MU181600A
Optical Transceiver (XFP)
MU181601A
Optical Transceiver (SFP)
Operation Manual

Seventh Edition

- **For safety and warning information, please read this manual before attempting to use the equipment.**
- **Additional safety and warning information is provided in the MP1800A Signal Quality Analyzer Installation Guide and the MT1810A 4 Slot Chassis Installation Guide. Please also refer to one of these documents before using the equipment.**
- **Keep this manual with the equipment.**

ANRITSU CORPORATION

Document No.: M-W2754AE-7.0

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Ensure that you clearly understand the meanings of the symbols BEFORE using the equipment. Some or all of the following symbols may be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.

Symbols used in manual

⚠ DANGER This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.

⚠ WARNING This indicates a hazardous procedure that could result in serious injury or death if not performed properly.

⚠ CAUTION This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.

This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.

This indicates a warning or caution. The contents are indicated symbolically in or near the triangle.

This indicates a note. The contents are described in the box.

These indicate that the marked part should be recycled.

MU181600A Optical Transceiver (XFP)
MU181601A Optical Transceiver (SFP)
Operation Manual

27 November 2006 (First Edition)
20 June 2013 (Seventh Edition)

For Safety

⚠ WARNING

1. Laser radiation warning
   - NEVER look directly into the cable connector on the equipment nor into the end of a cable connected to the equipment. There is a risk of injury if laser radiation enters the eye.
   - The Laser Safety label is attached to the equipment for safety use as indicated in "Laser Safety" later in this section.

Class 1 indicates the danger degree of the laser radiation specified below according to IEC 60825-1:2007.

Class 1: Lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

⚠ CAUTION

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

The use of optical instruments with this product will increase eye hazard.

For Safety

Laser Safety

The laser in this equipment is classified as Class 1 according to the IEC 60825-1:2007 standard.

Table 1 Laser Safety Classifications Based on IEC 60825-1:2007

Model Name	Recommended Module Model Name or Option Model Name/Part Name	Class	Max. Optical Output Power (mW)*1	Pulse Width (s)/ Repetition Rate	Emitted Wavelength (nm)	Beam Divergence (deg)	Laser Aperture
MU181600A	G0174A 850 nm XFP module	1	0.78	CW	840-860	36.9	Fig. 1, [1]
	G0175A 1310 nm XFP module	1	0.8	CW	1290-1330	11.5	Fig. 1, [1]
	G0176A 1550 nm XFP module	1	1.58	CW	1530-1565	11.5	Fig. 1, [1]
MU181601A	G0177A 850 nm SFP module	1	0.56	CW	830-860	36.9	Fig. 2, [1]
	G0178A 1310 nm SFP module	1	1.0	CW	1270-1360	11.5	Fig. 2, [1]
	G0179A 1550 nm SFP module	1	1.0	CW	1430-1590	11.5	Fig. 2, [1]

*1: Indicates the possible optical output power when each and every reasonably foreseeable single-fault condition is included.

Table 2 Incorporated Laser Specification

Model Name	Recommended Module Model Name or Option Model Name/Part Name	Max. Optical Output Power (mW)*1	Pulse Width (s)/Rep-etition Rate	Emitted Wave-length (nm)	Beam Divergence (deg)
MU181600A	G0174A 850 nm XFP module	0.78	CW	840-860	36.9
	G0175A 1310 nm XFP module	0.8	CW	1290-1330	11.5
	G0176A 1550 nm XFP module	1.58	CW	1530-1565	11.5
MU181601A	G0177A 850 nm SFP module	0.56	CW	830-860	36.9
	G0178A 1310 nm SFP module	1.0	CW	1270-1360	11.5
	G0179A 1550 nm SFP module	1.0	CW	1430-1590	11.5

*1: Indicates the possible optical output power when each and every reasonably foreseeable single-fault condition is included.

Table 3 Labels on Product

	Type	Label	Affixed to:	Model Name
1	Explanation		Fig. 1, A Fig. 2, A	MU181600A MU181601A
2	Explanation		Fig. 3, A Fig. 4, A	MP1800A MT1810A
3	Certification		Fig. 3, B Fig. 4, B	MP1800A MT1810A
4	Identification		Fig. 3, C Fig. 4, C	MP1800A MT1810A

