Discover What's Possible™ Anritsu

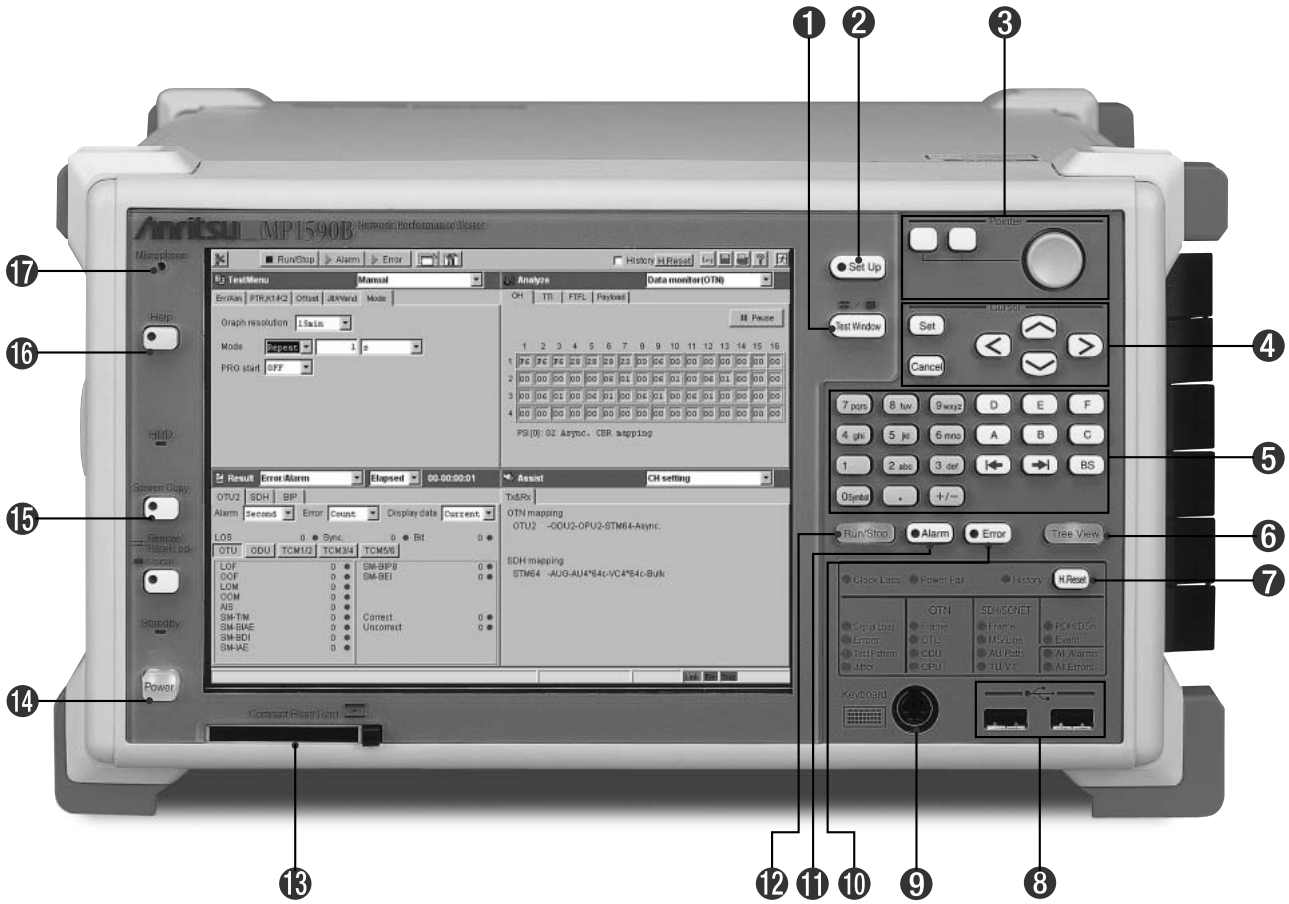
MP1590B

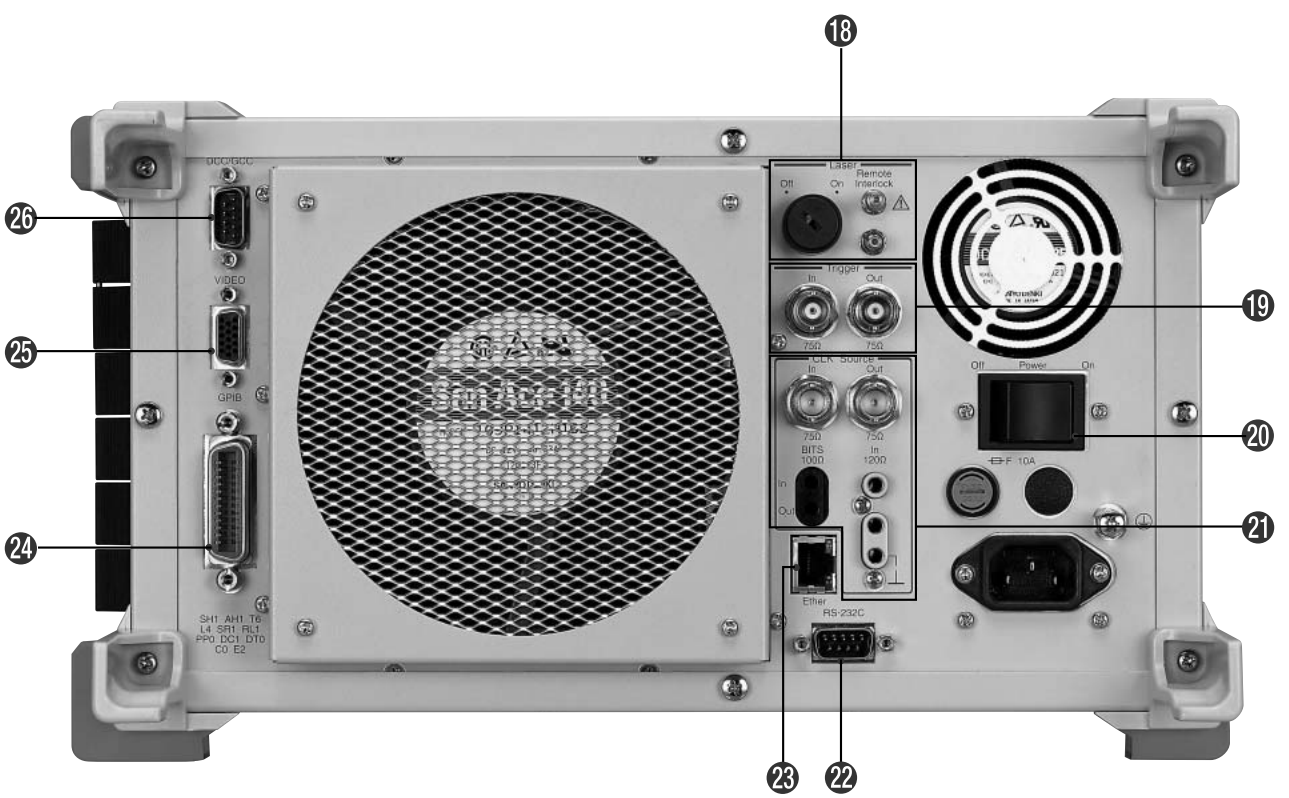
Network Performance Tester

Specifications

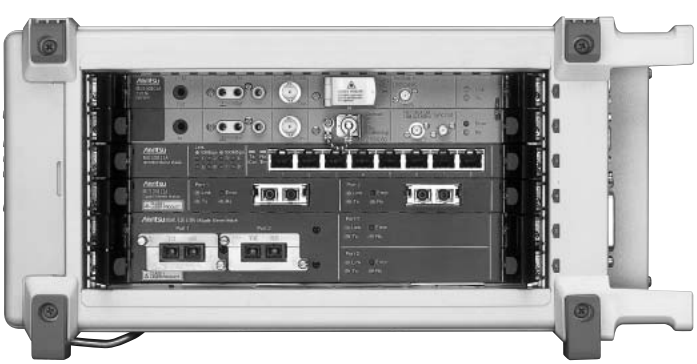
One Box Tester supporting Converged Network

MP1590B Key Layout



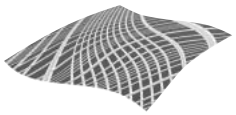


❶ **Test Window:** Switches Test window screen between full and 1/4 split screens.
❷ **Setup:** Switches between Setup and Test window screens.
❸ **Pointer:** Same function as mouse.
❹ **Cursor**
Set: Sets data.
Cancel: Cancel data setting.
∧∨< >: Scrolls screen cursor.
❺ **Keys:** Inputs numeric data
❻ **Tree View:** ON/OFF for Tree View area
❼ **H.Reset:** Resets history data
❽ **USB Connector:** Connector for USB devices.
❾ **Keyboard:** Connector for external keyboard.
❿ **Error:** Starts/stops Error insertion.
⓫ **Alarm:** Starts/stops Alarm insertion.
⓬ **Run/Stop:** Starts/stops measurements and tests.
⓭ **Compact Flash Card:** Compact Flash memory interface.
⓮ **Power:** When the Power indicator is on, the MP1590B application ends, it automatically changes to Standby condition. In Standby condition (when the Standby indicator is on), the MP1590B application software can be started and operated.
⓯ **Screen Copy:** Copies the displayed screen to a disk file.
⓰ **Help:** Displays the Help screen
⓱ **Microphone:** Microphone for order wire
⓲ **Laser**
Key Switch: Switches optical signals "On" and "communication Off".
Remote interlock: Connector for laser remote interlock.
⓳ **Trigger**
In: Input connector for external trigger to control APS test and capture.
Out: Output connector for error/alarm and capture trigger.
⓴ **Power (Main power):** Switches MP1590B power on and off.
㉑ **CLK Source**
In: Reference signal input connector for synchronizing the transmission signal with an external reference signal.
Out: Reference signal output connector for synchronizing the transmission signal with an external reference signal.
㉒ **RS-232C:** RS-232C remote control interface.
㉓ **Ether:** 10BASE-T/100BASE-TX Ethernet remote control interface.
㉔ **GPIB:** GPIB remote control interface.
㉕ **VIDEO:** Connector for external VGA display.
㉖ **DCC/GCC:** Connector for data/clock input/output for DCC (SDH/SONET), GCC (OTN byte) or Add/drop data.



EoS

Differential I/F



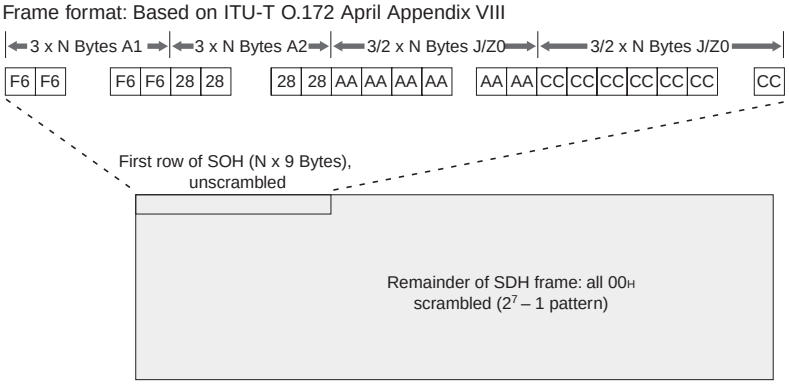
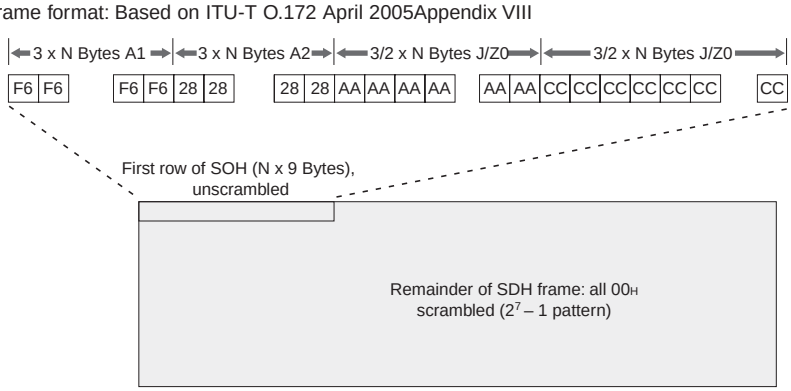
Specifications

● **MP1590B (main frame)**

Mode	SDH/SONET/OTN/PDH/DSn mode	EoS/Ethernet mode
Reference Clock input	Frequency Clock: 1.544 MHz*1, 2.048 MHz, 64 kHz + 8 kHz, 5 MHz*1, 10 MHz*1 Data: 1.544 Mbit/s (BITS), 2.048 Mbit/s Input range: ±50 ppm Level/Code 1.544 Mbit/s: ANSI T1.403 (B8ZS) 2.048 Mbit/s: ITU-T G.703 Table10 (HDB3) 1.544 MHz*1, 2.048 MHz, 5 MHz*1, 10 MHz*1: TTL (Rectangle, Sine Wave) 64 kHz + 8 kHz: 0.63 to 1.1 Vo-p (AMI, 8 kHz violation) Connector 1.544 MHz*1, 2.048 MHz, 2.048 Mbit/s, 5 MHz*1, 10 MHz*1: BNC 75 Ω 2.048 MHz, 2.048 Mbit/s, 64 kHz + 8 kHz: SIEMENS 120 Ω 1.544 Mbit/s: BANTAM 100 Ω Effective SDH/SONET/OTN bit rate.	
Reference Clock output	Frequency Clock: 1.544 MHz, 2.048 MHz, 5 MHz, 10 MHz Data: 1.544 Mbit/s (BITS), 2.048 Mbit/s Level/Code 1.544 Mbit/s: ANSI T1.403 (B8ZS) 2.048 Mbit/s: ITU-T G.703 Table10 (HDB3) 1.544 MHz, 2.048 MHz, 5 MHz, 10 MHz: TTL (Rectangle) Connector 1.544 MHz, 2.048 MHz, 2.048 Mbit/s, 5 MHz, 10 MHz: BNC 75 Ω 1.544 Mbit/s: BANTAM 100 Ω Effective SDH/SONET/OTN bit rate.	—
Trigger	Trigger input: For capture/APS measurement Trigger output: Transmit Error/Alarm, Receive Error/Alarm, Capture trigger Level: TTL (active High) Connector: BNC 75 Ω	Trigger input: For capture Trigger output: Capture trigger Level: TTL (active High) Connector: BNC 75 Ω
DCC/GCC	Data input/output: D1-D3 (192 kbit/s), D4-D12 (576 kbit/s), GCC0-2 (13124 kbit/s, 326.7 kbit/s) Clock output: 192 kHz , 576 kHz, 13124 kHz, 326.7 kHz Level: V.11 Connector: D-sub 9 pin	—
Remote interface	RS-232C (installed MP1590B-01), GPIB (installed MP1590B-02), LAN (10BASE-T/100BASE-TX, installed MP1590B-03)	
Peripheral connection	VGA output (SVGA), USB (2 port, Rev. 1.1), keyboard (PS/2)	
External memory	Compact flash (2 to 512 MB, recommended by CFA)	
Pointing device	By standard pointing device for a main frame, cursor movement in a screen is possible.	
Display size	8.4 inch, color TFT (800 x 600)	
LED	OTN: Frame, OTU, ODU, OPU SDH/SONET: Frame, MS/Line, AU/Path, TU/VT Standby, HDD, Clock Loss, Power Fail, History, Signal Loss, Errors, Test Pattern, Jitter, PDH/DSn, Event, All Errors, All Alarms	
EMC	EN61326: 1997/A2: 2001 (Class A), EN61000-3-2: 2000 (Class A), EN61326: 1997/A2: 2001 (Annex A)	
LVD	EN61010-1: 2001 (Pollution degree 2)	
Power	85 to 132/170 to 250 Vac (100/200 V system automatic change), 47.5 to 63 Hz	
Power consumption	≤500 VA	
Operational temperature	+5 to +40 ˚C	
Dimensions and mass	320 (W) x 177 (H) x 350 (D) mm, ≤13 kg (excluding plug-in units)	

*1: Only support on SDH/SONET/OTN/PDH/DSn mode.

