                     | SFP+         | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | OTU2e (11.096G)                     | SFP+         | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | OTU1f (11.270G)                     | SFP+         | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | OTU2f (11.318G)                     | SFP+         | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | OTU3 (43.018G)                      | QSFP+        |                                                         |        |        |        |        | 1 Port |        |     |        |        |        |        |        |        |        |
|                        | OTU3e1 (44.571G)                    | QSFP+        |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | OTU3e2 (44.583G)                    | QSFP+        |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | OTU4 (111.810G)                     | CFP4, QSFP28 |                                                         |        |        |        |        |        | 1 Port |     |        |        |        |        |        |        |        |
| Mobile X Haul          | eCPRI/RoE 10/100/1000M (Electrical) | RJ45         | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | eCPRI/RoE 1000BASE-x                | SFP          | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | eCPRI/RoE 10GBASE-xx                | SFP+         | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | eCPRI/RoE 25GBASE-xx                | SFP28        |                                                         |        |        |        | 1 Port |        |        |     |        |        |        |        |        |        | 2 Port |
|                        | eCPRI/RoE 40GBASE-xx                | QSFP+        |                                                         |        | 1 Port |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | eCPRI/RoE 100GBASE-xx               | CFP4, QSFP28 |                                                         |        |        | 1 Port |        |        |        |     |        |        |        |        |        |        |        |
|                        | CPRI Option1 (614.4M)               |              |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | OBSAI 1x (768.0M)                   |              |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | CPRI Option2 (1228.8M)              |              |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | OBSAI 2x (1536.0M)                  |              |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
| CPRI Option3 (2457.6M) | SFP                                 |              |                                                         |        |        |        |        |        |        |     |        | 1 Port | 2 Port |        |        |        |        |
| CPRI Option4 (3072.0M) | SFP                                 |              |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
| OBSAI 4x (3072.0M)     | SFP                                 |              |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
| CPRI Option5 (4915.2M) | SFP                                 |              |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | CPRI Option6 (6144.0M)              |              |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | OBSAI 8x (6144.0M)                  | SFP+         |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | CPRI Option7 (9830.4M)              | SFP+         |                                                         |        |        |        |        |        |        |     |        |        | 1 Port | 2 Port |        |        |        |
|                        | CPRI Option8 (10137.6M)             | SFP+         |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | CPRI Option9 (12165.12M)            | SFP28        |                                                         |        |        |        |        |        |        |     |        |        |        |        | 1 Port | 2 Port |        |
|                        | CPRI Option10 (24330.24M)           | SFP28        |                                                         |        |        |        |        |        |        |     |        |        |        |        | 1 Port | 2 Port |        |
| Fibre Channel          | 1GFC (1.063G)                       | SFP          |                                                         |        |        |        |        |        |        |     | 1 Port | 2 Port |        |        |        |        |        |
|                        | 2GFC (2.125G)                       | SFP          |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | 4GFC (4.250G)                       | SFP          |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | 8GFC (8.500G)                       | SFP+         |                                                         |        |        |        |        |        |        |     | 1 Port | 2 Port |        |        |        |        |        |
|                        | 10GFC (10.520G)                     | SFP+         |                                                         |        |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | 16GFC (14.025G)                     | SFP+         |                                                         |        |        |        |        |        |        |     |        | 1 Port |        |        |        |        |        |
| SDH/SONET              | STM-1/OC-3 (155.52M)                | SFP          | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | STM-4/OC-12 (622.08M)               | SFP          | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |
|                        | STM-64/OC-192 (9.953G)              | SFP+         | 1 Port                                                  | 2 Port |        |        |        |        |        |     |        |        |        |        |        |        |        |

## Ordering Information

### High Performance GNSS Disciplined Oscillator MU100090B

| Model/Order No.             | Name                                         |
|-----------------------------|----------------------------------------------|
| MU100090B*1                 | High Performance GNSS Disciplined Oscillator |
| MU100090B-001               | High Stability/Multi-Band                    |
| MU100090B-002               | Multi-GNSS                                   |
| <b>Standard accessories</b> |                                              |
| J1705A                      | AUX Conversion Adaptor                       |
| J1886A*2                    | GNSS Antenna                                 |
| J1710A                      | BNC Cable (20 cm) × 2                        |
| Z2122A                      | Tripod for GNSS Antenna                      |

\*1: Excellent Eco Product non-compliant.

\*2: With 5 m cable, IP67 Ingress protection.

MT1000A-005 is required for MU100090B.