For Safety

Laser Radiation Markings

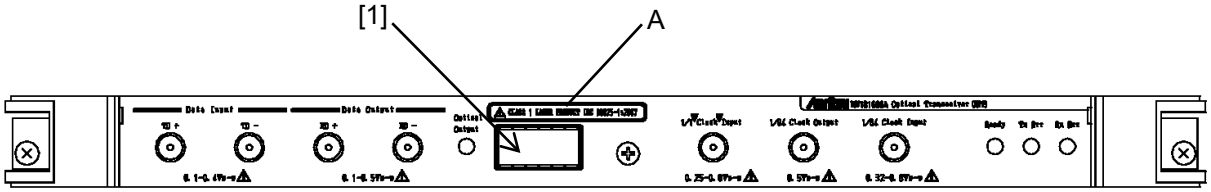

Fig. 1 Front Panel of MU181600A Module

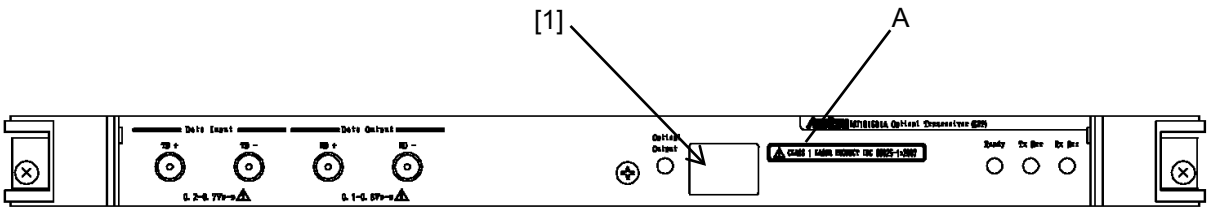

Fig. 2 Front Panel of MU181601A Module

Laser Radiation Markings

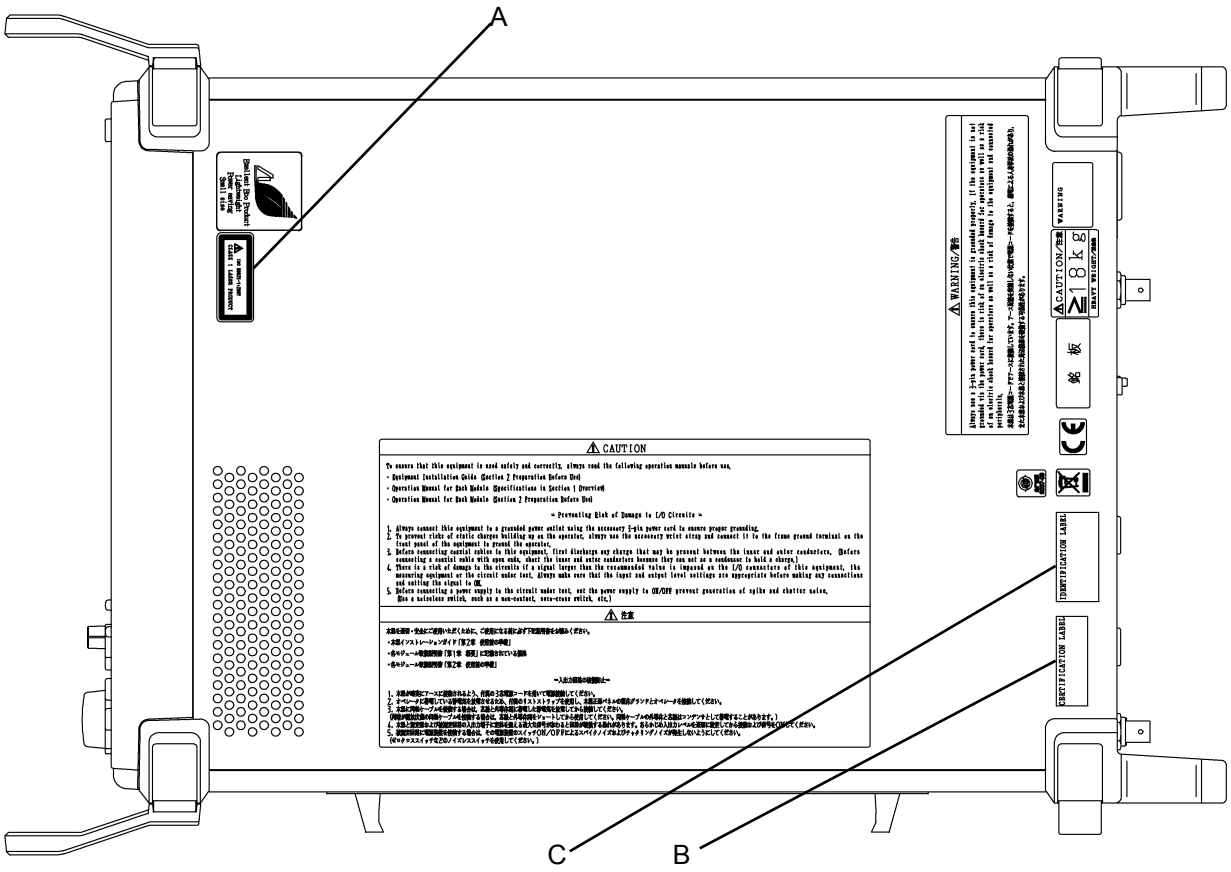

Fig. 3 MP1800A Exterior

Laser Radiation Markings

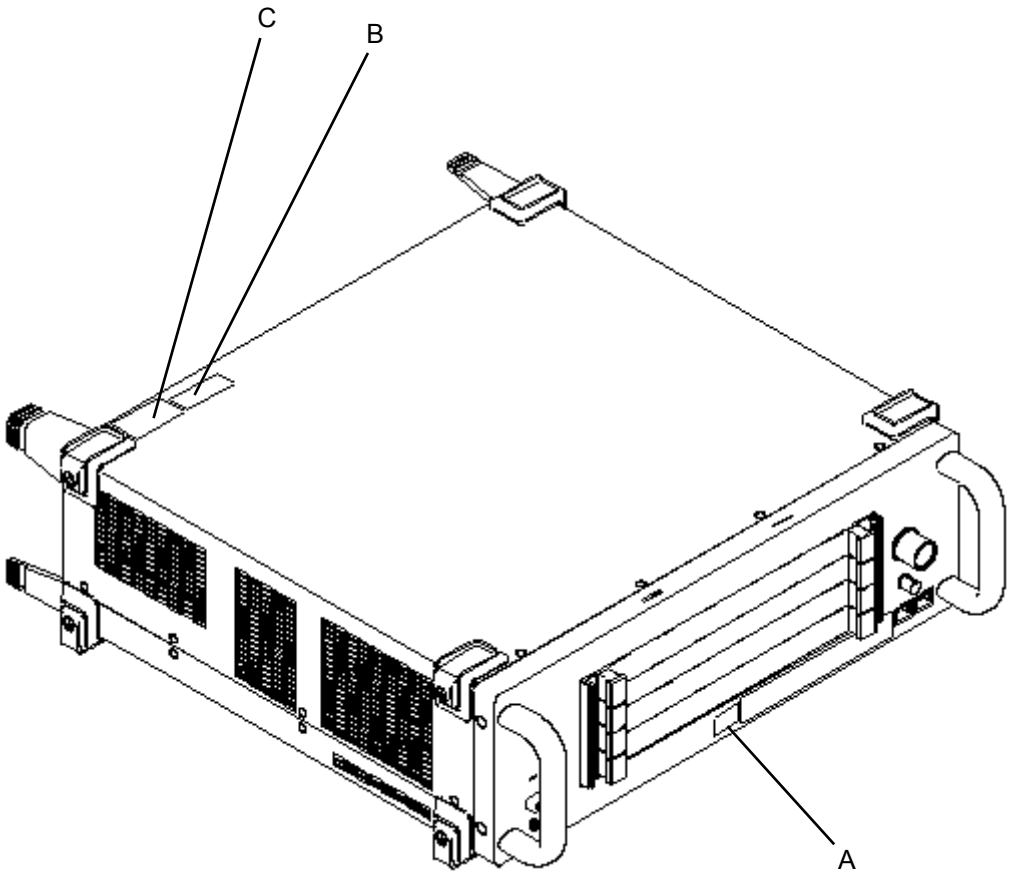

Fig. 4 MT1810A Exterior

For Safety

⚠ CAUTION

Lifetime of Parts

The life span of certain parts used in this instrument is determined by the operating time or the power-on time. Due consideration should be given to the life spans of these parts when performing continuous operation over an extended period. The safety of the instrument cannot be guaranteed if component parts are used beyond their life spans. These parts must be replaced at the customer's expense even if within the guaranteed period described in Warranty at the beginning of this manual.
For details on life-span, refer to the corresponding section in this manual.
For 30-pin multipole connector for XFP module: See Section 1.3 “Specifications”.
For 20-pin multipole connector for SFP module: See Section 1.3 “Specifications”.

Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories, including the National Institute of Advanced Industrial Science and Technology, and the National Institute of Information and Communications Technology, and was found to meet the published specifications.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within one year after shipment due to a manufacturing fault. However, software fixes will be made in accordance with the separate Software End-User License Agreement. Moreover, Anritsu Corporation will deem this warranty void when:

- The fault is outside the scope of the warranty conditions separately described in the operation manual.
- The fault is due to mishandling, misuse, or unauthorized modification or repair of the equipment by the customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster, including fire, wind, flooding, earthquake, lightning strike, or volcanic ash, etc.
- The fault is due to damage caused by acts of destruction, including civil disturbance, riot, or war, etc.
- The fault is due to explosion, accident, or breakdown of any other machinery, facility, or plant, etc.
- The fault is due to use of non-specified peripheral or applied equipment or parts, or consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.
- The fault is due to use in unusual environments(Note).
- The fault is due to activities or ingress of living organisms, such as insects, spiders, fungus, pollen, or seeds.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation shall assume no liability for injury or financial loss of the customer due to the use of or a failure to be able to use this equipment.

Note:
For the purpose of this Warranty, "unusual environments" means use:

- In places of direct sunlight
- In dusty places
- Outdoors
- In liquids, such as water, oil, or organic solvents, and medical fluids, or places where these liquids may adhere
- In salty air or in places where chemically active gases (SO_2, H_2S, Cl_2, NH_3, NO_2, or HCl, etc.) are present
- In places where high-intensity static electric charges or electromagnetic fields are present
- In places where abnormal power voltages (high or low) or instantaneous power failures occur
- In places where condensation occurs
- In the presence of lubricating oil mists
- In places at an altitude of more than 2,000 m
- In the presence of frequent vibration or mechanical shock, such as in cars, ships, or airplanes

Anritsu Corporation Contact

In the event of this equipment malfunctions, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.

Notes On Export Management

This product and its manuals may require an Export License/Approval by the Government of the product's country of origin for re-export from your country.

Before re-exporting the product or manuals, please contact us to confirm whether they are export-controlled items or not.

When you dispose of export-controlled items, the products/manuals need to be broken/shredded so as not to be unlawfully used for military purpose.

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   ii) If this Software is used in conjunction with other non-Anritsu-approved software.
   iii) Recovery of lost or damaged data.
   iv) If this Software or the Equipment has been modified, repaired, or otherwise altered without Anritsu's prior approval.
   v) For any other reasons out of Anritsu's direct control and responsibility, such as but not limited to, natural disasters, software virus infections, etc.

b. Expenses incurred for transport, hotel, daily allowance, etc., for on-site repairs by Anritsu engineers necessitated by the above faults shall be borne by you.

c. The warranty period for faults listed in article 3a above covered by this EULA shall be either 6 months from the date of purchase of this Software or 30 days after the date of repair, whichever is longer.

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5. Termination

Anritsu shall deem this EULA terminated if you violate any conditions described herein. This EULA shall also be terminated if the conditions herein cannot be continued for any good reason, such as violation of copyrights, patents, or other laws and ordinances.

6. Reparations

If Anritsu suffers any loss, financial or otherwise, due to your violation of the terms of this EULA, Anritsu shall have the right to seek proportional damages from you.

7. Responsibility after Termination

Upon termination of this EULA in accordance with item 5, you shall cease all use of this Software immediately and shall as directed by Anritsu either destroy or return this Software and any backup copies, full or partial, to Anritsu.

8. Dispute Resolution

If matters of dispute or items not covered by this EULA arise, they shall be resolved by negotiations in good faith between you and Anritsu.

9. Court of Jurisdiction

This EULA shall be interpreted in accordance with Japanese law and any disputes that cannot be resolved by negotiation described in Article 8 shall be settled by the Japanese courts.

CE Conformity Marking

Anritsu affixes the CE Conformity marking on the following product(s) in accordance with the Council Directive 93/68/EEC to indicate that they conform to the EMC and LVD directive of the European Union (EU).

CE marking

1. Product Model

Plug-in Units: MU181600A Optical Transceiver (XFP)
MU181601A Optical Transceiver (SFP)

2. Applied Directive and Standards

When the MU181600A Optical Transceiver (XFP) or MU181601A Optical Transceiver (SFP) is installed in the MP1800A or MT1810A, the applied directive and standards of this unit conform to those of the MP1800A or MT1810A main frame.

PS: About main frame
Please contact Anritsu for the latest information on the main frame types that MU181600A or MU181601A can be used with.

C-Tick Conformity Marking

Anritsu affixes the C-Tick marking on the following product(s) in accordance with the regulation to indicate that they conform to the EMC framework of Australia/New Zealand.

C-Tick marking

1. Product Model

Plug-in Units: MU181600A Optical Transceiver (XFP)
MU181601A Optical Transceiver (SFP)

2. Applied Directive and Standards

When the MU181600A Optical Transceiver (XFP) or MU181601A Optical Transceiver (SFP) is installed in the MP1800A or MT1810A, the applied directive and standards of this unit conform to those of the MP1800A or MT1810A main frame.

PS: About main frame
Please contact Anritsu for the latest information on the main frame types that MU181600A or MT1810A can be used with.

About This Manual

A testing system combining an MP1800A Signal Quality Analyzer or MT1810A 4-Slot Chassis mainframe, module(s), and control software is called a Signal Quality Analyzer Series. The operation manuals of the Signal Quality Analyzer Series consist of separate documents for the installation guide, the mainframe, remote control operation, module(s), and control software, as shown below.