● MP1590B Option 30 (High Precision Jitter Analysis)

Overview	This option offers the high-accuracy jitter measurement according to the following specifications by precision tuning.
The Jitter generation measurement accuracy	Accuracy : ±20 mUIp-p (toward the amount of transmitter Jitter (≤ 100 mUIp-p) made a standard by the Phase Analysis Calibration Method) Bit rate : 2488.32 Mbit/s, 9953.28 Mbit/s Interface : optical Measurement condition Optical input power : –10 to –12 dBm Measurement period : 60 sec/1 time Measurement method : The Phase Analysis Calibration Method (O.172 April. 2005 Appendix VIII) Average value : Five measurements Filters : 20 kHz to 80 MHz, 50 kHz to 80 MHz Optical unit for Tx: MU150121A or MU150134A Frame format: Based on ITU-T O.172 April Appendix VIII 
Repeatability of Jitter generation measurement	Accuracy : ±5 mUIp-p (Average value at five measurements under constant measurement condition) Bit rate : 9953.28 Mbit/s, 2488.32 Mbit/s Interface : optical Measurement condition Optical input power: –10 to –12 dBm Measurement period: 60 sec/1 time Measurement method: Loop Back Filters: 20 kHz to 80 MHz, 50 kHz to 80 MHz, 4 to 80 MHz Optical unit for Tx: MU150121A/B, MU150134A (9953M), MU150100A (2488M) Mapping: STS192c/STM-64c-Bulk (2^{23} – 1 Inv.) (9953M), OC-48c/STM-16c-Bulk (2^{23} – 1 Inv.) (2488M)
Output Jitter of Transmitter	Jitter value : < 50 mUIp-p (MU150134A), < 60 mUIp-p (MU150121A/B) Bit rate : 9953.28 Mbit/s Interface : optical Measurement condition Measurement method: The Phase Analysis Calibration Method (O.172 April. 2005 Appendix VIII) Average value : average of 3 times measurement Filters: 20 kHz to 80 MHz, 50 kHz to 80 MHz Sampling oscilloscope : > 20 GHz bandwidth Frame format: Based on ITU-T O.172 April 2005Appendix VIII 

General specification	Operating temperature: +20˚ to +30˚C Recommending calibration period: One year after the shipping or after the calibration

Precautions about MP1590B-30

This option can only be installed in the following equipment configurations. Other combinations cannot be installed. (The MU150101A is not supported.)
This option is managed by equipment model and serial number. Accordingly, if it is installed in a unit with the same model number but different serial number, it will be disabled.
When changing to a configuration that is different from the configuration with the option installed, the MP1590B functions and performance operate normally based on the switched configuration.
This option is enabled when using the 9953.28 Mbit/s Optical Interface.

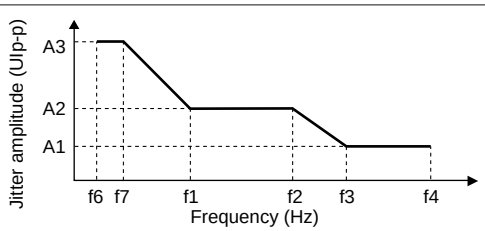
MP1590B : Network Performance Tester
MU150100A : 10/10.7G Unit
MU150121A/B, MU150134A : 10/10.7G Optical (/Electrical) Transmitter Unit
MU150123A/B : 10/10.7G 10/10.7G Optical (/Electrical) Receiver Unit (Wide)
MU150125A : 10/10.7G Jitter Unit

The “Transmission Output Jitter” is specified in the certificate attached to the option.
The MP1590B-30 recommended calibration interval is 1 year after shipment and annually thereafter.
The MP1590B-90 (3-year Warranty Option) does not apply to this option.

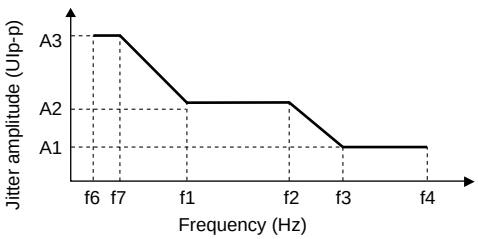
● MU150100A 10G/10.7G Unit, MU150101A 2.5/2.6G EoS Unit

Model	MU150100A	MU150101A*1
Electrical interface (1.544 to 155.52 Mbit/s)	Bit rate PDH/DSn: 1.544 Mbit/s, 2.048 Mbit/s, 8.448 Mbit/s, 34.368 Mbit/s, 44.736 Mbit/s, 139.264 Mbit/s SDH/SONET: 51.84 Mbit/s, 155.52 Mbit/s Code 1.544 Mbit/s: AMI/B8ZS 2.048 Mbit/s, 8.448 Mbit/s, 34.368 Mbit/s: HDB3 44.736 Mbit/s, 51.84 Mbit/s: B3ZS 139.264 Mbit/s, 155.52 Mbit/s: CMI Connector 1.544 Mbit/s : BANTAM 100 Ω Balanced 2.048 Mbit/s : 3 pin Siemens 120 Ω Balanced 2.048 Mbit/s, 8.448 Mbit/s, 34.368 Mbit/s, 44.736 Mbit/s, 51.84 Mbit/s, 139.264 Mbit/s, 155.52 Mbit/s : BNC 75 Ω Level ANSI T1.102 (1.544 Mbit/s, 44.736 Mbit/s) ITU-T G.703 (2.048 Mbit/s, 8.448 Mbit/s, 34.368 Mbit/s, 139.264 Mbit/s, 155.52 Mbit/s/) DSX output (1.544 Mbit/s): 0/655 feet DSX output (44.736 Mbit/s, 51.84 Mbit/s): 0/450/900 feet Monitor gain 20 dB, 26 dB : 1.544 Mbit/s, 2.048 Mbit/s, 8.448 Mbit/s, 34.368 Mbit/s, 44.736 Mbit/s, 51.84 Mbit/s 20 dB : 139.264 Mbit/s, 155.52 Mbit/s	
Electrical interface (9953.28 M, 10709.225 Mbit/s)	Bit rate SDH/SONET: 9953.28 Mbit/s OTN: 10709.225 Mbit/s (Installed Option 05) Code: NRZ Connector: SMA 50 Ω Level Clock Output: 1.3 to 0.6 Vp-p Data Output: 0 to –0.2 V (High), –0.85 to –1.5 V (Low) Data Input: 1.5 to 0.3 Vp-p	—
Optical interface	Bit rate SDH/SONET: 51.84 Mbit/s, 155.52 Mbit/s, 622.08 Mbit/s, 2488.32 Mbit/s OTN: 2666.057 Mbit/s (Installed Option 05) Code: NRZ Connector: FC-PC (SMF), replaceable	
Optical output	Level: –1 to +3 dBm (ATT = 0 dB, Option 04) Extinction ratio: ≥10 dB SMSR: ≥30 dB Peak wavelength: 1550 nm ±20 nm (Option 02,03), 1310 nm ±20 nm (Option 01,03) –20 dB width: ≤1 nm Safety classification: IEC 60825-1: CLASS 1M, 21CFR 1040.10: CLASS III b	
Optical input	Optical input level : –8 to –33 dBm (51.84 Mbit/s, 155.52 Mbit/s), –8 to –29 dBm (622.08 Mbit/s, 2488.32 Mbit/s, 2666.057 Mbit/s) Wavelength : 1260 to 1610 nm Overload : +3 dBm (Average)	
Clock	Internal, External (Reference input, 1/1 input), Receive Internal Accuracy: ±0.1 ppm [After power on, calibrate after 24 hours, warm-up 23 ±5˚C, aging rate (Max.) : ±0.05 ppm/day, ±0.5 ppm/year] Offset range : ±100 ppm/0.1 ppm step	
Frame	1.544 Mbit/s : D4/ESF/Japan ESF 2.048 Mbit/s : 30, 31ch with or without CRC4 8.448 Mbit/s : G.742 34.368 Mbit/s : G.751 44.736 Mbit/s : M13/C-bit 139.264 Mbit/s : G.751 51.84 Mbit/s : SDH/SONET 155.52 Mbit/s : SDH/SONET 622.08 Mbit/s : SDH/SONET 2488.32 Mbit/s : SDH/SONET 9953.28 Mbit/s : SDH/SONET*2	
No frame	1.544, 2.048, 8.448, 34.368, 44.736, 139.264 Mbit/s 51.84, 155.52, 622.08, 2488.32, 9953.28*2 Mbit/s	

Model	MU150100A	MU150101A*1
Test pattern	PRBS, Word, all0, all1, 3 in 24 (only 1.544 Mbit/s) PRBS (SDH/SONET) No Frame : $2^{15}-1$ (only 52/156M), $2^{23}-1$, $2^{31}-1$ Concatenation mapping : $2^{15}-1$ (1c/4c), $2^{23}-1$, $2^{31}-1$ Another mapping : $2^{11}-1$, $2^{15}-1$, $2^{20}-1$, $2^{20}-1$z (only 1.5M/45M), $2^{23}-1$ Invert ON/OFF PRBS (PDH/DSn) $2^{11}-1$, $2^{15}-1$, $2^{20}-1$, $2^{20}-1$z (only 1.544 Mbit/s, 44.736 Mbit/s), $2^{23}-1$ Invert ON/OFF Word : 16-bit programmable (mark ratio 1/2 at no frame) Transmit/Receive : An independent setup is possible	
OH preset	SOH/TOH/POH : All bytes (except parity byte, K1/K2 byte, H1, H2 and H3) Dummy channel POH : All bytes (except parity byte)	
Error addition/ measurement	PDH/DSn : Bit all (only addition), Code, Bit info, Bit 1.5M, Bit 2M, Bit 8M, Bit 34M, Bit 45M, Bit 139M, FAS 1.5M, FAS 2M, FAS 8M, FAS 34M, FAS 45M, FAS 139M, EXZ, CRC6, Ebit, Parity, Cbit, REI SDH : FAS, Frame (only measurement), B1, B2, HP-B3, LP-B3, BIP-2, MS-REI (M0/M1), HP-REI, LP-REI, Bit all (only addition), Bit info, OH bit, HP-IEC, LP-IEC, N2 BIP-2, HP-TC-REI, LP-TC-REI, HP-OEI, LP-OEI SONET : FAS, Frame (only measurement), B1, B2, HP-B3, LP-B3, BIP-2, REI-L (M0/M1), REI-P, REI-V, Bit all (only addition), Bit info, OH bit, HP-IEC, LP-IEC, N2 BIP-2, HP-TC-REI, LP-TC-REI, HP-OEI, LP-OEI	
Error addition timing	Rate, Alternative, Single, Burst, All, Frame Rate Fix rate : $1*10^{-n}$ (n : 3 to 9), User program : $A*10^{-B}$ (A : 1.0 to 9.9 step 0.1, B : 2 to 10) Alternative Error frame : 0 to 64000, Normal frame : 1 to 64000 Frame (only PDH/DSn) : n in 16 frame (n : 1 to 4) B1, B2, B3, BIP-2 can be set Error bit.	
Alarm addition/ measurement	PDH/DSn : LOS, LOF, AIS, RDI, RDI (MF) SDH: LOS, LOF, OOF (only measurement), RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-ERDIP, HP-ERDIS, HP-ERDIC, HP-TIM, HP-UNEQ, HP-SLM, TU-AIS, TU-LOP, TU-LOM, LP-RDI, LP-ERDIP, LP-ERDIS, LP-ERDIC, ISF, LP-RFI, LP-TIM, LP-UNEQ, LP-SLM, Sync. loss, OH Sync., HP-VC-AIS, LP-VC-AIS, HP-FAS, LP-FAS, HP-Incoming AIS, LP-Incoming AIS, HP-TC-RDI, LP-TC-RDI, HP-ODI, LP-ODI, HP-TC-TIM, LP-TC-TIM, HP-LTC, LP-LTC SONET : LOS, LOF, OOF (only measurement), RS-TIM, AIS-L, RDI-L, AIS-P, LOP-P, RDI-P, ERDIP-P, ERDIS-P, ERDIC-P, TIM-P, UNEQ-P, PLM-P, AIS-V, LOP-V, LOM-V, RDI-V, ERDIP-V, ERDIS-V, ERDIC-V, ISF, RFI-V, TIM-V, UNEQ-V, PLM-V, Sync. loss, OH Sync., HP-VC-AIS, LP-VC-AIS, HP-FAS, LP-FAS, HP-Incoming AIS, LP-Incoming AIS, HP-TC-RDI, LP-TC-RDI, HP-ODI, LP-ODI, HP-TC-TIM, LP-TC-TIM, HP-LTC, LP-LTC	
Alarm addition timing	Single, Burst, Alternative, All Alternative Error frame = 0 to 64000, Normal frame = 1 to 64000	
Monitor	PDH/DSn : FAS 1.5M, FW 2M, NFW 2M, MFW 2M, FAS 8M, FAS 34M, FAS 45M, FAS 139M, Info byte (only 2M) SDH/SONET : SOH/TOH/POH, Path Trace, Tandem byte, K1/K2 byte, AU/STS, TU/VT pointer	
Through	Transparent, Overhead overwrite (only SDH/SONET/OTN)	
MUX/DEMUX	MUX/DEMUX is possible to 64 k units in PDH and DSn	
Add/Drop	PDH/DSn signal can be added to or dropped from the SDH/SONET mapping. Bit rate : 1.5 Mbit/s, 2 Mbit/s, 34 Mbit/s, 45 Mbit/s, 139 Mbit/s STM-0/1/4/16 or OC-1/3/12/48 signal can be added to or dropped from STM-64 or OC-192 signal (required MU150100A-09)*2	
Delay measurement	Measurement period : 0.5, 1, 2, 5, 10 s Measurement range : 0.1 to 999 µs, 1.0 to 999.9 ms, 1.0 to 10.0 s, >Time out	
Dummy channel	Mode : Copy/Dummy Dummy pattern : all 0, all 1, $2^{11}-1$, $2^{15}-1$ (Invert)	
Path Trace	J0, J1, J2 byte can be set arbitrarily. 16 byte (CRC On), 64 byte (CRC OFF, J1 only)	
Tandem connection	N1/Z5, N2 byte can be set arbitrarily. It can set ON/OFF	
Pointer generation	AU/STS, TU/VT pointer Action : NDF, ±PJ (Pointer Justification) PJC Timing : Manual, Burst (2 to 64)	
Pointer measurement	AU/STS, TU/VT pointer, C bit Measurement item : NDF, + PJC, –PJC, Cons, C, C1/C2	