### High Performance GPS Disciplined Oscillator MU100090A

| Model/Order No.             | Name                                        |
|-----------------------------|---------------------------------------------|
| MU100090A*3, *4             | High Performance GPS Disciplined Oscillator |
| <b>Standard Accessories</b> |                                             |
| J1705A                      | AUX Conversion Adaptor                      |
| J1706A*3                    | GPS Antenna                                 |
| J1710A                      | BNC Cable (20 cm) × 2                       |

\*3: Cannot be shipped to EU/EFTA countries and UK because of not being RoHS 10 compliant.

\*4: Excellent Eco Product non-compliant.

MT1000A-005 is required for MU100090A.

### Optional Accessories

| Model/Order No.          | Name                                              |
|--------------------------|---------------------------------------------------|
| <b>Operation Manuals</b> |                                                   |
| W3933AE                  | MT1000A Transport Module Operation Manual         |
| W3736AE                  | MT1000A/MT1100A Remote Scripting Operation Manual |
| <b>Optical Module</b>    |                                                   |
| G0332A                   | 100M FX 1310 nm MM SFP                            |
| G0319A                   | Up to 2.7G 1310 nm 15 km SFP                      |
| G0320A                   | Up to 2.7G 1310 nm 40 km SFP                      |
| G0321A                   | Up to 2.7G 1550 nm 80 km SFP                      |
| G0328A                   | 1G/2G/4G FC 850 nm SFP                            |
| G0322A                   | 1G/2G/4G FC 1310 nm SFP                           |
| G0323A                   | 1G/2G/4G FC 1550 nm SFP                           |
| G0315A                   | 10G LR/LW 1310 nm SFP+                            |
| G0316A                   | 10G ER/EW 1550 nm 40 km SFP+                      |
| G0318A                   | 10G ZR/ZW 1550 nm 80 km SFP+                      |
| G0329A                   | 10G LR 1310 nm SFP+                               |
| G0356A                   | 8G FC/10G SR 850 nm SFP+                          |
| G0386A                   | 16GFC SR 850 nm SFP+                              |
| G0387A                   | 16GFC LR 1310 nm SFP+                             |
| G0388A                   | 25G SR 850 nm SFP28                               |
| G0389A                   | 25G LR 1310 nm SFP28                              |
| G0359A                   | 40G SR4 850 nm QSFP+                              |
| G0334A                   | 40G LR4 1310 nm QSFP+                             |
| G0366A                   | 100G SR4 850 nm QSFP28                            |
| G0364A                   | 100G LR4 1310 nm QSFP28                           |
| G0365A                   | 100G LR4 Dual Rate 1310 nm QSFP28                 |
| G0369A                   | 100G LR4 Dual Rate 1310 nm CFP4                   |

| Model/Order No. | Name                                        |
|-----------------|---------------------------------------------|
| <b>Cables</b>   |                                             |
| J1571A          | Optical Cable SM LC/PC to SC/PC 3 m         |
| J1575A          | Optical Cable SM LC/PC to FC/PC 3 m         |
| J1579A          | Optical Cable SM LC/PC to LC/PC 3 m         |
| J1581A          | Optical Cable MM LC/PC to LC/PC 3 m         |
| J1583A          | Optical Attenuator 10 dB LC/PC to LC/PC     |
| J1584A          | RJ45 Cable 3 m                              |
| J1585A*5        | RJ48 to Crocodile Clips Cable 3 m           |
| J1586A*5        | RJ48 to Crocodile Clips Cable 20 dB ATT 3 m |
| J1588A*6        | BNC Cable 2.5 m                             |
| J1589A*6        | BNC to 1.6/5.6 Cable 2.5 m                  |
| J1591A*5        | RJ48 to Two 3-pin Banana Plug Cable 2.5 m   |
| J1597A*5        | RJ48 Balanced PDH Cable Crossed 3 m         |
| J1598A*7        | Bantam Cable 3 m                            |
| J1710A*8        | BNC Cable 0.2 m                             |
| J0127B*8        | COAXIAL CORD, 2.0 M                         |

\*5: E1 interface cable.

\*6: E1, E3, E4, DS3, STM-1e, STS-3 interface cable. Impedance: 75Ω

\*7: DS1 interface cable.