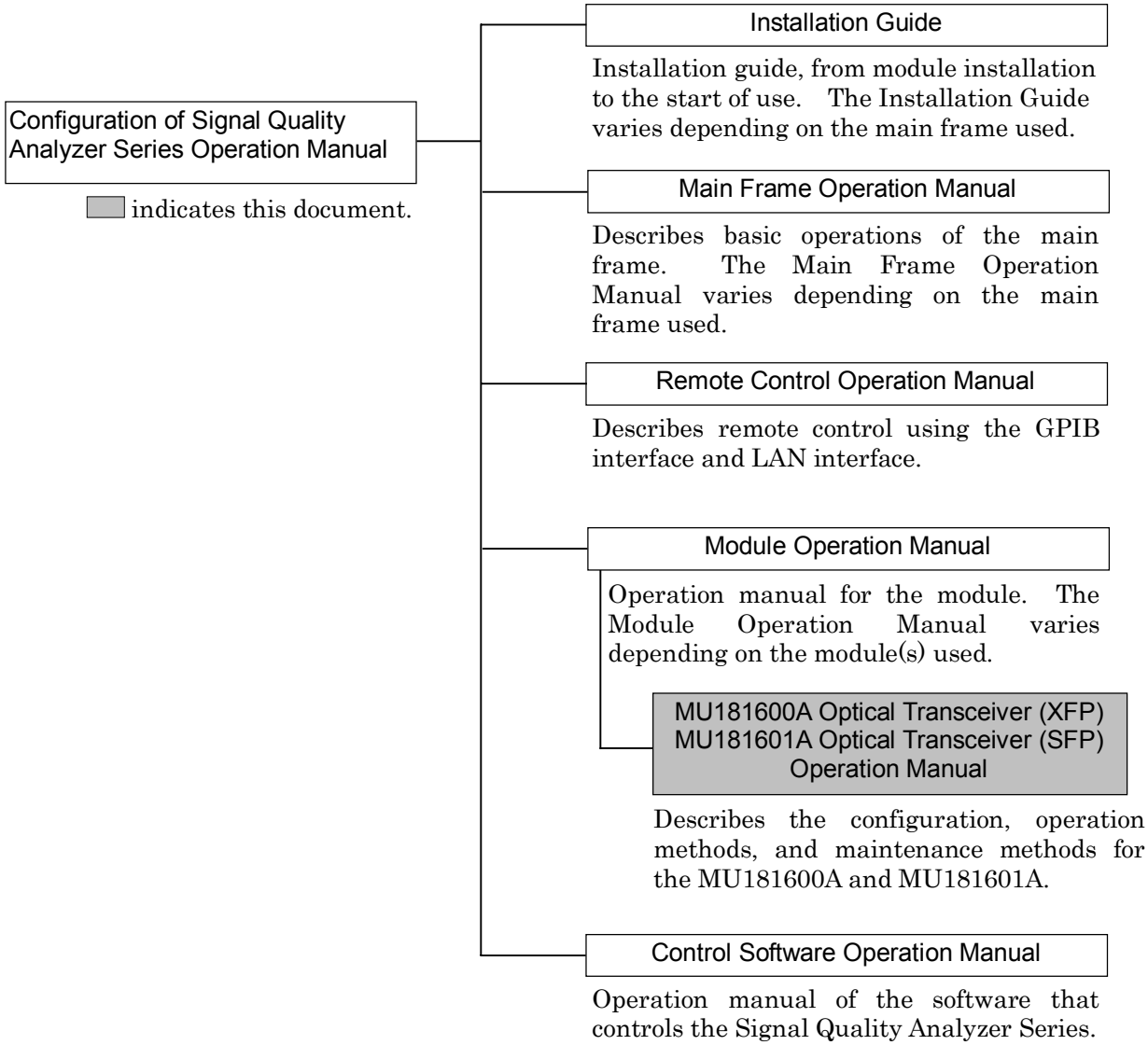


Table of Contents

IV.

Section 1 Overview

This section provides an overview and the specifications of the MU181600A Optical Transceiver (XFP) (hereinafter, referred to as "MU181600A") and the MU181601A Optical Transceiver (SFP) (hereinafter, referred to as "MU181601A").

1.1 Product Overview

The MU181600A and the MU181601A are modules that can be built into a Signal Quality Analyzer Series mainframe. These transceivers convert digital electric signals input from an external device into optical signals. They also convert input optical signals into digital electric signals and output the converted electrical signals. The MU181600A and MU181601A are therefore useful for research, development, and production of various types of digital communication equipment and digital communication modules and devices.

1.2 Product Composition

1.2.1 Standard composition

Tables 1.2.1-1 and 1.2.1-2 show the items standardly included with the MU181600A and MU181601A, respectively.

Table 1.2.1-1 Standard composition of MU181600A

Item	Model name/symbol	Product name	Q'ty	Remarks
Main unit	MU181600A	Optical transceiver (XFP)	1	
Accessory	Z0897A	MP1800A Manual CD	1	CD-ROM version
	J1355A	Semirigid cable	1	For connection of 1/64 clock output and 1/64 clock input
	J0541A	10 dB fixed attenuator	2	MU181020A-002 and MU181600A For connection of TD+/TD–
	J0541E	6 dB fixed attenuator	2	MU181020A-001 and MU181600A For connection of TD+/TD–
	Z0918A	MX180000A Software CD	1	CD-ROM version

Table 1.2.1-2 Standard composition of MU181601A

Item	Model name/symbol	Product name	Q'ty	Remarks
Main unit	MU181601A	Optical transceiver (SFP)	1	
Accessory	Z0897A	MP1800A Manual CD	1	CD-ROM version
	J0541E	6 dB fixed attenuator	1	MU181020A-002 and MU181601A For connection of TD+/TD–
	Z0918A	MX180000A Software CD	1	CD-ROM version

1.2.2 Application parts

Tables 1.2.2-1 and 1.2.2-2 show the application parts for the MU181600A and MU181601A, respectively. All application parts are sold separately.

Table 1.2.2-1 Application parts for MU181600A

Model name/symbol	Product	Q'ty	Remarks
G0174A	850 nm XFP module (9.95 to 11.10 Gbit/s)	1	Applicable fiber: Multi-mode fiber
G0175A	1310 nm XFP module (9.95 to 11.30 Gbit/s)	1	Applicable fiber: Single mode fiber
G0176A	1550 nm XFP module (9.95 to 11.75 Gbit/s)	1	Applicable fiber: Single mode fiber
J1342A	Coaxial cable, 0.8 m	1	SMA at both ends, for inter-module connection

Table 1.2.2-2 Application parts for MU181601A

Model name/symbol	Product	Q'ty	Remarks
G0177A	850 nm SFP module (1.062 to 4.25 Gbit/s)	1	Applicable fiber: Multi-mode fiber
G0178A	1310 nm SFP module (0.155 to 2.67 Gbit/s)	1	Applicable fiber: Single mode fiber
G0179A	1550 nm SFP module (0.155 to 2.67 Gbit/s)	1	Applicable fiber: Single mode fiber
J1343A	Coaxial cable, 1 m	1	SMA at both ends, for inter-module connection

Table 1.2.2-3 shows the common application parts for the MU181600A and MU181601A. All common application parts are sold separately.

Table 1.2.2-3 Common application parts for MU181600A and MU181601A

Model name/symbol	Product	Q'ty	Remarks
J1344A	LC/PC-LC/PC-1M-SM	1	Single mode fiber LC at both ends, 1 m
J1139A	FC/PC-LC/PC-1M-SM	1	Single mode fiber FC at one end, LC at one end, 1 m
J1345A	SC/PC-LC/PC-1M-SM	1	Single mode fiber SC at one end, LC at one end, 1 m
J1346A	LC/PC-LC/PC-1M-GI (62.5/125)	1	Multi-mode fiber LC at both end, 1 m
J1347A	FC/PC-LC/PC-1M-GI (62.5/125)	1	Multi-mode fiber FC at one end, LC at one end, 1 m
J1348A	SC/PC-LC/PC-1M-GI (62.5/125)	1	Multi-mode fiber SC at one end, LC at one end, 1 m
J1137	Terminator	1	50 Ω SMA
W2754AE	MU181600A Optical Transceiver (XFP)/ MU181601A Optical Transceiver (SFP) Operation Manual	1	Printed version
Z0282	Ferrule cleaner	1	CLETOP type
Z0283	Replacement reels for ferrule cleaner	1	6/pack
Z0284	Adapter cleaner	1	Stick type (200/set)

1.3 Specifications

1.3.1 Specifications for MU181600A

Table 1.3.1-1 Module main unit

Item		Specifications
Transmitter data input TD+, TD–	Differential data input level	0.2 to 0.8 Vp-p
	Code	NRZ
	Connector	SMA
	Termination	100 Ω Differential (Nominal value)
Receiver data output RD+, RD–	Differential data output level	Min. 0.3 Vp-p, Max. 0.9 Vp-p (within the input power range of the recommended XFP module)
	Code	NRZ
	Connector	SMA
	Termination	100 Ω Differential (Nominal value)
1/1 clock input	Input frequency	9.5 to 12.5 GHz
	Level	0.25 to 0.8 Vp-p
	Connector	SMA
	Impedance	50 Ω/GND
1/64 clock output	Frequency	(1/1 clock input frequency)/64
	Level	0.5 Vp-p ±0.18 V
	Rise/fall time	300 ±100 ps (20 to 80%)
	Duty	50 ±10%
	Connector	SMA
	Impedance	50 Ω/GND
1/64 clock input	Frequency	(Operating bit rate)/64
	Level	0.32 to 0.8 Vp-p
	Rise/fall time	200 to 1250 ps (20 to 80%)
	Duty	40 to 60%
	Connector	SMA
	Impedance	50 Ω/GND
XFP module connector pin configuration	Pin 1	GND
	Pin 2	VEE5
	Pin 3	Mod_DeSel
	Pin 4	$\overline{\text{Interrupt}}$
	Pin 5	TX_DIS
	Pin 6	VCC5
	Pin 7	GND
	Pin 8	VCC3
	Pin 9	VCC3
	Pin 10	SCL
	Pin 11	SDA
	Pin 12	Mod_ABS
	Pin 13	Mod_NR
	Pin 14	RX_LOS

Table 1.3.1-1 Module main unit (continued)

Item		Specifications
XFP module connector pin configuration (Cont'd)	Pin 15	GND
	Pin 16	GND
	Pin 17	RD–
	Pin 18	RD+
	Pin 19	GND
	Pin 20	VCC2
	Pin 21	P_Down/RST
	Pin 22	VCC2
	Pin 23	GND
	Pin 24	REFCLK+
	Pin 25	REFCLK–
	Pin 26	GND
	Pin 27	GND
	Pin 28	TD–
	Pin 29	TD+
	Pin 30	GND
Status monitor	Ready	Monitors the XFP module installation state. If the XFP module is installed and is in the Operation mode, the LED lights green and the state is displayed on the screen.
	Optical Out	The LED lights green when the laser of the XFP module is emitted.
	Wavelength	Displays the wavelength of the recommended XFP module when it is inserted.
	Tx Err	Monitors Unlock/Laser output errors of Tx PLL. The LED lights red in case of an error.
	Rx Err	The LED lights red when Rx PLL is unlocked or LOS is detected.
	Laser fault	Displays the laser output error on the screen.
	Tx Unlock	Monitors Unlock of Tx PLL and displays the state on the screen.
	LOS	Monitors the Rx LOS detection state and displays the state on the screen.
	CDR Unlock	Monitors the Rx CDR Unlock state and displays the state on the screen.
XFP memory control	XFP 2 wire interface	Reads and writes data from/to the XFP internal memory.
Mechanical performance	Dimensions	234 mm (W) × 21 mm (H) × 175 mm (D) (Compact-PCI 1 slot) (Protrusion excluded)
	Mass	1.5 kg or less

Table 1.3.1-1 Module main unit (continued)

Item		Specifications
Environmental performance	Allowable number of insertions/ removals of the XFP connector	100 times
	Operating temperature	+5 to +40°C (when installed in the mainframe; temperature around equipment)
	Storage temperature	–20 to +60°C (recommended range: +5 to +30°C)

CAUTION

The allowable number of insertions/removals of the 30-pin multipole connector for the XFP module is 100 times. If the multipole connector is used beyond the allowable number of insertions/removals, performance may deteriorate due to poor contact. Observe the allowable number of insertions/removals when using it.