<table>
<tr><td>Model</td><td>MU150100A</td><td>MU150101A*1</td></tr>
<tr><td>Payload offset</td><td colspan="2">Offset range : ±100 ppm/0.1 ppm step can set at the Async. mapping.</td></tr>
<tr><td>APS test</td><td colspan="2">Switching time measurement
Measurement time : 0.1 to 2000.0 ms, Timeout (not include time for pointer/frame synchronization)
APS Sequence Generator
Generator timing : 2 to 64 word, Max. 8000 frame/word
It can be set for each K1/K2, K3, K4.</td></tr>
<tr><td>Overhead sequence capture</td><td colspan="2">Capture byte : K1/K2, K3, K4, AU/STS-Pointer, TU/VT-Pointer
Size : 64 sequence
Repeat : Max. 8000 frame/sequence</td></tr>
<tr><td>Overhead test</td><td colspan="2">SOH/TOH/POH 1byte, A1/A2, K1/K2, RSOH, MSOH, SOH, POH (except parity byte, K1/K2 byte, H1, H2 and H3)
Timing : Alternative (A : 1 to 8000 times, B : 1 to 8000 times), A and B can be set up to 256 frames.</td></tr>
<tr><td>OH BERT test</td><td colspan="2">Test byte : SOH/TOH/POH 1 byte, D1-D3, D4-D12 (except parity byte, K1/K2 byte, H1, H2 and H3)
Pattern : $2^{11}-1$, $2^{15}-1$ (Invert)
Error addition : Bit (only Single)
Measurement : Bit error, Sync loss</td></tr>
<tr><td>OH Add/Drop</td><td colspan="2">Test byte : D1-D3, D4-D12</td></tr>
<tr><td>Performance</td><td colspan="2">G.821, G.826, G.828, G.829, M.2100, M.2101, M.2110, M.2120, GR.820</td></tr>
<tr><td>Optical power meter</td><td colspan="2">Wavelength : 1310 nm/1550 nm
Measurement range : –7 to –40 dBm
Measurement accuracy : ±1 dB (–10 to –30 dBm), ±2 dB (–7 to –9.9 dBm, –30.1 to –40 dBm)</td></tr>
<tr><td>Frequency counter</td><td colspan="2">Measurement frequency (f0):
1.544, 2.048, 8.448, 34.368, 44.736, 139.264 MHz
51.84, 155.52, 622.08, 2488.320, 2666.057 MHz
9953.28*2, 10709.225*2 MHz
Measurement range : f0 ±100 ppm
Accuracy : ±0.1 ppm</td></tr>
<tr><td>Jitter tolerance
(52M to 2.5G/2.6G)</td><td colspan="2"> 

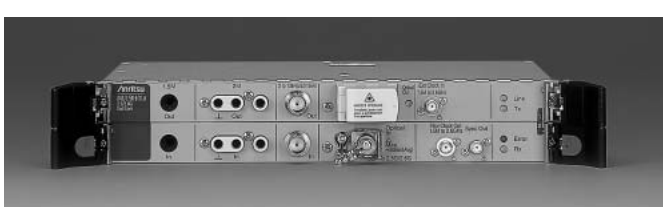
<table>
<tr><th>Bit rate (Mbit/s)</th><th>A1 (UIp-p)</th><th>A2 (UIp-p)</th><th>A3 (UIp-p)</th><th>f6 (Hz)</th><th>f7 (Hz)</th><th>f1 (Hz)</th><th>f2 (Hz)</th><th>f3 (Hz)</th><th>f4 (Hz)</th></tr>
<tr><td>51.84</td><td>20</td><td>2</td><td>0.2</td><td>10</td><td>30</td><td>300</td><td>2k</td><td>20k</td><td>400k</td></tr>
<tr><td>155.52</td><td>50</td><td>2</td><td>0.2</td><td>10</td><td>19.3</td><td>500</td><td>6.5k</td><td>65k</td><td>1.3M</td></tr>
<tr><td>622.08</td><td>200</td><td>2</td><td>0.2</td><td>10</td><td>10</td><td>1k</td><td>25k</td><td>250k</td><td>5M</td></tr>
<tr><td>2488.32</td><td>800</td><td>2</td><td>0.2</td><td>10</td><td>12.1</td><td>5k</td><td>100k</td><td>1M</td><td>20M</td></tr>
<tr><td>2666.05*3</td><td>800</td><td>2</td><td>0.2</td><td>10</td><td>12.1</td><td>5k</td><td>100k</td><td>1M</td><td>20M</td></tr>
</table>
Measurement condition : MU150100A/MU150101A loop-back measurement
Temperature condition : +10˚ to +40 ˚C
Optical input level : –10 to –12 dBm (2488M, 2666M), –10 to –20 dBm (52M, 156M, 622M)
Error threshold : 10^{-8} (52M), 10^{-9} (156M, 622M), 10^{-10} (2488M, 2666M)
Optical input wavelength : 1310 nm/1550 nm
Mapping
SDH : VC3-Bulk (52M), VC4-nc (n = 1, 4, 16) (156M/622M/2488M)
SONET : STSnc (n = 1, 3, 12, 48)
OTU-1 : ODU1-OPU1-PRBS
Test pattern : $2^{23}-1$ (Inv.) (SDH/SONET), $2^{23}-1$ (OTU-1), Mark ratio 1/2, Scramble “On”
Clock : internal</td></tr>
</table>

<table>
<tr><th>Model</th><th>MU150100A</th><th>MU150101A*1</th></tr>
<tr><td>Jitter tolerance*2
(9.9G/10.7G)</td><td>


<table>
<tr><th>Bit rate (Mbit/s)</th><th>A1 (UIp-p)</th><th>A2 (UIp-p)</th><th>A3 (UIp-p)</th></tr>
<tr><td>9953</td><td>0.2</td><td>2</td><td>3200</td></tr>
<tr><td>10709*3</td><td>0.2</td><td>2</td><td>3200</td></tr>
</table>
<table>
<tr><th>Bit rate (Mbit/s)</th><th>f6 (Hz)</th><th>f7 (Hz)</th><th>f1 (Hz)</th><th>f2 (Hz)</th><th>f3 (Hz)</th><th>f4 (Hz)</th></tr>
<tr><td>9953</td><td>10</td><td>12.1</td><td>20k</td><td>400k</td><td>4M</td><td>80M</td></tr>
<tr><td>10709*3</td><td>10</td><td>12.1</td><td>20k</td><td>400k</td><td>4M</td><td>80M</td></tr>
</table>
Measurement condition :
MU150100A, MU150121A, MU150123A loop-back measurement
Temperature condition : +10˚ to +40 ˚C
Optical input level : –10 to –12 dBm
Optical input wavelength : 1310 nm/1550 nm
Mapping
SDH : VC4-64c (9953M)
SONET : STS192c (9953M)
OTU-2 : ODU2-OPU2-PRBS
Test pattern : $2^{23} – 1$ (Inv.) (SDH/SONET), $2^{31} – 1$ (OTU-2), Mark ratio 1/2, Scramble “On”
Clock : internal
</td><td>—</td></tr>
<tr><td>Auxiliary interface</td><td colspan="2">External clock input, Receive clock output, Cock/Frame sync. output</td></tr>
<tr><td>Optical output power adjustable (Option 04)</td><td colspan="2">Variable range : 0 to 30 dB, Accuracy : ≤±0.5 dB (0 to 10 dB), ≤±1.0 dB (10.1 to 30 dB), Setting resolution : 0.1 dB</td></tr>
<tr><td>Supported main frame option</td><td>MP1590B-30</td><td>MP1590B-11</td></tr>
</table>

*1 : Please refer to the section of MU150101A-06/-07 about specification of EoS mode.
*2 : Don't support in MU150101A.
*3 : When it is installed MU150125A-05.


MU150100A


MU150101A

● MU150100A Option 05 (OTU-1/OTU-2), MU150101A Option 05 (OTU-1)

Option	MU150100A-05	MU150101A-05*1
Bite rate	10709.225 Mbit/s, 2666.057 Mbit/s	2666.057 Mbit/s
Frame	10709.225 Mbit/s : OTU-2, 2666.057 Mbit/s : OTU-1	2666.057 Mbit/s : OTU-1
No frame	10709.225 Mbit/s, 2666.057 Mbit/s	2666.057 Mbit/s
Test pattern	PRBS, Word, all 0, all 1 PRBS No frame : $2^{15} - 1$, $2^{23} - 1$, $2^{31} - 1$ PRBS mapping : $2^{15} - 1$, $2^{23} - 1$, $2^{31} - 1$ SDH/SONET mapping : According to SDH/SONET mapping Invert ON/OFF Word : 16-bit programmable (mark ratio 1/2 at no frame) Transmit/Receive : An independent setup is possible	
OH preset	OTU, ODU, OPU, FAS (except parity byte, MFAS and JC byte) TTI (SPAI [1] - [15], DAPI [1] - [15]) can be set character. PT is set automatically according to mapping (can be edit).	
FEC	G.709, RS (255, 239) It can set ON/OFF.	
Justification	Generation Action : ±Justification Timing : Single, Burst (2 to 64) Measurement item : + JC, –JC	
Payload offset	Offset range : ±65.9 ppm/0.1 ppm step can set at the Async. mapping.	
Error addition/ measurement	FAS, BIP-8 (SM, PM, TCM1-6), BEI (SM, PM, TCM1-6), Bit all (only addition for OTN frame), Bit, Corrected error bit (only measurement), Uncorrectable FEC block (only measurement)	
Error addition timing	Single, Rate, All, Alternate, Random (only Bit all) Rate Fix rate : $1*10^{-n}$ (n : 3 to 9), User program : $A*10^{-B}$ (A : 1.0 to 9.9, B : 2 to 10) Alternative Error frame : 0 to 64000, Normal frame : 1 to 64000 Random : Only Bit all When the Parity error is set, it can be select Error position	
Alarm addition/ measurement	LOF, OOF (only measurement), LOM, OOM (only measurement), BDI (SM, PM, TCM1-6), AIS (OTU, ODU), ODU-OCI, ODU-LCK, ODU-PLM (only measurement), IAE (SM,TCM1-6), TIM (SM, PM, TCM1-6), LTC (TCM1-6), BIAE (SM, TCM1-6)	
Alarm addition timing	Alternative, All, Burst, Single Alternative Error frame : 0 to 64000, Normal frame : 1 to 64000	
Monitor	All OH (OTU, ODU, OPU), TTI, FTFL, Payload Multi-frame indicate is possible at the TTI and FTFL.	
Overhead sequence capture	Capture byte : APS/PCC Size : 64 sequence Repeat : Max. 8000 frame/sequence	
Overhead test	OTU/ODU/OPU 1byte, FAS, APS/PCC, TCM1-6, SM, PM, GCC0-2, EXP (except parity byte, MFAS and JC byte) Timing : Alternative (A : 1 to 8000 times, B : 1 to 8000 times), A and B can be set up to 256 frames.	
OH BERT test	GCC0-2, OH 1byte (except Parity byte) Pattern : $2^{11} - 1$, $2^{15} - 1$ (Invert) Error addition : Bit (only Single) Measurement : Bit error, Sync.loss	
OH Add/Drop	Test byte : GCC0-2	

*1 : MU150101A doesn't support OTN measurement on EoS mode.

● MU150100A Option 07 (10/10.7G Minus option)

Function	This Option removes the 10/10.7G electrical capability from the MU150100A. This Option must be installed in the factory.

*1 : This option cannot be installed together with MU150100A-09.

● MU150101A Option 06 (GFP-F/LEX/LAPS), MU150101A Option 07 (POS)

Option	MU150101A-06	MU150101A-07
Bitrate	155.52 Mbit/s, 622.08 Mbit/s, 2488.32 Mbit/s (Optical only)	
Encapsulation	GFP-F, LEX, LAPS (X.86)	PPP, CiscoHDLC, MAPOS version1, MAPOS 16
Encapsulation setting	GFP : Scramble : On/off (Core Header and Payload Area setup is possible independently.) Descramble : On/off (Core Header and Payload Area setup is possible independently.) FCS : 32 bit Receive Conditions Extension Header size Extension header size other than NULL or Linear 2 to 58 byte (except eHEC) cHEC Presync times : 1 to 16 CSF Recovery : 1 to 16 Payload header checking : On/Off Ethernet MAC address Ethernet Maximum frame size (64 to 65535 byte) LAPS : Scramble/Descramble : On only Minimum Flag Length : 1 byte / 2 byte FCS : 32 bit Rate adaptation X/Y (add X byte every Y frame byte) X : 0 to 1024 byte/16 byte Y : 4096/8192/16384/32768/65536 Ethernet MAC address Ethernet Maximum frame size (64 to 65535 byte) LEX : Scramble/Descramble : On/off Minimum Flag Length : 1 byte / 2 byte FCS : 16 bit Negotiation : On/off, Restart, Retry, Abort, Max-Receive-Unit (MRU : default1500), Magic-number (random) , IPCP (Send this port IP address) Retry (1 to 10), Time out (1 to 180) PPP-LEX : Send Startup command option ON/OFF, MAC Address	PPP/CiscoHDLC/MAPOS version1/MAPOS 16 : Scramble : On/off Descramble : On/off Minimum Flag Length : 1 byte / 2 byte FCS : 16 bit / 32 bit Negotiation : (Only PPP except MRU) On/off, Restart, Retry, Abort, Max-Receive-Unit (MRU:default1500), Magic-number (random), IPCP (Send this port IP address) Retry (1 to 10), Time out (1 to 180)
Frame setting	FCS (LEX) : 16 bit MAC address : fixed, increment, decrement, random (Changeable portions specified in 4 bits units) IP address : fixed, increment, decrement, random VLAN tag*1 : fixed, increment, decrement, random Protocol editing : GFP, LEX, LAPS, Ethernet, ARP, IPv4, IGMP/IPv4, ICMP/IPv4, TCP/IPv4, UDP/IPv4, RIP/UDP/IPv4, DHCP/UDP/IPv4, IPv6, IPX, IS-IS, MAC Control Frame, LEX Control Packet	FCS : CRC32, CRC16 IP address : fixed, increment, decrement, random Protocol editing : PPP, CiscoHDLC, MAPOS v1, MAPOS 16, ARP, IPv4, IGMP/IPv4, ICMP/IPv4, TCP/IPv4, UDP/IPv4, RIP/UDP/IPv4, DHCP/UDP/IPv4, IPv6, IS-IS
	MPLS label*1 : Up to 10 MPLS labels can be appended. Data field : All1, All0, Alternate1/0 (by bit, 2 bit, nibble, byte, 2 byte) Increment by byte*2, Decrement by byte*2, Random by bytes*2, PRBS9*2, [Only Data field 1] Time Stamp*2, Sequence Number*2, Programmable, Test frame, Test Frame for MU120101A	
Frame length	Fixed : GFP 8,12,16 to 65535 byte PPP/LEX/LAPS 8 to 65535 byte (Packet Length + IFG ≥ 16 byte) Random : 64 to 65535 byte (IFG ≥ 16 byte)*3 Increment : 64 to 65535 byte (IFG ≥ 16 byte)*3 Auto : sets the frame size to the minimum required for the protocols selected.	
Stream setting	Distribution Patterns : Continuous, Continuous Burst, Stop after this Stream, Next Stream, Jump to Stream, Jump to Stream for count (Jump to stream NO.1 to 256 Loop count : 1 to 16000000 Frames per burst: 1 to 16000000 Bursts per Stream: 1 to 16000000) Inter Frame Gap : GFP 0 ns to 2 min (Step 13.4 ns), PPP/LEX/LAPS 3.3 ns to 2 min (Step 3.3 ns) Random*4 : 53.5 ns to 2 min (Frame length ≥ 64 byte)	