\*8: 50Ω impedance cable for MU100090B and main-frame external clock input connector

### Maintenance Service

| Model/Order No. | Name                              | Supported Modules |
|-----------------|-----------------------------------|-------------------|
| MT1000A-ES210   | 2 Years Extended Warranty Service | MT1000A           |
| MT1000A-ES310   | 3 Years Extended Warranty Service |                   |
| MT1000A-ES510   | 5 Years Extended Warranty Service |                   |
| MU100010A-ES210 | 2 Years Extended Warranty Service | MU100010A         |
| MU100010A-ES310 | 3 Years Extended Warranty Service |                   |
| MU100010A-ES510 | 5 Years Extended Warranty Service |                   |
| MU100011A-ES210 | 2 Years Extended Warranty Service | MU100011A         |
| MU100011A-ES310 | 3 Years Extended Warranty Service |                   |
| MU100011A-ES510 | 5 Years Extended Warranty Service |                   |
| MU100090A-ES210 | 2 Years Extended Warranty Service | MU100090A         |
| MU100090A-ES310 | 3 Years Extended Warranty Service |                   |
| MU100090A-ES510 | 5 Years Extended Warranty Service |                   |
| MU100090B-ES210 | 2 Years Extended Warranty Service | MU100090B         |
| MU100090B-ES310 | 3 Years Extended Warranty Service |                   |
| MU100090B-ES510 | 5 Years Extended Warranty Service |                   |

## Ordering Information

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### Remote Software Service

The following licenses must be purchased to use the MX109020A Site Over Remote Access.

#### Mainframe Option License

| Model/Order No.           | Name                            |
|---------------------------|---------------------------------|
| MT1000A-003* <sup>1</sup> | WLAN/Bluetooth Connect          |
| MT1000A-011* <sup>2</sup> | Site Over Remote Access Connect |

\*1: Available for certified countries and regions including USA, Canada, Japan and EU countries. Please visit the Anritsu web site for updated information.

Although this product has not been approved by Bluetooth SIG, the supported frequencies are in the range assigned to Bluetooth® communications.

\*2: Validity period is unlimited. An open TCP port may be required to allow the MT1000A to be connected from an in-company LAN to MX109020A, depending on the LAN security policy.

#### Subscription Option License

| Model/Order No.                                                            | Name                                    |
|----------------------------------------------------------------------------|-----------------------------------------|
| MX109020A* <sup>3</sup> , * <sup>5</sup> , * <sup>6</sup> , * <sup>7</sup> | Site Over Remote Access Basic License   |
| MX109020A-TL001* <sup>3</sup> , * <sup>4</sup>                             | Site Over Remote Access 1 Year License  |
| MX109020A-001* <sup>5</sup>                                                | Site Over Remote Access 8 Units         |
| MX109020A-002* <sup>5</sup>                                                | Site Over Remote Access Unlimited Units |
| MX109020A-003* <sup>8</sup>                                                | Centralized Data Management             |

\*3: We recommend purchasing a 1-year license in addition to the basic license.

\*4: When extending the usage period, we recommend purchasing in 1-year license periods

\*5: Up to two measuring instruments can be remotely controlled simultaneously with the basic license.

This number can be increased to up to 8 units by purchasing the MX109020A-001 option, and up to 100 units by purchasing the MX109020A-002 option.

\*6: You must agree to the service terms before purchasing SORA.

Refer to the service terms at the following URL: <https://www.anritsu.com/en-AU/test-measurement/support/downloads/manuals/dwl20059>

\*7: This product cannot be used in some regions and countries; please read the service terms for more details.

\*8: Users must provide their own storage at the upload destination.



Specifications are subject to change without notice.

• **United States**

**Anritsu Americas Sales Company**

450 Century Parkway, Suite 190, Allen, TX 75013 U.S.A.  
Phone: +1-800-Anritsu (1-800-267-4878)

• **Canada**

**Anritsu Electronics Ltd.**

700 Silver Seven Road, Suite 120, Kanata,  
Ontario K2V 1C3, Canada  
Phone: +1-613-591-2003  
Fax: +1-613-591-1006

• **Brazil**

**Anritsu Eletronica Ltda.**

Praça Amadeu Amaral, 27 - 1 Andar  
01327-010 - Bela Vista - Sao Paulo - SP, Brazil  
Phone: +55-11-3283-2511  
Fax: +55-11-3288-6940

• **Mexico**

**Anritsu Company, S.A. de C.V.**

Blvd Miguel de Cervantes Saavedra #169 Piso 1, Col. Granada  
Mexico, Ciudad de Mexico, 11520, MEXICO  
Phone: +52-55-4169-7104