Table 1.3.1-2 G0174A Recommended 850 nm XFP module

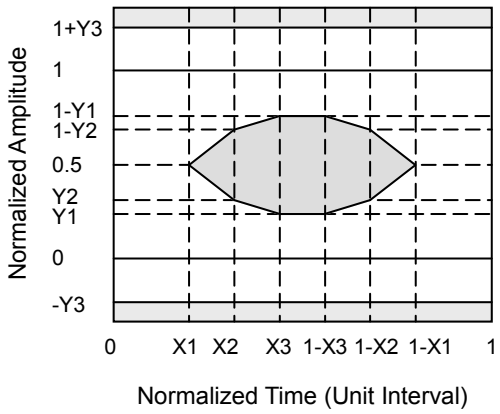
Item		Specifications
Input data signal		PRBS $2^{31} - 1$, mark ratio 1/2
Operating bit rate		9.95 to 11.10 Gbit/s. The specifications for the transmitter and receiver shown below are defined at 10.3125 Gbit/s.
Transmitter	Power	Min. –4.0 dBm, Max. –1.08 dBm, at the center wavelength of 850 nm.
	Laser safety	Class 1 (IEC 60825-1 : 2007, 21 CFR 1040.10 Laser Safety Notice 50)
	Center wavelength	Min. 840 nm, Max. 860 nm
	RMS spectral width	≤ 0.45 nm
	Extinction ratio	≥3.0 dB
	Applicable fiber	GI (50/125 μm), GI (62.5/125 μm)
	Connector	LC/PC
	Eye mask	X1, X2, X3, Y1, Y2, Y3} {0.25, 0.40, 0.45, 0.25, 0.28, 0.40}  Using 7.5 GHz 4th Bessel filter
Receiver	Wavelength range	840 to 860 nm (design assurance)
	Sensitivity	≤–9.9 dBm (Average, BER ≤ 10^{-12})
	Maximum input power	–1.0 dBm (Average, BER ≤ 10^{-12}, design assurance)
	Applicable fiber	GI (50/125 μm), GI (62.5/125 μm)
	Connector	LC/PC
	LOS assert level	≤–14.0 dBm

Table 1.3.1-3 G0175A Recommended 1310 nm XFP module

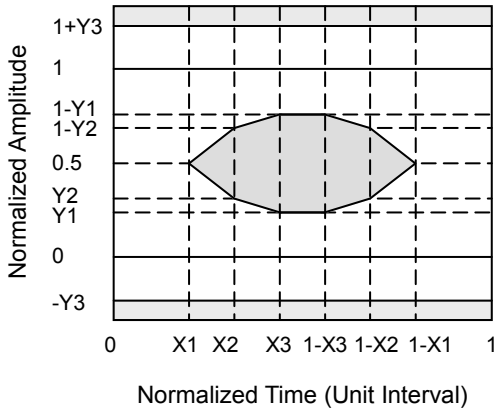
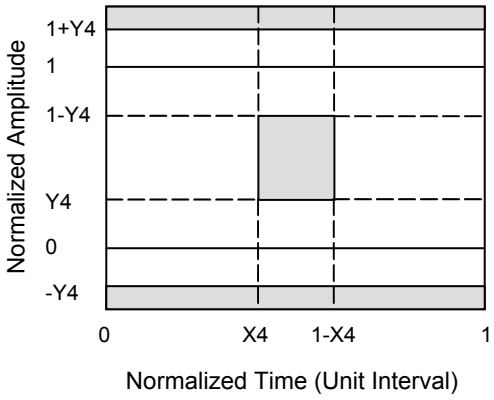
Item		Specifications
Input data signal		PRBS $2^{31} - 1$, mark ratio 1/2
Operating bit rate		9.95 to 11.30 Gbit/s. The specifications for the transmitter and receiver shown below are defined at 10.3125 Gbit/s.
Transmitter	Power	Min. –6.0 dBm, Max. –1.0 dBm
	Laser safety	Class1 (IEC 60825-1 : 2007, 21 CFR 1040.10 Laser Safety Notice 50)
	Center wavelength	Min. 1290 nm, Max. 1330 nm
	Side-mode suppression ratio	≥ 30.0 dB
	Extinction ratio	≥ 6.0 dB
	Applicable fiber	SM Fiber (ITU-T G.652)
	Connector	LC/PC
	Eye mask	{X1, X2, X3, Y1, Y2, Y3} {0.25, 0.40, 0.45, 0.25, 0.28, 0.40} {X4, Y4} {0.4, 0.25}   Using 7.5 GHz 4th Bessel filter

Table 1.3.1-3 G0175A Recommended 1310 nm XFP module (continued)

Item		Specifications
Receiver	Wavelength range	1290 to 1330 nm (design assurance)
	Sensitivity	≤–13.4 dBm (Average, BER ≤ 10^{-12})
	Maximum input power	+0.5 dBm (Average, BER ≤ 10^{-12} design assurance)
	Applicable fiber	SM Fiber (ITU-T G.652)
	Connector	LC/PC
	LOS assert level	≤–20.0 dBm

Table 1.3.1-4 G0176A Recommended 1550 nm XFP module

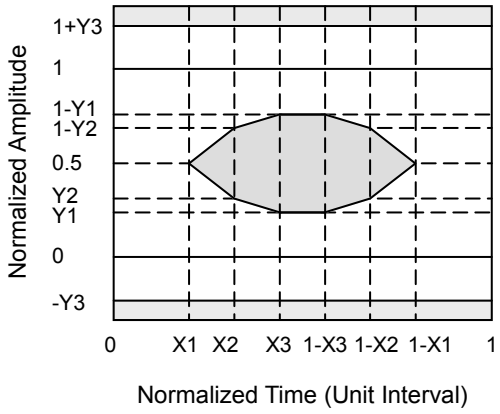
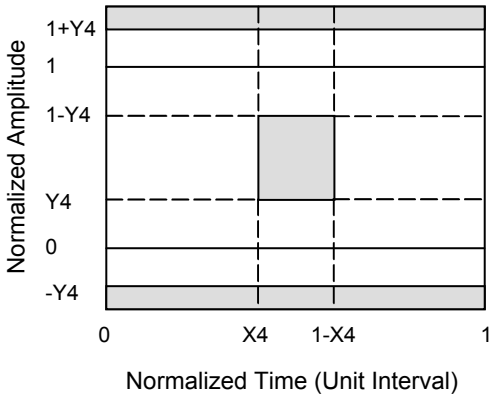
Item		Specifications
Input data signal		PRBS 2^{31} – 1, mark ratio 1/2
Operating bit rate		9.95 to 10.75 Gbit/s. The specifications for the transmitter and receiver shown below are defined at 10.3125 Gbit/s.
Transmitter	Power	Min. –1.0 dBm, Max. +2.0 dBm
	Laser safety	Class1 (IEC 60825-1 : 2007, 21 CFR 1040.10 Laser Safety Notice 50)
	Center wavelength	Min. 1530 nm, Max. 1565 nm
	Side-mode suppression ratio	≥ 30.0 dB
	Extinction ratio	≥8.2 dB
	Applicable fiber	SM Fiber (ITU-T G.652)
	Connector	LC/PC
	Eye mask	{X1, X2, X3, Y1, Y2, Y3} {0.25, 0.40, 0.45, 0.25, 0.28, 0.40} {X4, Y4} {0.4, 0.25}   Using 7.5 GHz 4th Bessel filter

Table 1.3.1-4 G0176A Recommended 1550 nm XFP module (continued)

Item		Specifications
Receiver	Wavelength range	1530 to 1565 nm (design assurance)
	Sensitivity	≤–15.8 dBm (Average, BER ≤ 10^{-12})
	Maximum input power	–1.0 dBm (Average, BER ≤ 10^{-12}, design assurance)
	Applicable fiber	SM Fiber (ITU-T G.652)
	Connector	LC/PC
	LOS assert level	≤–20.0 dBm