<table>
<tr><th>Option</th><th>MU150101A-06</th><th>MU150101A-07</th></tr>
<tr><td>Stream setting</td><td colspan="2">Inter Burst Gap : GFP 53.5 ns to 2 min (Step 13.4 ns), PPP/LEX/LAPS 3.3 ns to 2 min (Step 3.3 ns)
Inter Stream Gap : GFP 53.5 ns to 2 min (Step 13.4 ns), PPP/LEX/LAPS 3.3 ns to 2 min (Step 3.3 ns)</td></tr>
<tr><td rowspan="2">Error Addition</td><td>GFP :
cHEC error, correctable cHEC error,
tHEC error, correctable tHEC error,
eHEC error, correctable eHEC error, FCS error
LAPS(X.86) : FCS error, Aborted Sequence
LEX : FCS error, Fragments error, Undersize error,
Oversize error, Oversize & FCS error, Aborted Sequence</td><td>PPP :
FCS Error, Undersize, Oversize, Fragments Error,
Oversize & FCS Error, Aborted Frame</td></tr>
<tr><td colspan="2">Ethernet : FCS error, Fragments error, Undersize error, Oversize error, Oversize & FCS error
Network layer : IP header checksum Error, TCP/UDP checksum error, PRBS9 Error (option11)</td></tr>
<tr><td rowspan="3">Counter</td><td>GFP :
Transmitted Frame (frames and fps), Transmitted Byte,
Transmitted Bit Rate (% and bit/s), Received Frame (frames and fps), Received Byte, Received Bit Rate (% and bit/s),
Transmitted Rate (%), Received Rate (%),
cHEC Error, correctable cHEC Error,
tHEC Error, correctable tHEC Error, eHEC Error, FCS Error,
Server Signal Fail Interval, Client Loss of Sync Frame,
Client Loss of Sync Interval, Client Loss of Signal Frame,
Client Loss of Signal Interval

LEX :
Transmitted Frame (frames and fps), Transmitted Byte,
Transmitted Byte After Adaptation, Transmitted Byte After Stuffing, Transmitted Bit Rate (% and bit/s), Received Frame (frames and fps), Received Byte, Received Byte Before Adaptation, Received Byte Before Destuffing,
Received Bit Rate (% and bit/s), Transmitted Rate (%),
Received Rate (%), FCS error, Aborted frame
LAPS (X.86)
Transmitted Frame (frames and fps), Received Frame (frames and fps), Transmitted Byte, Transmitted Byte After Stuffing, Transmitted Bit Rate (% and bit/s), Received Byte,
Received Byte Before Destuffing, Received Bit Rate (% and bit/s), Transmitted Rate (%), Received Rate (%),
FCS error, Fragments, Undersize, Oversize,
Oversize & FCS Error, Aborted frame</td><td></td></tr>
<tr><td>SDH/SONET :
B1, B2, MS-REI, Bit Info [Count/Rate] LOS, LOF, OOF, MS-AIS, MS-RDI [Count/Second]
B3, BIP2, HP-REI, LP-REI, SQM [Count/Rate] : (with HO/LO VCAT option)
AU-AIS, AU-LOP, HP-SLM, HP-RDI, HP-UNEQ, VCAT-LOM, OOM1 (HO), OOM2 (HO) [Count/Second] : (with HO VCAT option)
TU-AIS, TU-LOP, TU-LOM, LP-RDI, LP-SLM, LP-UNEQ, Pattern Sync. Loss, VCAT-LOM, OOM (LO) [Count/Second] : (with LOVCAT option)
GID, CRC8(HO), CRC3 (LO) [Count/Rate]
LOA [Count/Second] : (with LCAS option)

Justification : NDF, +PJC, -PJC, Consecutive [Count/Rate], PPM

Bulk : Bit Info [Count/Rate], Pattern Sync. Loss [Second]</td><td></td></tr>
<tr><td colspan="2">Ethernet :
Transmitted Ethernet Frame (packets and fps), Transmitted Ethernet Byte, Received Ethernet Frame (packets and fps), Received Ethernet Byte, Transmitted Ethernet Bit Rate (%), Received Ethernet Bit Rate (%), Ethernet FCS error, Ethernet Fragments error, Ethernet Undersize error, Ethernet Oversize error, Ethernet Oversize & FCS error, Transmitted ARP Reply, Transmitted ARP Request, Received ARP Reply, Received ARP Request</td></tr>
</table>

Option	MU150101A-06	MU150101A-07
Counter	Other : Transmitted IPv4 Packet (packets and pps), Received IPv4 Packet (packets and pps), IPv4 Header Checksum Error, Received UDP Packet (packets and pps), Received TCP Packet (packets and pps), TCP Checksum Error, UDP Checksum Error, Capture Trigger, Capture Filter Frame, Transmitted Ping Reply, Transmitted Ping Request, Received Ping Reply, Received Ping Request, QoS 0 to 7 (packets and pps), User defined x 2 (packets and pps), Transmitted Test Pattern, Received Test Pattern Packet Error : Sequence Error, PRBS Frame Error [Count/Rate], PRBS Bit Error (with MP1590B-11)	
Frame Arrival time Variation measurement	Time resolution : 1 µs, 10 µs, 100 µs, 1 ms, 10 ms, 100 ms, 1 s	
QoS counter	Using QoS described below, 8-level priority frame count : IEEE802.1D VLAN tag user priority field, 3 LSB of RFC2474 DSCP field	
Unframed BER test	Test pattern : 2^{23} -1 (Inv), 2^{31} -1 Error insertion : Bit unit Error insertion timing : Single error, Fix rate : $1 * 10^{-n}$ (n : 3 to 9), User program : $A * 10^{-B}$ (A : 1.0 to 9.9 step 0.1, B : 2 to 10)	
Capture buffer	256 Mbyte	
Capture filter	At following conditions, capture filter condition settings : Destination MAC address*5, Source MAC address*5, Destination IP address, Source IP address, 32-bit pattern (settable bit length and offset) x 2, Error conditions	
Capture trigger	At following conditions, capture trigger condition settings : Destination MAC address*5, Source MAC address*5, Destination IP address, Source IP address, 32-bit pattern (settable bit length and offset) x 2, Error conditions, Traffic over, Latency over, External trigger input	
Protocol decode	ARP, CiscoHDLC, DHCP, DVMRP, Ethernet, GFP, ICMP, ICMPv6, IGAP, IGMP, IPCP, IPv4, IPv6, IPv6CP, IPX, IS-IS, LAPS(X.86), LCP, LDP, LEX, LLC, MAC Control Frame, MAPOS, MPLS, MPLSCP, OSPFv2, PPP, PPP-LEX, RIP, RSVP, SNAP, TCP, UDP, VLAN, Test Frame	
Protocol emulation	ARP, PPP, ICMPv4 (PING), IGMP	
Traffic monitor	IP packet count for up to 64 flows, Frame count for up to 64 protocols	
Traffic map	IP data flow for up to 256 flows	
Service disruption time	Measure a total time of receiving no frame as service disruption time. A resolution of this measurement depends on the transmitted frame size and IFG	

*1 : VLAN tag and MPLS labels cannot be used simultaneously.
*2 : This function causes TCP/UDP checksum error when it uses TCP/UDP frame.
*3 : Increment and random of frame length can be used only when choosing None as a protocol.
*4 : Random setting is effective only when frame length is more than 64 bytes.
*5 : Available only on GFP/LAPS/LEX mapping.

● MU150100A Option 08 (10.3G)

Bite rate (No frame)	10312.5 Mbit/s
Test pattern	PRBS, Word, all 0, all 1 PRBS No frame : $2^{15} - 1$, $2^{23} - 1$, $2^{31} - 1$ Invert ON/OFF Word : 16-bit programmable (mark ratio 1/2) Transmit/Receive : An independent setup is possible
Alarm/Error addition/ measurement	Bit all (addition), Bit syncloss (measurement)
Error addition timing	Single, Rate, All, Alternate Rate Fix rate : $1*10^{-n}$ (n : 3 to 9), User program : $A*10^{-B}$ (A : 1.0 to 9.9, B : 2 to 10) Alternative Error frame : 0 to 64000, Normal frame : 1 to 64000
Clock	External (1/1 input)

• MU150101A Option 11 (HO Virtual Concatenation), MU150101A Option 12 (LO Virtual Concatenation)

Option	MU150101A-11	MU150101A-12
Contiguous concatenation mapping	VC4 - Nc (N=16,8,4,3,2), VC4, VC3, VC4-Xc (X=1 to 16) Size : VC4-Xc : 1-16 (2488.320 Mbit/s), VC4-Xc : 1-4 (622.080 Mbit/s)	
Virtual concatenation mapping	AU4-VC4-Xv (STS3c-Xv) AU3-VC3-Xv (STS1-Xv)	AU4-TUG3-VC3-Xv AU4-TUG3-TUG2-VC12-Xv AU3-TUG2-VC12-Xv AU4-TUG3-TUG2-TU11-VC11-Xv AU3-TUG2-TU11-VC11-Xv
Virtual concatenation group	2488.320 Mbit/s : AU4-VC4-Xv : 1 to 16 AU4/3-VC3-Xv : 1 to 48 622.080 Mbit/s : AU4-VC4-Xv : 1 to 4 AU4/3-VC3-Xv : 1 to 12 155.520 Mbit/s : AU4/3-VC3-Xv : 1 to 3	2488.320 Mbit/s : TU12-VC12-Xv : 1 to 63 TU11-VC11-Xv : 1 to 64* 622.080 Mbit/s : TU12-VC12-Xv : 1 to 63 TU11-VC11-Xv : 1 to 64* 155.520 Mbit/s : TU12-VC12-Xv : 1 to 63 TU11-VC11-Xv : 1 to 64* (*VCG Size is 1 to 84, Provisioned Size 1to 64 when LCAS is ON)
	It is possible to select any position and any order for VCG member. In addition, it is possible to select any channel across any AU-Chs in AU4-VC3-Xv or VC12-Xv or VC-11Xv mapping.	
Detect VCG (Require MU150101A-13)	It is possible to detect VCG from the received signal automatically. It is possible to detect VCG across all AU-Ch in AU4-VC3-Xv or VC11-Xv or VC12-Xv mapping. This function is available only on LCAS network.	
Error addition	Contiguous Concatenation : FAS, Bit all, B1, B2, MS-REI, Bit info. Error, HP-B3, HP-REI Virtual Concatenation : FAS, Bit all, B1, B2, MS-REI, Bit info. Error, HP-B3, HP-REI, SQM, SQ Change, GID (LCAS) AU4-VC4-Xv, AU3-VC3-Xv :1st MFI, 2nd MFI, CRC8 (LCAS ON) AU4-VC3-Xv : LP-B3, LP-REI, 1st MFI, 2nd MFI, CRC8 (LCAS ON) VC12-Xv, VC11-Xv : BIP2, LP-REI, MFI, CRC3 (LCAS ON) It is possible to add an error into some chosen channels in HO/LO VCAT.	
Error addition timing	Single, Rate, All, Alternate, Rate : Fix rate : $1 * 10^{-n}$ (n : 3 to 9), User program : $A * 10^{-B}$ (A : 1.0 to 9.9, B: 2 to 10) Alternative : Error frame : 0 to 64000, Normal frame: 1 to 64000	
Alarm addition	Contiguous Concatenation : LOS, LOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-UNEQ, HP-SLM Virtual Concatenation : LOS, LOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-SLM, HP-TIM, HP-UNEQ, HP-SLM, VCAT-LOM, SQNC : (HOVCAT) AU4-VC3-Xv : TU-AIS, TU-LOP, LP-RID, LP-TIM, LP-UNEQ, LP-SLM VC12-Xv, VC11-Xv : TU-AIS, TU-LOP, TU-LOM, LP-RDI, LP-SLM, LP-UNEQ, VCAT-LOM : (LOVCAT) It is possible to add an alarm into some chosen channels in HO/LO VCAT.	
Alarm addition timing	Alternative, All, Burst, Single Alternative : Error frame : 0 to 64000, Normal frame : 1 to 64000	
Path monitor	Monitor errors, alarms and other state of each VCG member. Summary window : CH, HP (AU), AU PJC, LP (TU), TU PJC, VCAT, VCAT/LCAS (LCAS ON), LCAS/State (LCAS ON), OK, FAIL, IDLE, (Unknown) Detail window for each VCG member : HP(AU) : AIS, LOP, RDI, UNEQ, SLM, B3, REI AU PJC : NDF, +PJC, -PJC VCAT/LCAS : LOM, SQM, GID (LCAS ON) AU4-VC4-Xv/AU3-VC3-Xv : VCAT/LCAS : OOM1, OOM2, CRC8 (LCAS ON) AU4-VC3-Xv : LP (TU) : AIS, LOP, RDI, UNEQ, SLM, B3, REI TU PJC : NDF, +PJC, -PJC VCAT/LCAS:OOM1, OOM2, CRC8 (LCAS ON) VC12-Xv, VC11-Xv : LP (TU) : LOM, AIS, LOP, RDI, RFI, UNEQ, SLM, BIP2, REI TU PJC : NDF, +PJC, -PJC VCAT/LCAS : OOM, CRC3 (LCAS ON) Detail Window for all Ch : VCAT : LOA VCAT/LCAS (LCAS On) : MND, PLCT, TLCT, PLCR, TLCR, SQNC ·Frame Mapped GFP : GFP : Server Signal Fail, Client Loss of Sync, Client Loss of Signal, cHEC Error, tHEC Error, eHEC Error, GFP FCS Error Ethernet/IP : Ethernet Size or FCS Error, IPv4 Header Checksum Error, TCP Checksum Error, UDP Checksum Error ·PPP, CiscoHDLC, MAPOS Version 1, MAPOS16 : PPP : Aborted Frame, PPP Size or FCS Error	

Option	MU150101A-11	MU150101A-12
Path monitor	Ethernet/IP : IPv4 Header Checksum Error, TCP Checksum Error, UDP Checksum Error ·LEX : LEX : Aborted Frame, PPP Size or FCS Error Ethernet/IP : Ethernet Size or FCS Error, IPv4 Header Checksum Error, TCP Checksum Error, UDP Checksum Error ·LAPS (X.86) : LAPS : Aborted Frame, LAPS FCS Error ·Bulk : Pattern Sync. Loss, Bit Info.	