• **United Kingdom**

**Anritsu EMEA Ltd.**

200 Capability Green, Luton, Bedfordshire, LU1 3LU, U.K.  
Phone: +44-1582-433200  
Fax: +44-1582-731303

• **France**

**Anritsu S.A.**

12 avenue du Québec, Immeuble Goyave,  
91140 VILLEBON SUR YVETTE, France  
Phone: +33-1-60-92-15-50

• **Germany**

**Anritsu GmbH**

Nemetschek Haus, Konrad-Zuse-Platz 1,  
81829 München, Germany  
Phone: +49-89-442308-0  
Fax: +49-89-442308-55

• **Italy**

**Anritsu S.r.l.**

Spaces Eur Arte, Viale dell'Arte 25, 00144 Roma, Italy  
Phone: +39-6-509-9711

• **Sweden**

**Anritsu AB**

Kistagången 20 B, 2 tr, 164 40 Kista, Sweden  
Phone: +46-8-534-707-00

• **Finland**

**Anritsu AB**

Technopolis Aviapolis, Teknobulevardi 3-5 (D208.5),  
FI-01530 Vantaa, Finland  
Phone: +358-20-741-8100

• **Denmark**

**Anritsu A/S**

c/o Regus Winghouse, Ørestads Boulevard 73, 4th floor,  
2300 Copenhagen S, Denmark  
Phone: +45-7211-2200

• **Russia**

**Anritsu EMEA Ltd.**

**Representation Office in Russia**

Tverskaya str. 16/2, bld. 1, 7th floor., Moscow, 125009, Russia  
Phone: +7-495-363-1694  
Fax: +7-495-935-8962

• **Spain**

**Anritsu EMEA Ltd.**

**Representation Office in Spain**

Paseo de la Castellana, 141. Planta 5, Edificio Cuzco IV  
28046, Madrid, Spain  
Phone: +34-91-572-6761

• **Austria**

**Anritsu EMEA GmbH**

Am Belvedere 10, A-1100 Vienna, Austria  
Phone: +43-(0)1-717-28-710

• **United Arab Emirates**

**Anritsu EMEA Ltd.**

**Anritsu A/S**

Office No. 164, Building 17, Dubai Internet City  
P. O. Box - 501901, Dubai, United Arab Emirates  
Phone: +971-4-3758479

• **India**

**Anritsu India Private Limited**

6th Floor, Indiqube ETA, No.38/4, Adjacent to EMC2,  
Doddanekundi, Outer Ring Road, Bengaluru - 560048, India  
Phone: +91-80-6728-1300  
Fax: +91-80-6728-1301

• **Singapore**

**Anritsu Pte. Ltd.**

11 Chang Charn Road, #04-01, Shriro House, Singapore 159640  
Phone: +65-6282-2400  
Fax: +65-6282-2533

• **Vietnam**

**Anritsu Company Limited**

16th Floor, Peakview Tower, 36 Hoang Cau Street, O Cho Dua Ward,  
Dong Da District, Hanoi, Vietnam  
Phone: +84-24-3201-2730

• **P.R. China (Shanghai)**

**Anritsu (China) Co., Ltd.**

Room 2701-2705, Tower A, New Caohejing International  
Business Center No. 391 Gui Ping Road Shanghai, 200233, P.R. China  
Phone: +86-21-6237-0898  
Fax: +86-21-6237-0899

• **P.R. China (Hong Kong)**

**Anritsu Company Ltd.**

Unit 1006-7, 10/F., Greenfield Tower, Concordia Plaza,  
No. 1 Science Museum Road, Tsim Sha Tsui East,  
Kowloon, Hong Kong, P.R. China  
Phone: +852-2301-4980  
Fax: +852-2301-3545

• **Japan**

**Anritsu Corporation**

8-5, Tamura-cho, Atsugi-shi, Kanagawa, 243-0016 Japan  
Phone: +81-46-296-6509  
Fax: +81-46-225-8352

• **Korea**

**Anritsu Corporation, Ltd.**

5FL, 235 Pangyojeok-ro, Bundang-gu, Seongnam-si,  
Gyeonggi-do, 13494 Korea  
Phone: +82-31-696-7750  
Fax: +82-31-696-7751

• **Australia**

**Anritsu Pty. Ltd.**

Unit 20, 21-35 Ricketts Road, Mount Waverley, Victoria 3149, Australia  
Phone: +61-3-9558-8177  
Fax: +61-3-9558-8255

• **Taiwan**

**Anritsu Company Inc.**

7F, No. 316, Sec. 1, NeiHu Rd., Taipei 114, Taiwan  
Phone: +886-2-8751-1816  
Fax: +886-2-8751-1817