1.3.2 Specifications for MU181601A

Table 1.3.2-1 Module main unit

Item		Specifications
Transmitter data input TD+, TD–	Single end input level	0.25 to 0.6 Vp-p
	Code	NRZ
	Connector	SMA
	Termination	50 Ω/GND (Nominal value)
Receiver data output RD+, RD–	Single end output level	Min. 0.18 Vp-p, Max. 1.0 Vp-p (within the input power range of the recommended SFP module)
	Code	NRZ
	Connector	SMA
	Termination	50 Ω/GND (Nominal value)
SFP module connector pin configuration	Pin 1	VeeT (Transmitter Ground)
	Pin 2	TX Fault (Transmitter Fault Indication)
	Pin 3	TX Disable (Transmitter Disable)
	Pin 4	MOD-DEF2 (Module Definition 2)
	Pin 5	MOD-DEF1 (Module Definition 1)
	Pin 6	MOD-DEF0 (Module Definition 0)
	Pin 7	Rate Select (Select between full or reduced receiver bandwidth)
	Pin 8	LOS (Loss of Signal)
	Pin 9	VeeR (Receiver Ground)
	Pin 10	VeeR (Receiver Ground)
	Pin 11	VeeR (Receiver Ground)
	Pin 12	RD– (Inv. Received Data Out)
	Pin 13	RD+ (Received Data Out)
	Pin 14	VeeR (Receiver Ground)
	Pin 15	VccR (Receiver Power)
	Pin 16	VccT (Transmitter Power)
	Pin 17	VeeT (Transmitter Ground)
	Pin 18	TD+ (Transmit Data In)
	Pin 19	TD– (Inv. Transmit Data In)
	Pin 20	VeeT (Transmitter Ground)
Status monitor	Ready	Monitors the SFP module installation state. If the SFP module is installed, the LED lights green and the state is displayed on the screen.
	Wavelength	Displays the wavelength of the recommended SFP module when it is inserted.
	Optical Out	The LED lights green when the laser of the SFP module is emitted.
	Tx Err	Monitors laser output errors. The LED lights red in case of an error.
	Rx Err	The LED lights red when LOS is detected.
	Laser fault	Displays the laser output error on the screen.

Table 1.3.2-1 Module main unit (continued)

Item		Specifications
Status monitor (Cont'd)	LOS	Monitors the Rx LOS detection state and displays the state on the screen.
SFP memory control	SFP 2 wire interface	Reads and writes data from/to the SFP internal memory.
Mechanical performance	Dimensions	234 mm (W) × 21 mm (H) × 175 mm (D) (Compact-PCI 1 slot) (Protrusion excluded)
	Weight	1.5 kg or less
Environmental performance	Allowable number of insertions/ removals of the SFP connector	100 times
	Operating temperature	+5 to +40°C (when installed in the main frame; temperature around equipment)
	Storage temperature	–20 to +60°C

CAUTION

The allowable number of insertions/removals of the 20-pin multipole connector for the SFP module is 100 times. If the multipole connector is used beyond the allowable number of insertions/removals, performance may deteriorate due to poor contact. Observe the allowable number of insertions/removals when using it.

Table 1.3.2-2 G0177A Recommended 850 nm SFP module

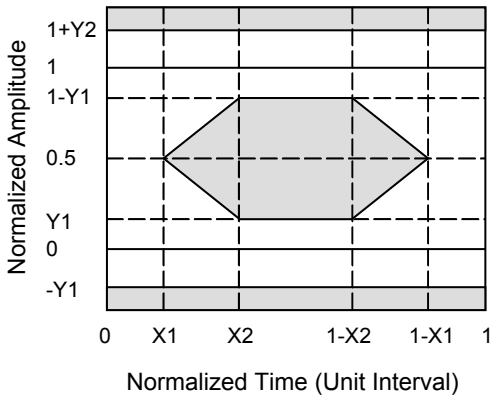
Item		Specifications
Input data signal		PRBS $2^{23} - 1$, mark ratio 1/2
Operating bit rate		1.062 to 4.25 Gbit/s. The specifications for the transmitter and receiver shown below are defined at 4.25 Gbit/s.
Rate Select		Available
Transmitter	Power	Min. –9.0 dBm, Max. –2.5 dBm
	Laser safety	Class1 (IEC 60825-1 : 2007, 21 CFR 1040.10 Laser Safety Notice 50)
	Center wavelength	Min. 830 nm, Max. 860 nm
	RMS spectral width	≤0.85 nm
	OMA	≥247 μW
	Applicable fiber	GI (50/125 μm), GI (62.5/125 μm)
	Connector	LC/PC
	Eye mask	{X1, X2, Y1, Y2} {0.22, 0.4, 0.2, 0.3}  Using 3.19 GHz 4th Bessel filter
Receiver	Wavelength range	830 to 860 nm (design assurance)
	Sensitivity	≤–15.0 dBm (Average, BER ≤ 10^{-12})
	Maximum input power	0.0 dBm (Average, BER ≤ 10^{-12}, design assurance)
	Applicable fiber	GI (50/125 μm), GI (62.5/125 μm)
	Connector	LC/PC
	LOS assert level	≤–20.0 dBm

Table 1.3.2-3 G0178A Recommended 1310 nm SFP module

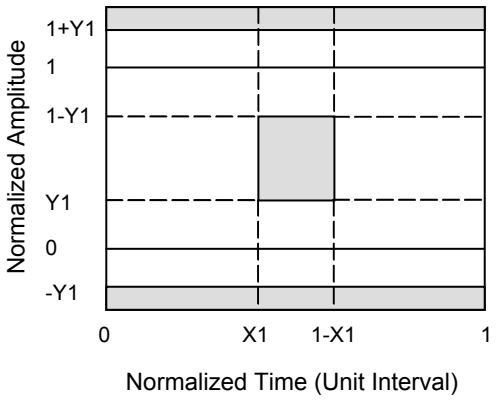
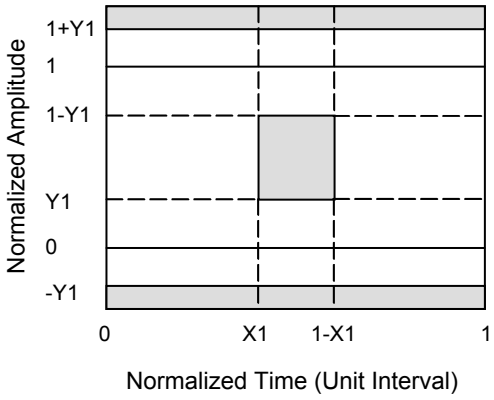
Item		Specifications
Input data signal		PRBS $2^{23} - 1$, mark ratio 1/2
Operating bit rate		0.155 to 2.67 Gbit/s. The specifications for the transmitter and receiver shown below are defined at 2.48832 Gbit/s.
Rate Select		Unavailable
Transmitter	Power	Min. –5.0 dBm, Max. 0.0 dBm
	Laser safety	Class1 (IEC 60825-1 : 2007, 21 CFR 1040.10 Laser Safety Notice 50)
	Center wavelength	Min. 1270 nm, Max. 1360 nm
	Side-mode suppression ratio	≥ 30.0 dB
	Extinction ratio	≥ 8.2 dB
	Applicable fiber	SM Fiber (ITU-T G.652)
	Connector	LC/PC
	Eye mask	{X1, Y1 } {0.4, 0.25}  Using 1.866 GHz 4th Bessel filter
Receiver	Wavelength range	1270 to 1360 nm (design assurance)
	Sensitivity	≤–18.0 dBm (Average, BER ≤ 10^{-12})
	Maximum input power	0.0 dBm (Average, BER ≤ 10^{-12}, design assurance)
	Applicable fiber	SM Fiber (ITU-T G.652)
	Connector	LC/PC
	LOS assert level	≤–18.0 dBm

Table 1.3.2-4 G0179A Recommended 1550 nm SFP module

Item		Specifications
Input data signal		PRBS $2^{23} - 1$, mark ratio 1/2
Operating bit rate		0.155 to 2.67 Gbit/s. The specifications for the transmitter and receiver shown below are defined at 2.48832 Gbit/s.
Rate Select		Unavailable
Transmitter	Power	Min. –5.0 dBm, Max. 0.0 dBm
	Laser safety	Class1 (IEC 60825-1 : 2007, 21 CFR 1040.10 Laser Safety Notice 50)
	Center wavelength	Min. 1430 nm, Max. 1580 nm
	Side-mode suppression ratio	≥ 30.0 dB
	Extinction ratio	≥8.2 dB
	Applicable fiber	SM Fiber (ITU-T G.652)
	Connector	LC/PC
	Eye mask	{X1, Y1} {0.4, 0.25}  Using 1.866 GHz 4th Bessel filter
Receiver	Wavelength range	1430 to 1580 nm (design assurance)
	Sensitivity	≤–18.0 dBm (Average, BER ≤ 10^{-12})
	Maximum input power	0.0 dBm (Average, BER ≤ 10^{-12}, design assurance)
	Applicable fiber	SM Fiber (ITU-T G.652)
	Connector	LC/PC
	LOS assert level	≤–18.0 dBm

Section 2 Preparation before Use

This section describes preparations required before using the MU181600A and MU181601A.

2.1 Installation to Signal Quality Analyzer

For information on how to install the MU181600A/MU181601A to the Signal Quality Analyzer and how to turn on the power, refer to Section 2 "Preparation before Use" in the Signal Quality Analyzer Series Installation Guide.

2.2 How to Operate Application

The modules connected to the Signal Quality Analyzer are controlled by operating the MX180000A Signal Quality Analyzer Control Software (hereinafter, referred to as "MX180000A").

For information on how to start up, shut down, and operate the MX180000A, refer to the MX180000A Signal Quality Analyzer Control Software Operation Manual.

2.3 Preventing Damage

Be sure to observe the rating voltage ranges when connecting input and output of the MU181600A/MU181601A.
Otherwise, the MU181600A/MU181601A may become damaged.