● MU150101A Option 13 (LCAS)

LCAS sequence generation	Number of sequence : 64 Command (Title) : ADD, Remove, Tmp. Remove, User CTLR value : IDEL, ADD, NORM, DNU, REMOVE, EOS Timing : Seq. Gap, Send time Time out : 1 to 8,000 multi frames Send Time : 1 to 8,000 multi frames Two or more channels are selected as target channels of a command.
Negotiation setting	MST and RS-Ack values can be set in the USER command mode. On/Off On : Wait time (1 to 8,000 multi frames) CTRL value setting (when receive MST = fail) DNU, and IDLE after wait time IDLE Available/Unavailable can be set to each members Off : MST value (OK or Fail) can be set to each members
Source/Sink summary	Display a LCAS status and Differential Delay for Source side and Sink side in one screen. Mode : Detail or State Scope : VCG member Display item : Source side Detail/State : PLCT, TLCT, XMT, XPT, XAT, Rs-Ack (For Rx) UMSTDetail : Ch, State, SQ, Ctrl, MST (For Rx) Differential Delay State : Position and State (CTRL) of Ch of Tx VCG members Sink side Detail/State : PLCR, TLCR, MND, SQNC, XMR, XPR, XAR, Rs-Ack (For Tx) Detail : Ch, State, SQ, Ctrl, Differential Delay, LOM, SQM, GID State : Position and State (CTRL) of Ch of Rx VCG members Alarm signal : PLCT, TLCT, UMST, PLCR, TLCR, MND, SQNC, LOM, SQM, GID
Monitor	SQ, CH, CTRL, RS-Ack(Invert or not), MST condition
Capture	OH : H4/K4 Trigger : Change value of SQ/CTRL/MST/RS-Ack, external Trigger position : 1 to 64 Display : SQ, CTRL, RS-Ack, MST Sequence : Move to next sequence when detect the change of CTRL value, MST value, RS-Ack value of selected member Maximum number of sequence : 64 (1 to 8000 multi frame per sequence)

● MU150101A Option 14 (Differential Delay)

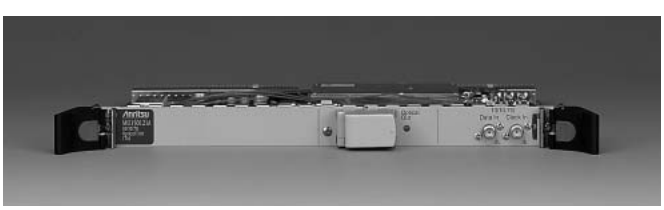
Differential delay measurement	Group Delay (ms), Path Trace Table View : CH, SQ, MF, Pointer, Δt (ms), State (Earliest, Latest) A sorting by CH or SQ or Δt (ms) is possible. Chart View : Display Δt as graph format. It is possible to zoom and output as Bitmap or Metafile. An ascending sort or a descending sort by CH or SQ or Δt (ms) is possible.
Differential delay addition	Generation range : 0 to 512 ms Equalization range : 0 to 256 ms NDF (MFI, Pointer), +PJC and -PJC can be set for each VCG member independently. Sweep function Target : It is possible to set two target value of delay for each VCG member. Target Delay Setting : MFI, Pointer Sweep Order : Step or Simultaneous Sweep mode : to A, to B, to A to B, to A to B to A Repeat : 1 to 99 (to A to B to A mode only) PJC Interval : 3 to 8000 frame Sweep Priority : AU or TU (AU4-VC3-Xv, AU4/3-VC12-Xv, AU4/3-VC11-Xv only) Display Estimated Time Tx Delay parameters (Present Value) : Ch, MFI, Pointer(AU, TU), Δt, Group Delay Rx Delay parameters : Ch, SQ, MFI, Pointer (AU, TU), Δt, Group Delay, State (Earliest, Latest) NDF and SS values setup for all members are possible

● MU150121A 10/10.7G Optical Unit (Tx)

● MU150121B 10/10.7G Optical/Electrical Unit (Tx)

Bit rate	9953.28 Mbit/s, 10312.5 Mbit/s, 10709.225 Mbit/s Accuracy : Depends on frequency accuracy of the MU150100A and external input frequency. Requires MU150100a-08 @10312.5 Mbit/s
Optical output	Peak wavelength : 1310 nm ± 20 nm (Option 01, 03) 1550 nm ± 20 nm (Option 02, 03) Spectrum range : ≤ 0.5 nm (@-20 dB) Side mode suppression ratio : ≥ 30 dB Extinction ratio : ≥ 10 dB Output power : MU150121A : 0 to +3 dBm MU150121B : -1 to +3 dBm Signal code : NRZ Connector : FC-PC (SMF) replaceable
Electrical input (Data,Clock)	Input level Data H : -0.2 to 1 V, L : -1.5 to -0.85 V Clock 0.6 to 1.3 Vp-p Signal code : NRZ Impedance : 50 Ω Connector : SMA
Electrical Differential output (Data, /Data)	Output level : variable (Refer to next item) Tr / Tf : 25 psec (Typical) Mapping : SDH VC4-64c, SONET STS192c, Test pattern 2^{23}-1 Phase difference of Data, /Data : ≤ 10 psec Code : NRZ Impedance : 50 Ω Connector : SMA
Variable electrical Differential output*	Variable range : 150 to 550 mVp-p (single) Data, /Data linked change Step : 10 mV Voh : 0 V
Safety classification	JIS, IEC 608251-1 : CLASS 1M, 21CFR 1040.10 : (CLASS Ⅲ b)
Variable optical Attenuator (Option 04)	Variable range : 0 to 20 dB Accuracy : ≤ ±0.5 dB (0 to 10 dB), ≤ ±1.0 dB (10.1 to 20 dB) Setting resolution : 0.1 dB

* : Only for MU150121B

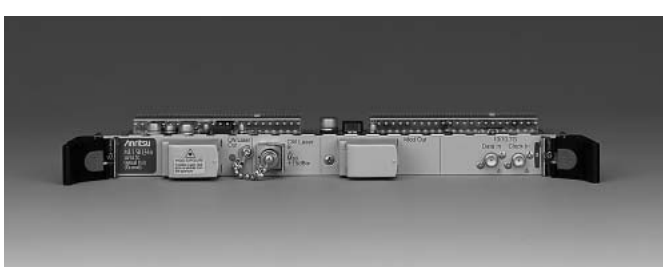


MU150121A

MU150121B

● MU150134A 10/10.7G Optical Unit (Tx external modulation)

Bit rate	9953.28 Mbit/s 10709.225 Mbit/s Depends on frequency accuracy of the MU150100A and external input frequency.
Optical output modulation	Output power : +3 dBm (C band) However, typical value when using built-in CW light source, and modulating by data signal of mark ratio 1/2. Extinction ratio : ≥10 dB Signal code : NRZ Connector : FC-PC (SMF) replaceable
External optical input	Light source : CW light source, polarization preservation fiber is used Peak wavelength : C band, L band Maximum input power : +15 dBm Minimum input power : +6 dBm Insertion loss : ≤7 dB (C band), ≤8 dB (L band) Connector : FC-PC (PMF), replaceable
Clock input	Frequency : 9953.28 MHz ±100 ppm, 10709.225 MHz ±100 ppm Input voltage : 1.3 to 0.6 Vp-p Connector : SMA (50 Ω GND)
Data input	Bit rate : 9953.28 Mbit/s ±100 ppm, 10709.225 Mbit/s ±100 ppm Input voltage Hi : 0.0074 to –0.2074 V, Lo : –0.8426 to –1.3074 V Connector : SMA (50 Ω GND)
Optical reference output	Optical source : CW light source Peak wavelength : 1550 ±20 nm (C band) –20 dB width : ≤1 nm Side mode suppression ratio : ≥30 dB Output power : +10 to +13 dBm Polarization Extinction ratio : ≥20 dB Connector : FC-PC (PMF), replaceable
Safety classification	IEC 60825-1 : CLASS 1M, 21CFR 1040.10 : CLASS Ⅲb
Optical output power adjustable (MU150134A-04)	Variable range : 0 to 20 dB, Accuracy : ≤±0.5 dB (0 to 10 dB), ≤±1.0 dB (10.1 to 20 dB), Setting resolution : 0.1 dB
Supported main frame option	MP1590B-30



MU150134A

- **MU150122A 10/10.7G Optical Unit (Rx narrow)**
- **MU150123A 10/10.7G Optical Unit (Rx wide)**
- **MU150123B 10/10.7G Optical/Electrical Unit (Rx wide)**

<table>
<tr><td>Bit rate</td><td>9953.28 Mbit/s ±100 ppm, 10709.225 Mbit/s ±100 ppm*2</td></tr>
<tr><td>Optical input</td><td>Wavelength : 1260 to 1610 nm
Sensitivity : –14 to 0 dBm
Absolute maximum optical input : +3 dBm (average)
Signal code : NRZ
Return loss : ≥ 27 dB
Connector : FC-PC (SMF), replaceable</td></tr>
<tr><td>Electrical output
(for BER,Jitter measurement)</td><td>Data output:
Output level : MU150122A : 0.3 to 0.7 Vp-p
MU150123A : 1.0 ±0.25 Vp-p
MU150123B : H : -0.2 to 0 V, L : -1.25 to -0.75 V
Signal code : NRZ
Clock output (MU150123A/B)
Output level : 0.8 ±0.25 Vp-p
Impedance : 50 Ω AC
Connector : SMA</td></tr>
<tr><td>Electrical output*1
(for O/E Data)</td><td>Output level : 0.35 Vp-p ± 0.15 V (@Optical input power : -12 to -10 dBm)
Impedance : 50 Ω AC
Connector : SMA</td></tr>
<tr><td>Electrical Differential input*1
(Data, /Data)</td><td>Input level (BER measurement) : Differential use : 50 to 550 mVp-p
single end use : 100 to 550 mVp-p
(Jitter measurement) : It differs according to the measurement condition. Refer to each item.
Phase difference tolerance of Data, /Data : ± 15 psec
Measurement condition
MU150100A/MU150121B (Differential loop back measurement)*2
Jitter OFF
Test pattern : SDH VC4-64c, SONET STS192c, Test pattern 2^{23}-1
OTU2-ODU2-OPU2-PRBS (2^{31}-1)
Impedance : 50 Ω AC
Connector : SMA</td></tr>
<tr><td>Variable electrical input threshold*1</td><td>Variable measuring instrument electrical input H/L evaluation threshold value. (only single end use)
Variable range : ±50 mV
Step : 1mV</td></tr>
<tr><td>Intrinsic Jitter*3</td><td>System measurement (with MU150121A/B)
<table>
<tr><td rowspan="3">Bit Rate (Mbit/s)</td><td rowspan="3">Interface</td><td colspan="8">jitter Amplitude</td></tr>
<tr><td colspan="6">UIp-p</td><td colspan="2">UIrms</td></tr>
<tr><td colspan="2">HP1+LP</td><td colspan="2">HP'+LP</td><td colspan="2">HP2+LP</td><td colspan="2">HP'+LP</td></tr>
<tr><td>Frame</td><td>Noframe*1</td><td>Frame</td><td>Noframe*1</td><td>Frame</td><td>Noframe*1</td><td>Frame</td><td>Noframe*1</td></tr>
<tr><td>9953.28</td><td>Optical
Electrical*1</td><td>0.08
0.045</td><td>0.09
0.09</td><td>0.08
0.045</td><td>0.09
0.09</td><td>0.06
0.045</td><td>0.075
0.075</td><td>0.006*1/0.009
0.006</td><td>0.006
0.006</td></tr>
<tr><td>10709.23*2</td><td>Optical
Electrical*2</td><td>0.008
0.045</td><td>0.09
0.09</td><td>0.08
0.045</td><td>0.09
0.096</td><td>0.06
0.045</td><td>0.075
0.075</td><td>0.006*1/0.009
0.006</td><td>0.006
0.006</td></tr>
</table>
Measurement condition
Temperature range : +10° to +40 °C
Optical input level : -12 to -10 dBm
Electrical input level : 200 to 500 mVp-p
Measurement time : 60 sec
Unit configuration : Optical interface (Loop back measurement)*2,
Electrical interface (Differential loop back measurement)*2
MU150123A + MU150100A/MU150121A/MU150125A
MU150123B + MU150100A/MU150121B/MU150125A
Optical input wavelength : 1310 nm/1550 nm
Test pattern : SDH VC4-64c, SONET STS192c, Test pattern 2^{23}-1
OTU2-ODU2-OPU2-PRBS (2^{31}-1)
No frame (2^{23}-1)
Extinction ratio : ≥ 8.2 dB</td></tr>
</table>

Intrinsic Jitter*3

System measurement (with MU150134A)

Bit Rate (Mbit/s)	Interface	jitter Amplitude			
		UIp-p			UIrms
		HP1+LP	HP'+LP	HP2+LP	HP'+LP
9953.28	Optical	0.065	0.065	0.06	0.006*1/0.009
10709.225*2	Optical	0.065	0.065	0.06	0.006*1/0.009

Measurement condition
- Temperature range : +10° to +40 °C
- Optical input level : -12 to -10 dBm
- Measurement time : 60 sec
- Unit configuration : Optical interface (Loop back measurement)*2,
  MU150123A/B + MU150100A/MU150134A/MU150125A
- Optical input wavelength : 1550 nm
- Test pattern : SDH VC4-64c, SONET STS192c, Test pattern 2^{23}-1
  OTU2-ODU2-OPU2-PRBS (2^{31}-1)
  No frame (2^{23}-1)
- Extinction ratio : ≥ 8.2 dB

Receiver measurement

Bit Rate (Mbit/s)	Interface	jitter Amplitude			
		UIp-p			UIrms
		HP1+LP	HP'+LP	HP2+LP	HP'+LP
9953.28	Electrical	0.02	0.02	0.02	0.004
10709.225*2	Electrical	0.02	0.02	0.02	0.004

Measurement condition
- Temperature range : +20° to +30 °C
- Electrical input amplitude : 200 to 500 mVpp
- Measurement time : 60 sec
- Transmitter : Anritsu reference transmitter
- Test pattern : O.172 Appendix VIII
  F6 (1536 bit) + 28 (1536 bit) + AA (768 bit) + CC (768 bit) + 2^7-1 (392 bit)
  "2^7-1" is scrambled all 0 pattern.

Random Jitter*3

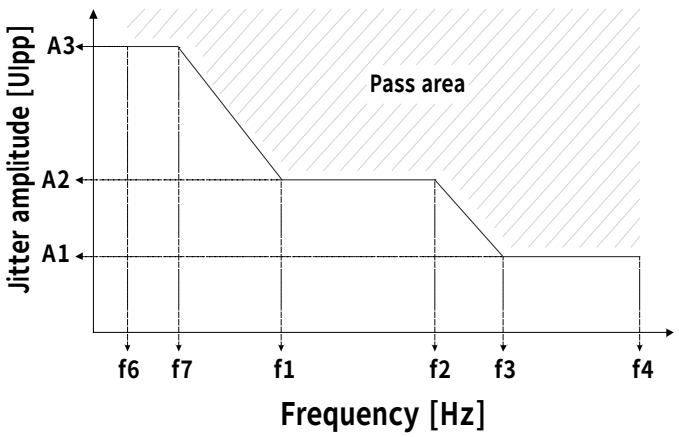
Bit Rate (Mbit/s)	Interface	jitter Amplitude
		UIp-p
		HP1+LP
9953.28	Optical	0.010 or less
10709.225*2	Optical	0.010 or less

Measurement condition
- Temperature range : +10° to +40 °C
- Optical input level : -12 to -10 dBm
- Measurement time : 60 sec
- Unit configuration : Optical interface (Loop back measurement)*2,
  MU150123A/B + MU150100A/MU150121B or MU150134A/MU150125A
- Optical input wavelength : 1550 nm
- Test pattern : Word16 ""1010101010101010"" (bin)

Calculation method
(1) Set the filter to HP1+LP and measure for 60 sec by MU150125A clock loopback.
(2) Set the filter to HP1+LP and measure for 60 sec by MU150123A/B + MU150100A/MU150121B or MU150134A/MU150125A Optical interface loopback.
(3) Take the difference of the measurement result of (1) and (2).

The value obtained by (3) becomes random jitter value.