CAUTION ⚠

1. **When signals are input to the MU181600A/MU181601A, avoid excessive voltage beyond the rating. Otherwise, the circuit may be damaged.**

2. **Use a 50 Ω/GND terminator at the output. Never feed any current to the output.**

3. **As a countermeasure against static electricity, ground other devices to be connected (including experimental circuits) with ground wires before connecting the I/O connector.**

4. **The outer conductor and core of the coaxial cable may become charged as a capacitor. Use metal like a copper wire to discharge electricity between the outer conductor and core before use.**

5. **Never open the MU181600A/MU181601A. If you open it and sufficient performance cannot be obtained, we may decline to repair the MU181600A/MU181601A.**

6. **To protect the MU181600A/MU181601A from electro-static discharge failure, a conductive sheet should be placed onto the workbench, and the operator should wear an electrostatic discharge wrist strap. Connect the ground connection end of the wrist strap to the conductive sheet or to the ground terminal of the main-frame.**

2.4 Inserting/Removing XFP/SFP Modules While Power Is On

Follow the procedure below when inserting/removing the XFP/SFP module to/from the MU181600A/MU181601A while power is on.

1. Turn off the optical output of the XFP/SFP module, and disconnect the signal input to the input connectors.
2. Remove the optical fiber cable from the XFP/SFP module.
3. When removing the XFP/SFP module, unlock the handle of the XFP/SFP module, and then pull it out.
4. When inserting the XFP/SFP module, lift the handle of the XFP/SFP module, and insert it fully along the insertion slot as it is stored in the XFP module.
5. Connect the optical fiber cable applicable to the inserted XFP/SFP module.
6. When the XFP module is inserted/removed with power on, the Power Down parameter is set to Standby (low power consumption mode). Switch it to Operation (normal operation mode), referring to Section 4.2.1 “Operation window for MU181600A.”

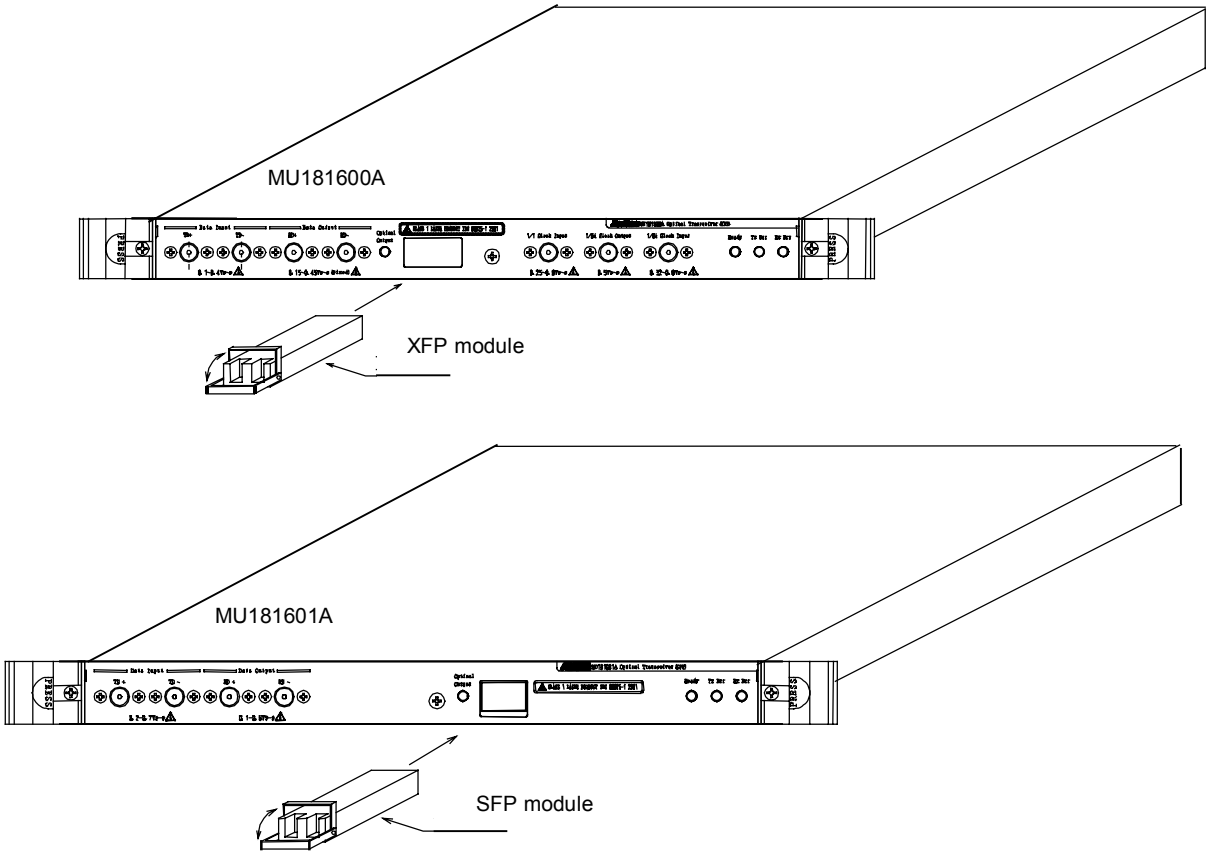


Fig. 2.4-1 Connecting XFP/SFP module

CAUTION ⚠

1. **When inserting the XFP/SFP module, make sure that the eject knob of the XFP/SFP module is retracted. If the eject knob protrudes during insertion, the XFP/SFP module may not be installed successfully.**

2. **Insert the anti-dust plug into the removed XFP/SFP module. Otherwise, dust may accumulate at the optical input/output opening of the XFP/SFP module, causing failure.**

3. **The XFP/SFP module is sensitive to electrostatic discharge (ESD). To prevent ESD, touch a grounded metal object to discharge static electricity charged in the body, before handling the module.**

4. **Wipe off any stains on the ferrule, according to Section 7.2 "Cleaning Optical Connector and Optical Adapter."**

5. **A laser beam may be output from the optical output opening of the XFP/SFP module when the fiber cable is not connected. Do not look into the optical output opening.**

6. **Do not install or remove the XFP/SFP module with the fiber cable inserted into the XFP/SFP module. The optical input/output opening and fiber cable connector may become damaged.**

7. **Do not touch the connectors on the back of the XFP/SFP module by hand. It may cause the XFP/SFP module to fail**

8. **The operation is not guaranteed if an XFP/SFP module that is not recommended by Anritsu is inserted. Be sure to use a recommended one.**
   For the information about the recommended modules, see the Anritsu Web site (http://www.anritsu.co.jp/E/MP1800).

Section 3 Panel Layout and Connectors

This section describes the panels and connectors of the MU181600A and the MU181601A.

3.1 Panel Layout

3.1.1 Panel layout of MU181600A

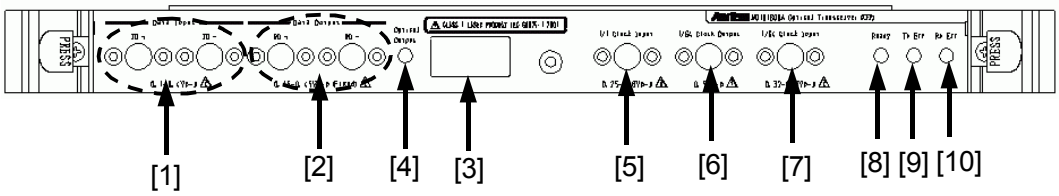


Fig. 3.1.1-1 Panel of MU181600A

Table 3.1.1-1 Name and Function of Each Part on MU181600A panel

No.	Name	Description
[1]	Data Input TD+, TD–	Connector to input electric signals to the XFP module (as an optical transmitter)
[2]	Data Output RD+, RD-	Connector to output electric signals from the XFP module (as an optical receiver)
[3]	XFP Module Slot	XFP module insertion slot The corresponding XFP module (see Section 2.1.2 "Application parts") is installed. Refer to Section 2.4 "Inserting/Removing XFP/SFP Modules While Power On" for how to install the XFP module.
[4]	Optical Output (LED)	Indicates that the XFP module is emitting an optical signal. This LED lights green when the optical signal is emitting.
[5]	1/1 Clock Input	Connector to input the 1/1 clock that is used to generate the reference clock for the XFP module. The input 1/1 clock is divided by 64, and is output from the 1/64 Clock Output connector.
[6]	1/64 Clock Output	Connector to output the 64-divided clocks.
[7]	1/64 Clock Input	Connector to input the reference clock that is used for XFP module's operations. Input a clock generated by dividing the 1/1 clock by 64 (operating data rate).
[8]	Ready (LED)	Indicates that the XFP module is installed. This LED lights green when the XFP module is installed and is ready for operation.
[9]	Tx Err (LED)	Indicates that there is an abnormality with the XFP transmitter. This LED lights red when the XFP transmitter detects a laser error or when the XFP transmitter PLL is in the Unlock state.
[10]	Rx Err (LED)	Indicates that there is an abnormality with the XFP receiver. This LED lights red when the XFP receiver detects LOS or when the receiver PLL is Unlocked.

3.1.2 Panel layout of MU181601A

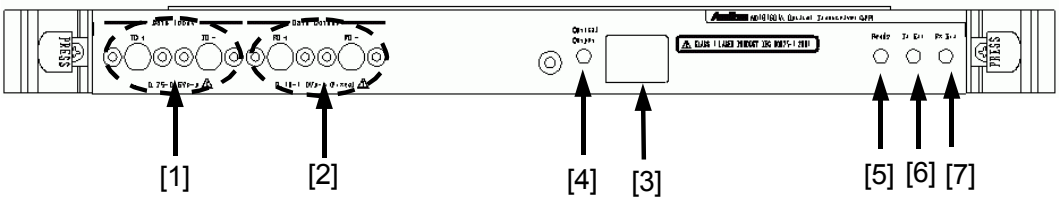


Fig. 3.1.2-1 Front panel of MU181601A

Table 3.1.2-1 Name and Function of Each Part on MU181601A panel

No.	Name	Description
[1]	Data Input TD+, TD–	Connector to input electric signals to the SFP module (as an optical transmitter) Connect a terminator (J1137) to either input end when using a single end interface.
[2]	Data Output RD+, RD-	Connector to output electric signals from the SFP module (as an optical receiver) Connect a terminator (J1137) to either input end when using a single end interface.
[3]	SFP Module Slot	SFP module insertion slot The corresponding SFP module is installed. Refer to Section 2.4 “Inserting/Removing XFP/SFP Modules While Power Is On” for how to install the SFP module.
[4]	Optical Output (LED)	Indicates that the SFP module is emitting an optical signal. This LED lights green when the optical signal is emitting.
[5]	Ready (LED)	Indicates that the SFP module is installed. This LED lights green when the SFP module is installed and is ready for operation.
[6]	Tx Err (LED)	Indicates that there is an abnormality with the SFP transmitter. This LED lights red when the SFP module detects a laser error.
[7]	Rx Err (LED)	Indicates that there is an abnormality with the SFP receiver. This LED lights red when the SFP receiver detects LOS.