Jitter tolerance*3



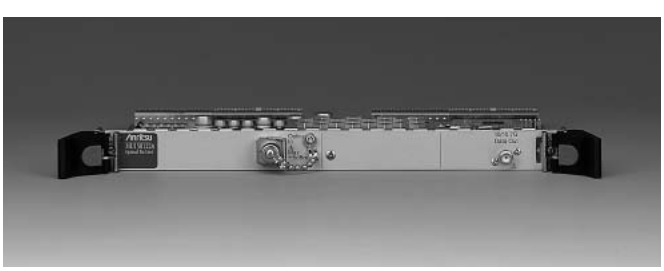
Bit Rate (Mbit/s)	A1 UIpp	A2 UIpp	A3 UIpp	f6 Hz	f7 Hz	f1 Hz	f2 Hz	f3 Hz	f4 Hz
9953	0.2	2	3200	10	12.1	20k	400k	4M	80M
10709*1	0.2	2	3200	10	12.1	20k	400k	4M	80M

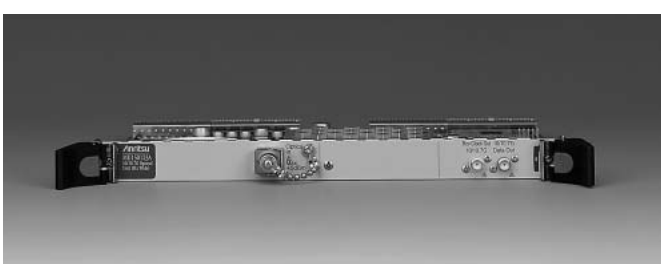
Measurement condition
Temperature range : +10° to +40 °C
Optical input level : -12 to -10 dBm
Electrical input level : 150 to 500 mVp-p
Measurement time : 60 sec
Unit configuration : Optical interface (Loop back measurement)*2,
Electrical interface (Differential loop back measurement)*2
MU150123B + MU150100A/MU150121B/MU150125A
Optical input wavelength : 1310 nm/1550 nm
Test pattern : SDH VC4-64c, SONET STS192c, Test pattern 2^{23}-1
OTU2-ODU2-OPU2-PRBS (2^{31}-1)

Optical input power measurement

Measurement range : –20 to +2 dBm
Measurement accuracy : MU150122A/MU150123A
≤ ±0.5 dB (+2 to –10 dBm), ≤ ±1.0 dB (–10.1 to –20 dBm)
MU150123B
≤ ±0.5 dB (-1.1 to –10 dBm), ≤ ±1.0 dB (+2 to -1.0 dBm, –10.1 to –20 dBm)

*1 : Only MU150123A-05 is applied.
*2 : MU150123A/B option 05 is required at 10709M.
*3 : MU150123A, MU150123B are applied.


MU150122A

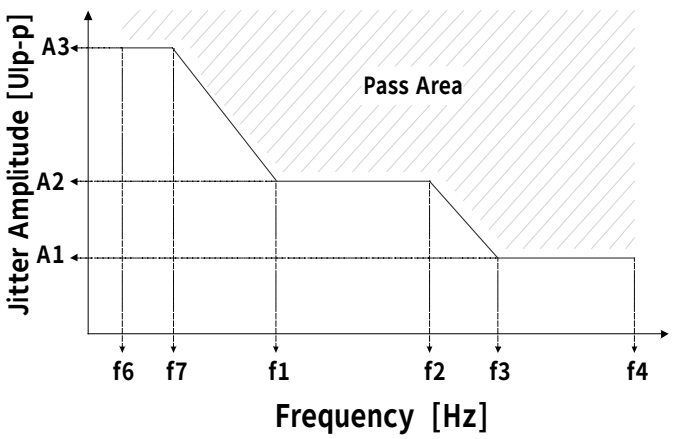

MU150123A


MU150123B

● MU150124B 10.3G Optical/Electrical Unit (Rx wide)

<table>
<tr><td>Bit rate</td><td>9953.28 Mbit/s ±100 ppm, 10312.5 Mbit/s ±100 ppm, 10709.225 Mbit/s ±100 ppm</td></tr>
<tr><td>Optical input</td><td>Wavelength : 1260 to 1610 nm
Sensitivity : –14 to 0 dBm
Absolute maximum optical input : +3 dBm (average)
Signal code : NRZ
Return loss : ≥ 27 dB
Connector : FC-PC (SMF), replaceable</td></tr>
<tr><td>Electrical output
(for BER,Jitter measurement)</td><td>Data output :
Output level : H : -0.2 to 0 V, L : -1.25 to -0.75 V
Signal code : NRZ
Clock output (Wide/Narrow)
Apply at 10312.5 MHz ± 100 ppm.
Output level : 0.8 ±0.25 Vp-p
Impedance : 50 Ω AC
Connector : SMA</td></tr>
<tr><td>Electrical output
(O/E Data)</td><td>Output level : 0.35 Vp-p ±0.15 V (Optical input power : -12 to -10 dBm)
Impedance : 50 Ω AC
Connector : SMA</td></tr>
<tr><td>Electrical Differential input
(Data, /Data)</td><td>Input level (BER measurement) : Differential use : 50 to 550 mVp-p (x2)
Single end use : 100 to 550 mVp-p
(Jitter measurement) : It differs according to the measurement condition. Refer to each item.
Phase difference tolerance of Data, /Data : ± 15 psec
Measurement condition
MU150100A/MU150121B (Differential loop back measurement)
Jitter OFF
Test pattern : No frame (2^{31}-1)
Impedance : 50 Ω AC
Connector : SMA</td></tr>
<tr><td>Variable electrical input
threshold</td><td>Variable measuring instrument electrical input H/L evaluation threshould value.
(only single end use)
Variable range : ± 50 mV
Step : 1 mV</td></tr>
<tr><td>Intrinsic jitter</td><td>System measurement (with MU150121B)
<table>
<tr><th rowspan="3">Bit Rate
(Mbit/s)</th><th rowspan="3">Interface</th><th colspan="4">jitter Amplitude</th></tr>
<tr><th colspan="3">UIp-p</th><th>UIrms</th></tr>
<tr><th>HP1+LP</th><th>HP'+LP</th><th>HP2+LP</th><th>HP'+LP</th></tr>
<tr><td>10312.5</td><td>Optical</td><td>0.09</td><td>0.09</td><td>0.075</td><td>0.006</td></tr>
<tr><td>Wide</td><td>Electrical</td><td>0.09</td><td>0.09</td><td>0.075</td><td>0.006</td></tr>
<tr><td>10312.5</td><td>Optical</td><td>0.04</td><td>0.04</td><td>0.03</td><td>0.005</td></tr>
<tr><td>Narrow</td><td>Electrical</td><td>0.04</td><td>0.04</td><td>0.03</td><td>0.005</td></tr>
</table>
Measurement condition
Temperature range : +10° to +40 °C
Optical input level : -12 to -10 dBm
Electrical input level : 200 to 500 mVp-p
Measurement time : 60 sec
Unit configuration : Optical interface (Loop back measurement),
Electrical interface (Differential loop back measurement)
MU150124B + MU150100A/MU150121B/MU150125A
Optical input wavelength : 1310 nm/1550 nm
Test pattern : No frame (2^{23}-1)
Extinction ratio : ≥ 8.2 dB

System measurement (with MU150134A)
<table>
<tr><th rowspan="3">Bit Rate
(Mbit/s)</th><th rowspan="3">Interface</th><th colspan="4">jitter Amplitude</th></tr>
<tr><th colspan="3">UIp-p</th><th>UIrms</th></tr>
<tr><th>HP1+LP</th><th>HP'+LP</th><th>HP2+LP</th><th>HP'+LP</th></tr>
<tr><td>10312.5 Wide</td><td>Optical</td><td>0.09</td><td>0.09</td><td>0.075</td><td>0.006</td></tr>
<tr><td>10312.5 Narrow</td><td>Optical</td><td>0.04</td><td>0.04</td><td>0.03</td><td>0.006</td></tr>
</table></td></tr>
</table>

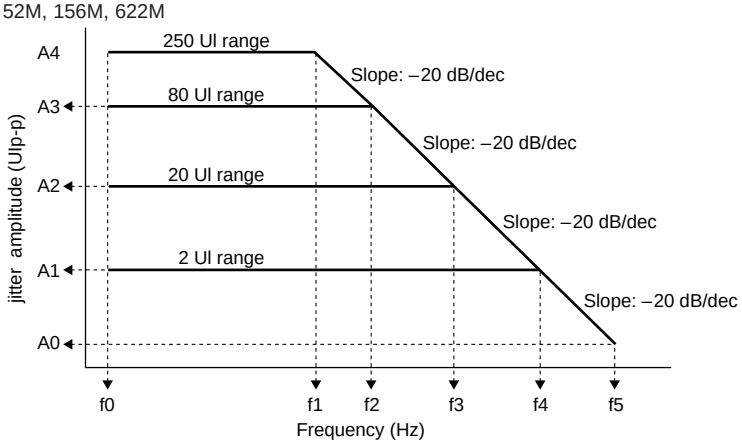
<table>
<tr><td>Intrinsic jitter</td><td>Measurement condition
Temperature range : +10° to +40 °C
Optical input level : -12 to -10 dBm
Measurement time : 60 sec
Unit configuration : Optical interface (Loop back measurement),
MU150124B + MU150100A-08/MU150134A/MU150125A
Optical input wavelength : 1550 nm
Test pattern : No frame (2^{23}-1)
Extinction ratio : ≥ 8.2 dB</td></tr>
<tr><td>Jitter tolerance</td><td> 

<table>
<tr><td>Bit Rate
(Mbit/s)</td><td>A1
Ulpp</td><td>A2
Ulpp</td><td>A3
Ulpp</td><td>f6
Hz</td><td>f7
Hz</td><td>f1
Hz</td><td>f2
Hz</td><td>f3
Hz</td><td>f4
Hz</td></tr>
<tr><td>10312.5</td><td>0.2</td><td>2</td><td>3200</td><td>10</td><td>12.1</td><td>20k</td><td>400k</td><td>4M</td><td>80M</td></tr>
</table>
Measurement condition
Temperature range : +10° to +40 °C
Optical input level : -12 to -10 dBm
Electrical input level : 150 to 500 mVp-p
Measurement time : 60 sec
Unit configuration : Optical interface (Loop back measurement),
Electrical interface (Differential loop back measurement)
MU150123B + MU150100A/MU150121B/MU150125A
Optical input wavelength : 1310 nm/1550 nm
Test pattern : No frame (2^{23}-1)</td></tr>
<tr><td>Optical input power measurement</td><td>Measurement range : –20 to +2 dBm
Measurement accuracy : ≤ ±0.5 dB (-10 to –1.1 dBm), ≤ ±1.0 dB (+2 to -1.0 dBm, –10.1 to –20 dBm)</td></tr>
</table>

MU150124B

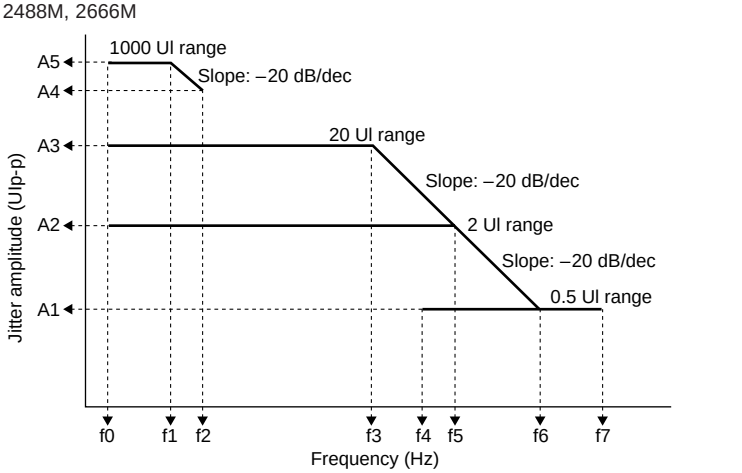
● MU150125A 10/10.7G jitter Unit

Jitter generation/ measurement frequency	51.84 MHz, 155.52 MHz, 622.08 MHz, 2488.32 MHz, 9953.28 MHz 2666.06 MHz (MU150125A-05), 10709.225 MHz (MU150125A-05) 10312.5 MHz (MU150125A-06)
10/10.3/10.7G Clock output 52M to 2.66 GHz Clock output	Frequency : 51.84 MHz ±100 ppm, 155.52 MHz ±100 ppm, 622.08 MHz ±100 ppm, 2488.32 MHz ±100 ppm, 2666.057 MHz ±100 ppm, 9953.28 MHz ±100 ppm, 10312.5 MHz ±100 ppm, 10709.225 MHz ±100 ppm Accuracy : ±0.1 ppm [After power on, calibrate after 24 hours, warm-up 23 ±5°C, aging rate (Max.) : ±0.05 ppm/day, ±0.5 ppm/year] Level : 0.8 Vp-p ±0.25 V Connector : SMA, 50 Ω (AC)
Jitter generation	Modulation frequency : 0.1 Hz to 80 MHz Amplitude : 0 to 4040 UIp-p Modulation value : 52M, 156M, 622M



Frequency (Hz)	f0 (Hz)	f1 (kHz)	f2 (kHz)	f3 (kHz)	f4 (kHz)	f5 (MHz)	A0 (UIp-p)	A1 (UIp-p)	A2 (UIp-p)	A3 (UIp-p)	A4 (UIp-p)
52M	0.1	—	—	50	500	1.3	0.776	2.02	20.20	—	—
155M	0.1	—	38	150	1500	3.8	0.797	2.02	20.20	80.8	—
622M	0.1	4.8	15	60	600	5	0.242	2.02	20.20	80.8	253.0

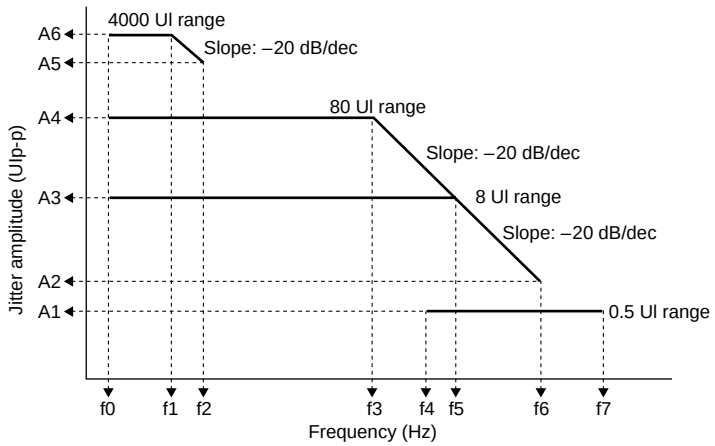
2488M, 2666M



Frequency (Hz)	f0 (Hz)	f1 (Hz)	f2 (Hz)	f3 (kHz)	f4 (kHz)	f5 (MHz)	f6 (MHz)	f7 (MHz)	A1 (UIp-p)	A2 (UIp-p)	A3 (UIp-p)	A4 (UIp-p)	A5 (UIp-p)
2488M 2666M	0.1	15	600	100	500	1	4	20	0.505	2.02	20.2	25	1010

Jitter generation

9953M, 10.3G, 10.7G



Frequency (Hz)	f0 (Hz)	f1 (Hz)	f2 (Hz)	f3 (kHz)	f4 (kHz)	f5 (kHz)	f6 (MHz)	f7 (MHz)	A1 (UIp-p)	A2 (UIp-p)	A3 (UIp-p)	A4 (UIp-p)	A5 (UIp-p)	A6 (UIp-p)
9953M 10.3G 10.7G	0.1	15	600	100	500	1	4	80	0.505	2.02	8.08	80.8	110	4040

Accuracy :
- 0.5 UI range : ±Q % of setting ±0.02 UIp-p
- 2 UI range : ±Q % of setting ±0.02 UIp-p
- 8 UI range : ±Q % of setting ±0.8 UIp-p
- 20 UI range : ±Q % of setting ±0.2 UIp-p
- 20 UI range : ±Q % of setting ±1.2 UIp-p (2488M, 2666M)
- 80 UI range : ±Q % of setting ±1.2 UIp-p
- 80 UI range : ±Q % of setting ±4.8 UIp-p (9953M, 10.3G, 10.7G)
- 250 UI range : ±Q % of setting ±6 UIp-p
- 1000 UI range : ±Q % of setting ±6 UIp-p
- 4000 UI range : ±Q % of setting ±24 UIp-p

Frequency	Variable error Q	Frequency range
52 MHz	±8 %	0.1 to 500 kHz
	±12 %	500 kHz to 1.3 MHz
156 MHz	±8 %	0.1 to 500 kHz
	±12 %	500 kHz to 1.5 MHz
	±15 %	1.5 MHz to 3.8 MHz
622 MHz	±8 %	0.1 to 500 kHz
	±12 %	500 kHz to 2 MHz
	±15 %	2M to 5 MHz
2488 MHz 2666 MHz	±8 %	0.1 to 500 kHz
	±12 %	500 kHz to 2 MHz
	±15 %	2M to 20 MHz
9953MHz 10.3 GHz 10.7 GHz	±8 %	0.1 to 500 kHz
	±12 %	500 kHz to 2 MHz
	±15 %	2M to 80 MHz