3.2 Inter-Module Connection

A connection example between the MU181600A, MU181000A 12.5 GHz Synthesizer (hereinafter, referred to as "MU181000A"), and MU181020A 12.5 Gbit/s PPG (hereinafter, referred to as "MU181020A") that are installed into a mainframe is shown below.

Note:

Avoid static electricity when handling the devices.

The inter-module level interface may not match, depending on the options installed in the MU181020A. In this case, connect the accessory attenuators between the modules to satisfy the input standard level. The following table shows the combinations of options in which an attenuator is required. Connect an attenuator by following the procedure below. Figure 3.2-1 shows a connection example.

Table 3.2-1 Attenuators required for connection

	Only MU181020A-001 is installed	Only MU181020A-002 is installed
MU181600A TD+/TD–	Connect a 6 dB attenuator.	Connect a 10 dB attenuator.
MU181601A TD+/TD–		Connect a 6 dB attenuator.

1. Connect the 3-pin power cord of the mainframe to the power receptacle. Be sure to use the 3-pin power cord supplied with the mainframe and a 3-pin receptacle.
2. Connect the Clock Output connector of the MU181000A and the Ext. Clock Input connector of the MU181020A, using a coaxial cable.
3. Connect the TD+ connector of the MU181600A and the Data Output connector of the MU181020A, using a coaxial cable. If an attenuator is required (see Table 3.2-1), connect the accessory attenuator to the TD+ connector of the MU181600A.
4. Connect the TD– connector of the MU181600A and the XData Output connector of the MU181020A, using a coaxial cable. If an attenuator is required (see Table 3.2-1), connect the accessory attenuator to the TD– connector of the MU181600A.
5. Connect the Clock Output connector of the MU181020A and the 1/1 Clock Input connector of the MU181600A, using a coaxial cable.
6. Connect the 1/64 Clock Output connector and 1/64 Clock Input connector of the MU181600A, using a coaxial cable.

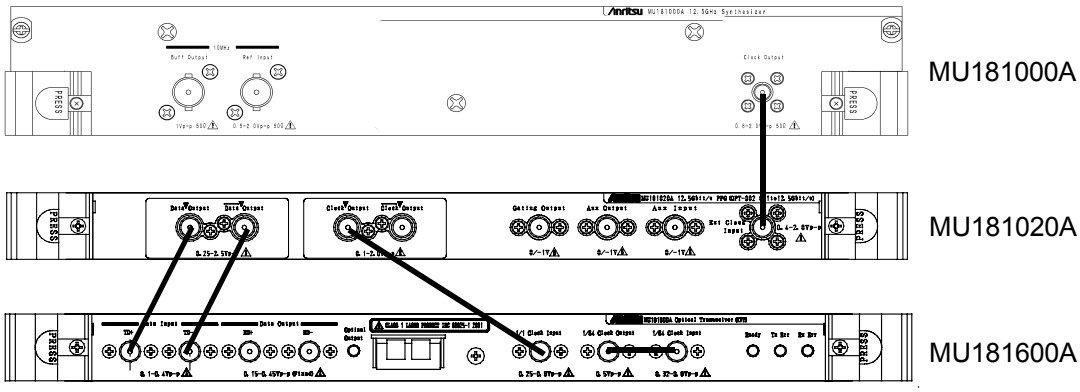


Fig. 3.2-1 An example of inter-module connection

CAUTION

If an excessive voltage is applied to the input connector, the protective circuit may be damaged. Avoid any input beyond the rating. If there is any possibility of the rating being exceeded, check that the input signal is within the rating before connection.

To prevent damage due to static electricity charged inside the coaxial cable, ground the core of the coaxial cable in contact to discharge it before connection.

3.3 Optical Fiber Cables Connection

Connect the optical fiber cable after inserting XFP/SFP module in MU181600A/MU181601A.

Table 3.3-1 Optical input/output connectors of XFP/SFP module

Plug-In Module Model Name	Recommended Module Model Name/Part Name	Optical output connector	Optical input connector
MU181600A	G0174A 850 nm XFP module	[1]	[2]
	G0175A 1310 nm XFP module	[1]	[2]
	G0176A 1550 nm XFP module	[1]	[2]
MU181601A	G0177A 850 nm SFP module	[3]	[4]
	G0178A 1310 nm SFP module	[3]	[4]
	G0179A 1550 nm SFP module	[3]	[4]

Optical input/output connectors of XFP/SFP module refer to Fig 3.3-1.

Fig. 3.3-1 Optical input/output connectors of XFP/SFP module

Before connecting the fiber, be sure to clean the connector end surface.

Section 4 Configuration of Setup Dialog Box

This section describes the configuration and the operation methods of the setup dialog box for the MU181600A and MU181601A.

4.1 Configuration of Entire Setup Dialog Box

The configuration of the setup dialog box when the MU181600A/ MU181601A is inserted into a mainframe is shown below.

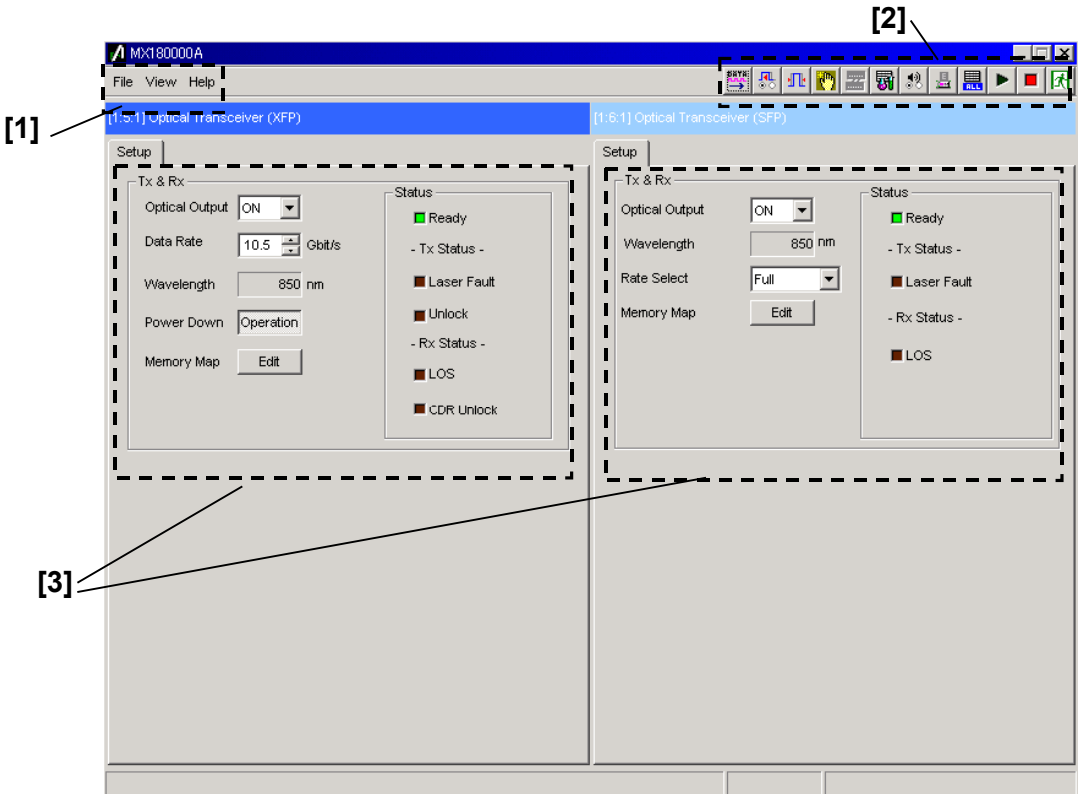


Fig. 4.1.1-1 Configuration of entire setup dialog box for MU181600A and MU181601A

The setup dialog box consists of three blocks as shown in Fig. 4.1.1-1. The following table describes each of the blocks.

Table 4.1.1-1 Functions of blocks

No.	Block	Function
[1]	Menu bar	Selects the settings related to the entire device. Refer to the MX180000A Signal Quality Analyzer Control Software Operation Manual for details.
[2]	Module function buttons	Shortcut buttons for the function items specific to the displayed module. Users can customize the pre-defined function buttons according to their own applications. Refer to the MX180000A Signal Quality Analyzer Control Software Operation Manual for details.
[3]	Operation windows	Configures settings specific to each module.

4.2 Operation Windows

4.2.1 Operation window for MU181600A

The operation window for the MU181600A is shown below.