10/10.3/10.7G Clock input
52M to 2.66 GHz Clock input

Frequency :
51.84 MHz ±100 ppm, 155.52 MHz ±100 ppm, 622.08 MHz ±100 ppm, 2488.32 MHz ±100 ppm, 2666.057 MHz ±100 ppm, 9953.28 MHz ±100 ppm, 10312.5 MHz ±100 ppm, 10709.225 MHz ±100 ppm
Level : 0.8 Vp-p ±0.3 V (52 MHz to 2.6 GHz), 0.8 Vp-p ±0.25 V (10/10.3/10.7 GHz)
Connector : SMA, 50 Ω (AC)

Jitter measurement

Manual jitter measurement : UIp-p, UI+p, UI-p/UIrms
UIp-p measurement :
- 2 UI range (–1.010 to 1.010 UIp-p/Step 0.001 UIp-p)
- 20 UI range (–10.10 to 10.10 UIp-p/Step 0.01 UIp-p)
- 80 UI range (–40.4 to 40.4 UIp-p/Step 0.25 UIp-p)
- 250 UI range (–123.0 to 123.0 UIp-p/Step 0.5 UIp-p)
- 1000 UI range (–510.0 to 510.0 UIp-p/Step 1 UIp-p)
- 4000 UI range (–2020 to 2020 UIp-p/Step 2 UIp-p)

UIrms measurement :
- 2 UI range (0.000 to 0.714 UIrms/Step 0.001 UIrms)
- 20 UI range (0.00 to 7.14 UIrms/Step 0.01 UIrms)

Jitter measurement

Measurement Filter

Frequency (Hz)	HP0 (Hz)	HP1 (Hz)	HP1' (Hz)	HP2 (Hz)	HP' (Hz)	HP (Hz)	LP (Hz)	LP' (Hz)
52M	10	100	—	20k	—	12k	400k	—
156M	10	500	—	65k	—	12k	1.3M	500
622M	10	1k	—	250k	—	12k	5M	1k
2488M 2666M	10	5k	—	1M	—	12k	20M	5k
9953M 10.3G 10.7G	10	20k	10k	4M	50k	12k	80M	20k

Accuracy (UIp-p, UI+p, UI-p) :
- 2 UI range : ±R% ±W UIp-p
- 20 UI range : ±R% ±W UIp-p
- 80 UI range : ±R% ±W UIp-p
- 250 UI range : ±R% ±W UIp-p
- 1000 UI range : ±R% ±W UIp-p
- 4000 UI range : ±R% ±W UIp-p

Accuracy (UIrms)
- 2 UI range : ±R% ±Y UI rms
- 20 UI range : ±R% ±Y UI rms

Frequency (Hz)	W Clock signal							Y Clock signal	
	UIp-p							UIrms	
	HP1+LP		HP2+LP		HP+LP*		HP0+LP'	HP+LP*	
	2 UI	20 UI	2 UI	20 UI	2 UI	20 UI	80/250/1000/4000 UI	0.008	0.04
52M	0.05	0.5	0.03	0.3	0.03	0.3	—	0.008	0.04
156M	0.05	0.5	0.02	0.2	0.03	0.3	2	0.008	0.04
622M	0.05	0.5	0.03	0.3	0.03	0.3	8	0.008	0.04
2488M 2.6G	0.05	0.5	0.03	0.3	0.03	0.3	20	0.008	0.04
9953M 10.3G 10.7G	0.05	0.5	0.03	0.3	0.03	0.3	80	0.008	0.05

* : Apply HP'+LP at 9953M, 10.3G, 10.7G

MU150100A loop back measurement

Bit rate (Mbit/s)	W data signal			Y data signal
	UIp-p			UIrms
	HP1+LP	HP+LP	HP2+LP	HP+LP
	2 UI	2 UI	2 UI	2 UI
51.84 (Optical)	0.070	0.070	0.035	0.010
51.84 (Electrical)	0.070	0.070	0.035	0.010
155.52 (Optical)	0.070	0.070	0.035	0.010
155.52 (Electrical)	0.070	0.070	0.035	0.010
622.08 (Optical)	0.070	0.070	0.035	0.010
2488.32 (Optical)	0.080	0.080	0.060	0.010
2666.05* (Optical)	0.080	0.080	0.060	0.010

* : Built-in MU150125A-05

Measurement condition
- Temperature condition : +10˚ to +40 ˚C
- Optical input level : –10 to –12 dBm
- Measurement time : 60 sec
- Optical input wavelength : 1310 nm/1550 nm
- Mapping
  - SDH : VC3-Bulk (52M), VC4-nc (n = 1, 4, 16) (156M/622M/2488M)
  - SONET : STSnc (n = 1, 3, 12, 48)
  - OTU-1 : ODU1-OPU1-PRBS
- Test pattern : $2^{23} - 1$ (Inv.) (SDH/SONET), $2^{31} - 1$ (OTU-1), Mark ratio 1/2, Scramble "On"
- Clock : internal

Jitter measurement

MU150100A with MU150125A Receiver only

Bit rate (Mbit/s)	W data signal (Typical)			Y data signal
	UIp-p			UIrms
	HP1+LP	HP+LP	HP2+LP	HP+LP
	2 UI	2 UI	2 UI	2 UI
51.84 (Optical)	0.035	0.035	0.035	0.009
51.84 (Electrical)	0.035	0.035	0.035	0.009
155.52 (Optical)	0.035	0.035	0.035	0.009
155.52 (Electrical)	0.035	0.035	0.025	0.009
622.08	0.035	0.035	0.035	0.009
2488.32	0.035	0.035	0.035	0.009
2666.05*	0.035	0.035	0.035	0.009

∗ : Built-in MU150125A-05

Measurement condition
Temperature condition : +10˚ to +40 ˚C
Optical input level : –10 to –12 dBm
Measurement time : 60 sec
Optical input wavelength :
1310 nm/1550 nm
Mapping
SDH : VC3-Bulk (52M),
VC4-nc (n = 1, 4, 16)
(156M/622M/2488M)
SONET : STSnc (n = 1, 3, 12, 48)
OTU-1 : ODU1-OPU1-PRBS
Test pattern : $2^{23} – 1$ (Inv.)
(SDH/SONET), $2^{31} – 1$ (OTU-1),
Mark ratio 1/2, Scramble “On”

MU150100A, MU150121A, MU150123A loop back measurement

Bit rate (Mbit/s)	W data signal			Y data signal
	UIp-p			UIrms
	HP1+LP	HP'+LP	HP2+LP	HP'+LP
	2 UI	2 UI	2 UI	2 UI
9953.280	0.080	0.080	0.060	0.010
10709.225*	0.080	0.080	0.060	0.010

∗ : Built-in MU150125A-05

Measurement condition
Temperature condition : +10° to +40 °C
Optical input level : –10 to –12 dBm
Measurement time : 60 sec
Optical input wavelength :
1310 nm/1550 nm
Mapping
SDH : VC4-64c (9953M)
SONET : STS192c (9953M)
OTU-2 : ODU2-OPU2-PRBS
Test pattern : $2^{23} – 1$ (Inv.)
(SDH/SONET), $2^{31} – 1$ (OTU-2),
Mark ratio 1/2, Scramble “On”
Clock : internal

MU150100A, MU150134A, MU150123A loop back measurement

Bit rate (Mbit/s)	W data signal			Y data signal
	UIp-p			UIrms
	HP1+LP	HP'+LP	HP2+LP	HP'+LP
	2 UI	2 UI	2 UI	2 UI
9953.280	0.065	0.065	0.060	0.010
10709.225*	0.065	0.065	0.060	0.010

∗ : Built-in MU150125A-05

Measurement condition
Temperature condition : +10° to +40 °C
Optical input level : –10 to –12 dBm
Measurement time : 60 sec
Optical input wavelength : 1550 nm
Mapping
SDH : VC4-64c (9953M)
SONET : STS192c (9953M)
OTU-2 : ODU2-OPU2-PRBS
Test pattern : $2^{23} – 1$ (Inv.)
(SDH/SONET), $2^{31} – 1$ (OTU-2),
Mark ratio 1/2, Scramble “On”
Clock : internal

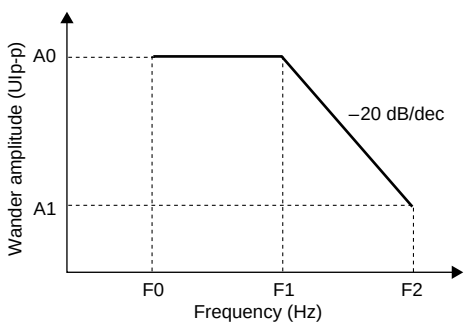
MU150123A with MU150125A Receiver only

Bit rate (Mbit/s)	W data signal			Y data signal
	UIp-p			UIrms
	HP1+LP	HP'+LP	HP2+LP	HP'+LP
	2 UI	2 UI	2 UI	2 UI
9953.280	0.035	0.035	0.035	0.009
10709.225*	0.035	0.035	0.035	0.009

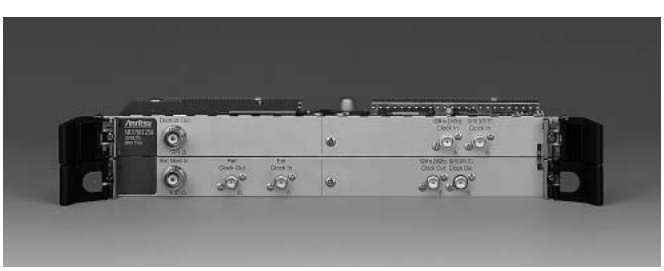
∗ : Built-in MU150125A-05

Measurement condition
Temperature condition : +10° to +40 °C
Optical input level : –10 to –12 dBm
Measurement time : 60 sec
Optical input wavelength :
1310 nm/1550 nm
Mapping
SDH : VC4-64c (9953M)
SONET : STS192c (9953M)
OTU-2 : ODU2-OPU2-PRBS
Test pattern : $2^{23} – 1$ (Inv.)
(SDH/SONET), $2^{31} – 1$ (OTU-2),
Mark ratio 1/2, Scramble “On”

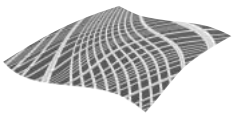
<table>
<tr><td>Jitter measurement</td><td>Additional error [R]
<table>
<tr><th>Additional error</th><th>Frequency range</th></tr>
<tr><td>±15 %</td><td><100 Hz (52M)
<500 Hz (156M)
<1 kHz (622M)
<5 kHz (2488M, 2666M)
<20 kHz (9953M/10.3G/10.7G)</td></tr>
<tr><td>±7 %</td><td>100 Hz to 300 kHz (52M)
500 Hz to 300 kHz (156M)
1 kHz to 300 kHz (622M)
5 kHz to 300 kHz (2488M, 2666M)
20 kHz to 300 kHz (9953M/10.3G/10.7G)</td></tr>
<tr><td>±8 %</td><td>300 kHz to 400 kHz (52M)
300 kHz to 1 MHz (≥156M)</td></tr>
<tr><td>±10 %</td><td>1 MHz to 1.3 MHz (156M)
1 MHz to 3 MHz (≥622M)</td></tr>
<tr><td>±15 %</td><td>3 MHz to 5 MHz (622M)
3 MHz to 10 MHz (≥2448M)</td></tr>
<tr><td>±20 %</td><td>10 MHz to 20 MHz (2488M, 2666M)
10 MHz to 80 MHz (9953M/10.3G/10.7G)</td></tr>
</table></td></tr>
<tr><td>Hit measurement</td><td>Count, Hit seconds, % free seconds</td></tr>
<tr><td>Jitter tolerance</td><td>Evaluate jitter tolerance by selected Mask
Mask selection :
Telcordia GR-253, ANSI T1.105.03
ITU-T G.783, G.825, G.813, G.8251
ETSI EN 302 084
User</td></tr>
<tr><td>Jitter transfer</td><td>Evaluate jitter transfer by selected Mask
Accuracy :±0.05 dB ±0.12*g
Applicable frequency range
0.01*fc to 100*fc, or maximum frequency setting value
The maximum frequency setting value is applied in the case of 100*fc
g : Transfer gain (dB) for every frequency point
fc : Cut-off frequency of transfer mask
Measurement condition
Average level : Fine
Waiting time : 20 s
Input jitter value : ≥0.15 UIp-p
Jitter modulation frequency : ≥300 Hz
Dynamic range : ≤–40 dB (at the above measurement condition)
Mask selection [Maximum value of a mask is 100 times as much modulation frequency as a break point (fc)] :
Telcordia GR-253
ANSI T1.105.03
ITU-T G.783, G.8251
ETSI 300 417-1-1
User</td></tr>
<tr><td>Reference clock output</td><td>Frequency : 52M : 51.84 MHz ±100 ppm
156M : 155.52 MHz ±100 ppm
622M : 622.08 MHz ±100 ppm
2488M/9953M : 155.52 MHz ±100 ppm or 622.08 MHz ±100 ppm
2666M : 166.629 MHz ±100 ppm or 666.514 MHz ±100 ppm
10.3G : 161.133 MHz ±100 ppm or 644.531 MHz ±100 ppm
10.7G : 167.332 MHz ±100 ppm or 669.327 MHz ±100 ppm
Output Voltage : 0.8 Vp-p ±0.25 V
Connector : SMA (50 Ω AC)</td></tr>
<tr><td>External clock input</td><td>Frequency : 52M : 51.84 MHz ±100 ppm
156M : 155.52 MHz ±100 ppm
622M : 622.08 MHz ±100 ppm
2488M/9953M : 155.52 MHz ±100 ppm or 622.08 MHz ±100 ppm
2666M : 166.629 MHz ±100 ppm or 666.514 MHz ±100 ppm
10.3G : 161.133 MHz ±100 ppm or 644.531 MHz ±100 ppm
10.7G : 167.332 MHz ±100 ppm or 669.327 MHz ±100 ppm</td></tr>
</table>

<table>
<tr><td>External clock input</td><td>Output Voltage : 0.8 Vp-p ±0.25 V
Connector : SMA (50 Ω AC)</td></tr>
<tr><td>External jitter modulation signal input</td><td>Frequency : 0.1 to 80 MHz
Sensitivity : 0.5 UI range : 2488M/2666M 0.5 UIp-p / 1Vp-p, 9953M/10.3G/10.7G 0.5 UIp-p / 0.25Vp-p
2 UI range : 2 UIp-p / 1Vp-p
20 UI range : 20 UIp-p / 1Vp-p
80 UI range : 80 UIp-p / 1Vp-p
250 UI range : 250 UIp-p / 1Vp-p
1000 UI range : 1000 UIp-p / 1Vp-p
4000 UI range : 4000 UIp-p / 1Vp-p
Connector : BNC (50 Ω GND)</td></tr>
<tr><td>Jitter recovery signal output</td><td>Frequency : 0.1 to 80 MHz
Sensitivity : 2 UI range : 2 UIp-p / 1Vp-p
20 UI range : 20 UIp-p / 1Vp-p
80 UI range : 80 UIp-p / 1Vp-p
250 UI range : 250 UIp-p / 1Vp-p
1000 UI range : 1000 UIp-p / 1Vp-p
4000 UI range : 4000 UIp-p / 1Vp-p
Connector : BNC (50 Ω GND)</td></tr>
<tr><td>Wander generation</td><td>Modulation frequency : 10 µHz to 10 Hz
Amplitude : 0 to 400,000 UI/Step 1 UIp-p
 

<table>
<tr><th>Frequency (Hz)</th><th>F0 (Hz)</th><th>F1 (Hz)</th><th>F2 (Hz)</th><th>A0 (UIp-p)</th><th>A1 (UIp-p)</th><th>Step (UIp-p)</th></tr>
<tr><td>52M
156M
622M
2488M
9953M</td><td>10 µ</td><td>400m</td><td>10</td><td>400,000</td><td>16,000</td><td>1</td></tr>
</table>
Accuracy
±Q% of setting ±100 UIp-p
<table>
<tr><th>Error Q</th><th>Frequency range</th></tr>
<tr><td>±8 %</td><td>10 µHz to 0.125 Hz</td></tr>
<tr><td>±12 %</td><td>0.125 to 1 Hz</td></tr>
<tr><td>±15 %</td><td>1 to 10 Hz</td></tr>
</table></td></tr>
<tr><td>Wander measurement (MU150125A-01)</td><td>Bit rate (bit/s) : 52M, 156M, 622M, 2488M, 9953M
Evaluation mode : TIE (P-P, +P, –P)
Range
p-p : 0.0 to 2E10 ns
+p, –p : 0.0 to 1E10 ns
Resolution : 0.1 ns
Accuracy : TIE
±0.5% ±Z0 (τ)
Filter selection : DC to 10 Hz, DC to 0.01 Hz, 0.01 to 10 Hz
<table>
<tr><th>Z0 (τ)(ns)</th><th>Observation time τ (s)</th></tr>
<tr><td>2.5 + 0.0275 τ</td><td>0.05 ≤ τ ≤1000</td></tr>
<tr><td>29 + 0.001 τ</td><td>τ >1000</td></tr>
</table></td></tr>
<tr><td>Supported main frame option</td><td>MP1590B-30</td></tr>
</table>



MU150125A



Ordering Information

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

Model/Order No.	Name	
	Main frame	
MP1590B	Network Performance Tester	
	Standard accessories	
	Shield power cord, 2.6 m :	1 pc[*1]
	Power cord L type (C7), 2.5 m :	1 pc[*1]
F0105	Fuse, 10 A :	2 pcs
E0010	Side cover :	1 pc
B0329G	Front cover (3/4MW4U) :	1 pc
J0907Q	Remote inter lock cord :	1 pc
J0908	Remote inter lock terminator :	1 pc
E0008A	Optical output control key :	2 pcs
W2428AE	MP1590B operation manual CD-ROM :	1 copy
J0617B[*2, *3]	Replaceable optical connector (FC-PC) :	1 pc/2 pcs
J0635A[*5]	Optical fiber cable (FC · PC-FC · PC-1M-SM), 1 m :	1 pc
J0739G[*4]	Optical adapter FC PANDA :	2 pcs
J1200[*6]	Pmoptical fiber cord, 0.5 m :	1 pc
J0747B[*7]	Fixed optical attenuator (10 dB, FC connector) :	1 pc
J0747C[*8]	Fixed optical attenuator (15 dB, FC connector) :	1 pc
J1003N[*9]	Semi-rigid cable (136.6 mm) :	2 pcs
J1003P[*9]	Semi-rigid cable (96 mm) :	1 pc
J1003Q[*10, *11]	Semi-rigid cable (75.6 mm) :	1 pc/2 pcs
J1003R[*9]	Semi-rigid cable (55.3 mm) :	1 pc
J1003S[*8]	Semi-rigid cable (56.5 mm) :	1 pc
J0994[*12]	Terminator (50 Ohm)	
	Units/Modules	
MU150100A[*13]	10/10.7G Unit	
MU150101A[*13]	2.5/2.6G EoS Unit	
MU150121A[*13]	10/10.7G Optical Unit (Tx)	
MU150121B[*13]	10/10.7G Optical/Electrical Unit (Tx)	
MU150122A	10/10.7G Optical Unit (Rx Narrow)	
MU150123A	10/10.7G Optical Unit (Rx Wide)	
MU150123B	10/10.7G Optical/Electrical Unit (Rx Wide)	
MU150124B	10.3G Optical/Electrical Unit (Rx Wide)	
MU150125A	10/10.7G Jitter Unit	
MU150134A	10/10.7G Optical Unit (Tx. Ex. mod)	
MU120101A	10M/100M Ethernet Module	
MU120102A[*14]	Gigabit Ethernet Module	
MU120111A	10/100M Ethernet Module	
MU120112A[*14]	Gigabit Ethernet Module	
MU120118B[*16]	10 Gigabit Ethernet Module	
MU120118C[*16]	10 Gigabit Ethernet Module	
MU120121A	10/100/1000 M Ethernet Module	
MU120122A[*15]	Gigabit Ethernet Module	
	Software	
MP159001B	Network Performance Tester Control Software	
MX159001B-05	5 Licenses	
MX159001B-08	8 Licenses	
	Options	
MP1590B-01	RS-232C	
MP1590B-02	GPIB	
MP1590B-03	LAN	
MP1590B-07	OSPF Protocol	
MP1590B-08	MPLS (LDP/CR-LDP) Protocol	
MP1590B-09	MPLS (RSVP) Protocol	
MP1590B-10	RFC2889 Benchmarking Test	
MP1590B-11	Packet BER Test	
MP1590B-12	IPv6 Expansion	

Model/Order No.	Name
MP1590B-13	XENPAK Test
MP1590B-14	IGAP Protocol
MP1590B-15	Auto negotiation Analysis
MP1590B-16	Link Fault Signaling
MP1590B-30[*17]	High precision Jitter analysis
MU150100A-01	Wavelength 1.31 µm
MU150100A-02	Wavelength 1.55 µm
MU150100A-03	Wavelength 1.31/1.55 µm
MU150100A-04	Optical output power adjustable
MU150100A-05	OTU1/OTU2
MU150100A-07[*18]	10/10.7G Minus Option
MU150100A-08	10.3G
MU150100A-09[*18]	Insert/Extract
MU150100A-38[*19]	ST connector
MU150100A-39[*19]	DIN connector
MU150100A-40[*19]	SC connector
MU150100A-43[*19]	HMS-10/A connector
MU150101A-01	Wavelength 1.31 µm
MU150101A-02	Wavelength 1.55 µm
MU150101A-03	Wavelength 1.31/1.55 µm
MU150101A-04	Optical output power adjustable
MU150101A-05	OTU1
MU150101A-06	GFP-F/LEX/LAPS
MU150101A-07	POS
MU150101A-11	HO Virtual Concatenation
MU150101A-12	LO Virtual Concatenation
MU150101A-13[*20]	LCAS
MU150101A-14[*20]	Differential delay
MU150101A-38[*19]	ST connector
MU150101A-39[*19]	DIN connector
MU150101A-40[*19]	SC connector
MU150101A-43[*19]	HMS-10/A connector
MU150121A-01	Wavelength 1.31 µm
MU150121A-02	Wavelength 1.55 µm
MU150121A-03	Wavelength 1.31/1.55 µm
MU150121A-04	Optical output power adjustable
MU150121A-38[*19]	ST connector
MU150121A-39[*19]	DIN connector
MU150121A-40[*19]	SC connector
MU150121A-43[*19]	HMS-10/A connector
MU150121B-01	Wavelength 1.31 µm
MU150121B-02	Wavelength 1.55 µm
MU150121B-03	Wavelength 1.31/1.55 µm
MU150121B-04	Optical output power adjustable
MU150121B-38[*19]	ST connector
MU150121B-39[*19]	DIN connector
MU150121B-40[*19]	SC connector
MU150121B-43[*19]	HMS-10/A connector
MU150122A-38[*19]	ST connector
MU150122A-39[*19]	DIN connector
MU150122A-40[*19]	SC connector
MU150122A-43[*19]	HMS-10/A connector
MU150123A-05	OTU2
MU150123A-38[*19]	ST connector
MU150123A-39[*19]	DIN connector
MU150123A-40[*19]	SC connector
MU150123A-43[*19]	HMS-10/A connector
MU150123B-05	OTU2
MU150123B-38[*19]	ST connector
MU150123B-39[*19]	DIN connector
MU150123B-40[*19]	SC connector
MU150123B-43[*19]	HMS-10/A connector
MU150124B-38[*19]	ST connector
MU150124B-39[*19]	DIN connector
MU150124B-40[*19]	SC connector
MU150124B-43[*19]	HMS-10/A connector
MU150125A-01	Wander measurement
MU150125A-05	OTU1/OTU2

Model/Order No.	Name
MU150125A-06	10.3G
MU150134A-04	Optical output power adjustable
MU150134A-38*19	ST connector
MU150134A-39*19	DIN connector
MU150134A-40*19	SC connector
MU150134A-43*19	HMS-10/A connector
	Maintenance service
MP1590B-90	Extended three year warranty service
MU150100A-90	Extended three year warranty service
MU150101A-90	Extended three year warranty service
MU150121A-90	Extended three year warranty service
MU150121B-90	Extended three year warranty service
MU150122A-90	Extended three year warranty service
MU150123A-90	Extended three year warranty service
MU150123B-90	Extended three year warranty service
MU150124B-90	Extended three year warranty service
MU150125A-90	Extended three year warranty service
MU150134A-90	Extended three year warranty service
MU120101A-90	Extended three year warranty service
MU120102A-90	Extended three year warranty service
MU120111A-90	Extended three year warranty service
MU120112A-90	Extended three year warranty service
MU120118B-90	Extended three year warranty service
MU120118C-90	Extended three year warranty service
MU120121A-90	Extended three year warranty service
MU120122A-90	Extended three year warranty service
	Optional accessories
J0796A	ST connector (replaceable, with protective caps, 1 set)
J0796B	DIN connector (replaceable, with protective caps, 1 set)
J0796C	SC connector (replaceable, with protective caps, 1 set)
J0796D	HMS-10/A connector (replaceable, with protective caps, 1 set)
J0796E	FC connector (replaceable, with protective caps, 1 set)
J0617B	Replaceable optical connector (FC-PC)
J1200	Pmoptical fiber cord (both-end SFC-SP connector), 0.5 m
J0747B	Fixed optical attenuator (10 dB, FC connector)
J0747C	Fixed optical attenuator (15 dB, FC connector)
J0747D	Fixed optical attenuator (20 dB, FC connector)
J1049A	Fixed optical attenuator (SC, 5 dB)
J1049B	Fixed optical attenuator (SC, 10 dB)
J1049C	Fixed optical attenuator (SC, 15 dB)
J0635A	Optical fiber cable (SM, FC-SPC connector both ends), 1 m
J0635B	Optical fiber cable (SM, FC-SPC connector both ends), 2 m
J0635C	Optical fiber cable (SM, FC-SPC connector both ends), 3 m
J0660B	Optical fiber cord (SM, SC-SC connector), 2 m
J0773B	Optical fiber cord (GI, SC-SC connector), 2 m
J1119B	Optical fiber cord (Duplex, MM), 2 m
J1271	Optical fiber cord (Duplex, SM, LC-LC connector), 2 m
J1272	Optical fiber cord (Duplex, SM, LC-SC connector), 2 m
J1273	Optical fiber cord (Duplex, GI, LC-LC connector), 2 m
J1274	Optical fiber cord (Duplex, GI, LC-SC connector), 2 m
Z0478	Polarization rotating module (for MU150134A)
J1003N	Semi-rigid cable (136.6 mm)
J1003P	Semi-rigid cable (96 mm)
J1003Q	Semi-rigid cable (75.6 mm)
J1003R	Semi-rigid cable (55.3 mm)
J1003S	Semi-rigid cable (56.5 mm)
J0775D	Coaxial cable (BNC-P620 · 3C-2WS · BNC-P620, 75 Ω), 2 m
J0776D	Coaxial cable (BNC-P-3W · 3D-2W · BNC-P-3W, 50 Ω), 2 m
J0322B	Coaxial cable (11SMA · SUCOFLEX104 · 11SMA), 1 m
J0162A	Balanced cable (Siemens 3P- Siemens 3P), 1 m
J0162B	Balanced cable (Siemens 3P- Siemens 3P), 2 m
J0845A	Balanced cable (BANTAM 3P/BANTAM 3P), 6 ft
J0008	GPIB cable, 2 m

Model/Order No.	Name	
G0105A	GBIC SX 850 nm :	1 pc
G0106A	GBIC LX 1310 nm :	1 pc
G0107A	GBIC LH 1310 nm :	1 pc
G0108A	GBIC ZX 1550 nm :	1 pc
G0124A	GBIC T (1000BASE-T) :	1 pc
G0136	SFP SX 850 nm :	1 pc
G0137	SFP LX 1310 nm :	1 pc
G0138	SFP LE 1550 nm :	1 pc
G0139	SFP LR 1310 nm :	1 pc
G0126A	XENPAK (10GBASE-LR) :	1 pc
G0131	XENPAK (10GBASE-ER) :	1 pc
G0132	XENPAK (10GBASE-SR) :	1 pc
MZ1221A	XAUI Extender	
MZ1222A	XENPAK Interface	
J1163A	XAUI cable, 0.5 m	
J1164A	MDIO cable, 0.5 m	
J1109B	LAN cable (Cross), 5 m	
J1110B	LAN cable (Straight), 5 m	
B0336C	Carrying case	
B0448	Soft case	
B0501B	Blank Panel	
Z0321A	Keyboard (PS/2)	
Z0541A	USB mouse	
W2420AE	MP1590B operation manual	
W2421AE	MX159001B operation SDH edition manual	
W2422AE	MX159001B operation SONET edition manual	
W2423AE	MP1590B remote control operation manual	
W2424AE	MU150100A specifications operation manual	
W2425AE	MU150101A specifications operation manual	
W2426AE	MU150125A specifications operation manual	
W2427AE	MU150121/2/3/34A specifications operation manual	
W2589AE	MU150121B/123B specifications operation manual	
W2590AE	MU150124B specifications operation manual	
W1931AE	MU120101A/11A 10M/100M Ethernet Module MU120102A/12A Gigabit Ethernet Module MU120118A 10 Gigabit Ethernet Module operation manual	

*1 : J0491 or J0670A is attached.
*2 : Supplied with MU150100A, MU150121A, MU150122A, MU150123A/B, MU150134A.
*3 : In MU150100A, MU150101A, 2 pcs are supplied.
*4 : Supplied with MU150134A.
*5 : Supplied with MU150100A, MU150101A, MU150122A, MU150123A. SM, FC-SPC connector both ends.
*6 : Supplied with MU150134A, FC · PANDA fiber.
*7 : Supplied with MU150122A, MU150123A/B.
*8 : Supplied with MU150100A, MU150101A.
*9 : Supplied with MU150125A.
*10 : Supplied with MU150121A/B, MU150122A, MU150123A/B, MU150134A.
*11 : MU150122A, MU150123A/B : 1 pc
MU150121A/B, MU150134A : 2 pcs are supplied.
*12 : Supplied with MU150121B.
*13 : Requires Option 01, 02 or 03.
*14 : MU120102A/12A require GBIC modules (sold separately).
*15 : MU120122A requires SFP modules (sold separately).
*16 : MU120118B/C requires XENPAK modules (sold separately).
*17 : Unit composition has restriction. For details, please refer to a MP1590B specifications.
*18 : This Option must be installed in the factory. MU150100A-07 and MU150101A-09 cannot be installed simultaneously.
*19 : Replaceable.
*20 : This option requires the MU150101A-11 and/or MU150101A-12.

Anritsu

Specifications are subject to change without notice.

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