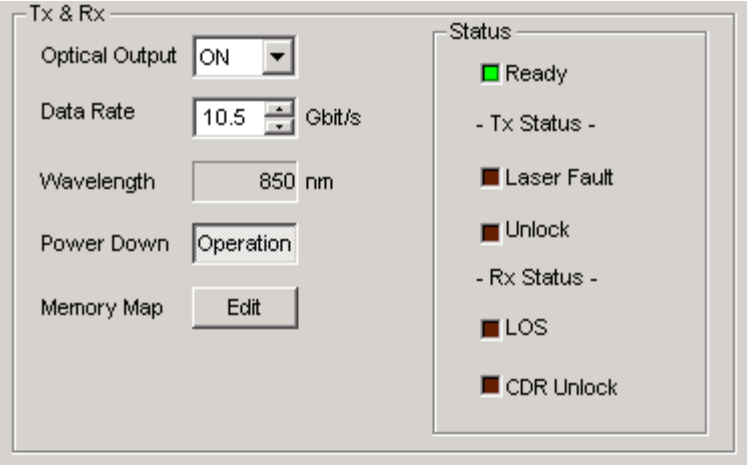


Fig. 4.2.1-1 Operation window for MU181600A

Table 4.2.1-1 Items in operation window for MU181600A

Item	Functions
Optical Output	Sets the optical output ON/OFF. ON: Optical signals are output from the XFP module. OFF: Optical signal output is stopped. The optical output can also be controlled by the optical output ON/OFF button . Optical signals are output when this setting is ON and the module function button is selected (recessed).
Data Rate	Specifies the operating data rate of the XFP module. The operating range varies depending on the installed XFP module. The setting range for the 850 nm XFP module (see Section 1.2.2 “Application parts”) is from 9.9 to 11.1 Gbit/s. Data Rate setting is not required for either the 1310 nm XFP module or the 1550 nm XFP module.
Wavelength	Displays the wavelength of the optical signal output from Optical Output connector. This item is enabled only when an application part XFP module is installed.
Power Down	This button is used to switch between the Standby mode (low power consumption mode) and the Operation mode (normal operation mode) for the XFP module. The current mode name is displayed on the button. The mode is automatically switched to the Standby mode after the XFP module is inserted or removed while power is on. Note that only the Memory Map is enabled during the Standby mode. Also, the Status field on the right is masked in the Standby mode.

Table 4.2.1-1 Items in operation window for MU181600A (continued)

Item	Functions
Memory Map	Used to read or write data from/to the XFP module internal memory. Click the Edit button to open the MemoryMap dialog box shown in Fig. 4.2.1-2.
Status: Ready	Indicates that the XFP module is installed. This illuminates green when the XFP module is installed and ready for operation.
Tx Status: Laser Fault	Indicates the state of the XFP transmitter. This illuminates red when an error is detected in the laser of the XFP module.
Tx Status: Unlock	Indicates the state of the XFP transmitter. This illuminates red when the PLL circuit of the XFP module is unlocked.
Rx Status: LOS	Illuminates red when the XFP receiver detects Loss of Signal (LOS).
Rx Status: CDR Unlock	Indicates the state of the XFP receiver. This illuminates red when the CDR circuit of the XFP module is unlocked.

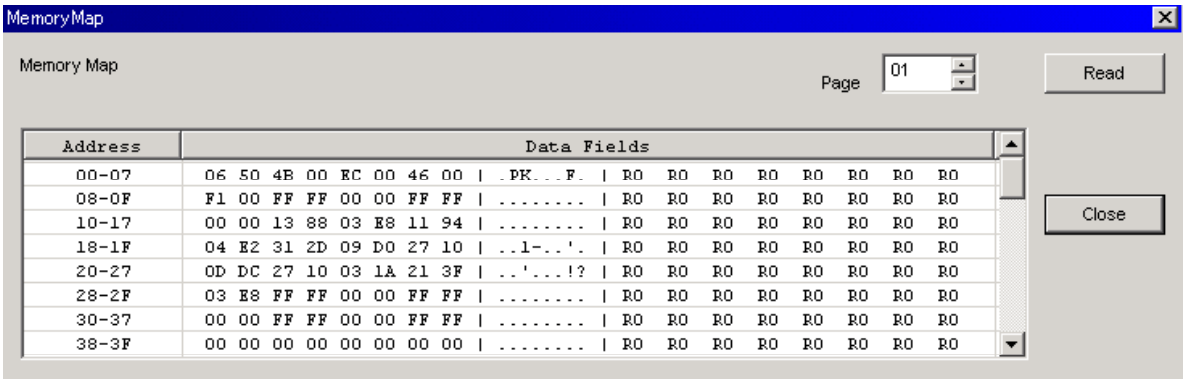


Fig. 4.2.1-2 MemoryMap dialog box

Table 4.2.1-2 Items in MemoryMap dialog box

Item	Function
Page	Specifies the Table of the lower 128 bytes of the XFP module internal memory. The accessible area of an application part XFP module is two pages of 01 and 02.
Address	Displays the address of the XFP module internal memory in hexadecimal format. To write data into the internal memory, select the target address area by double-clicking. The MemoryMapEditor dialog box (see Fig. 4.2.1-3) is then displayed.
Data Fields	Displays the data stored in the corresponding address in hexadecimal format (left) and ASCII format (right).
Read	Used to read the current state of the internal memory. When this button is clicked, the content of the Read port in the internal memory is read and updated.

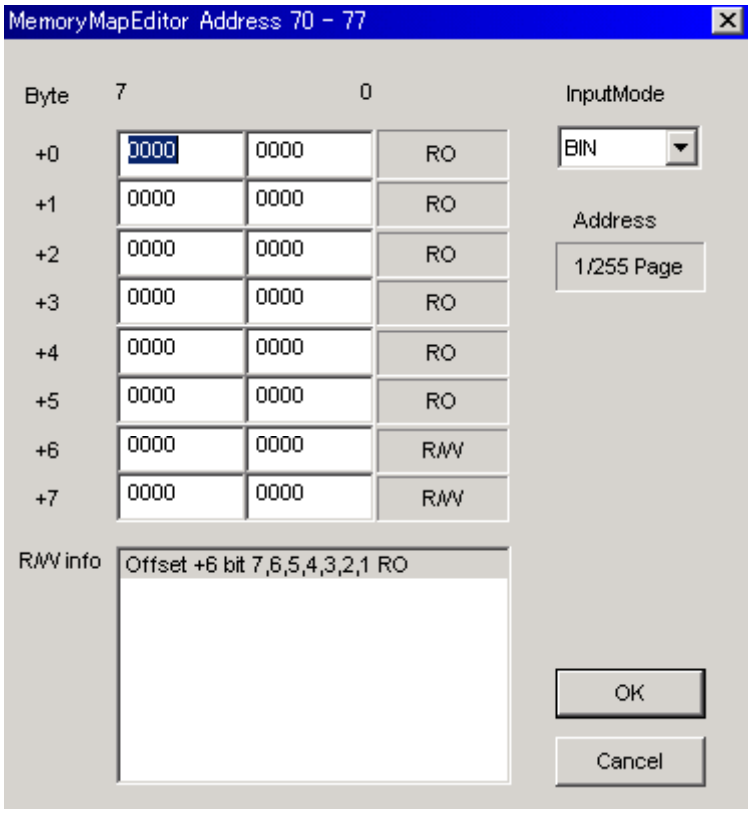


Fig. 4.2.1-3 MemoryMapEditor dialog box

Table 4.2.1-3 Items in MemoryMapEditor dialog box

Item	Function
Input Mode	Allows the input mode to be selected from this list box. Values can be entered in either binary (BIN) or hexadecimal (HEX) format.
Byte	Displays the address selected in the MemoryMap dialog box. +0: Indicates the beginning of the selected address. +7: Indicates the end of the selected address.
R/O, R/W	Displays the internal memory type. RO: Read only R/W: Readable/writable WO: Write only The memory type may be set in bit units for some addresses. In this case, the details of the memory type are displayed in the R/W info field.
OK	After editing the data as necessary, click [OK] to write the edited data into the internal memory.

4.2.2 Operation window for MU181601A

The operation window for the MU181601A is shown below.

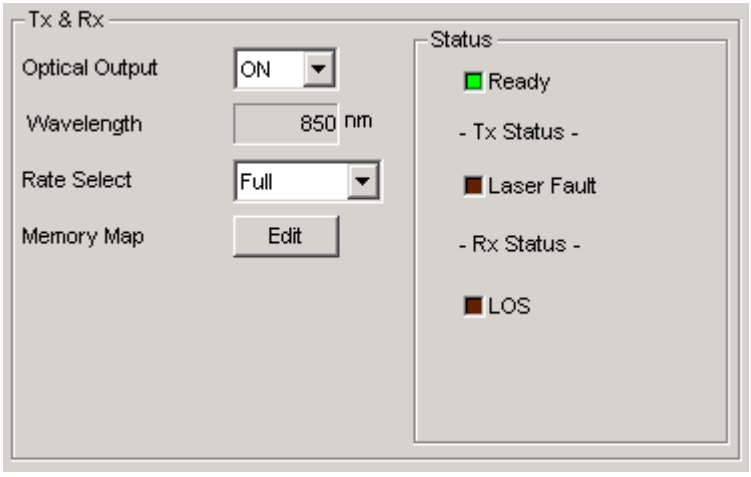


Fig. 4.2.1-1 Operation window for MU181601A

Table 4.2.2-1 Items in operation window for MU181601A

Item	Functions
Optical Output	Sets the optical output ON/OFF. ON: Optical signals are output from the SFP module. OFF: Optical signal output is stopped. The optical output can also be controlled by the optical output ON/OFF button . Optical signals are output when this setting is ON and the module function button is selected (recessed).
Wavelength	Displays the wavelength of the optical signal output from the Optical Output connector. This item is enabled only when an application part SFP module is installed.
Rate Select	Selects the band for the SFP module used. Reduced: Select when using the SFP module at a high operating bit rate. Full: Select when using the SFP module at a low operating bit rate. The application parts G0178A and G0179A SFP modules do not support this function.
Memory Map	Used to read or write data from/to the SFP module internal memory. Click [Edit] to open the MemoryMap dialog box shown in Fig. 4.2.2-2.
Status: Ready	Indicates the SFP module installation state. This illuminates green when the SFP module is installed and is ready.
Tx Status: Laser Fault	Indicates the state of the SFP module. This illuminates red when an error is detected in the laser of the SFP module.
Rx Status: LOS	Illuminates red when the SFP module detects Loss of Signal (LOS).

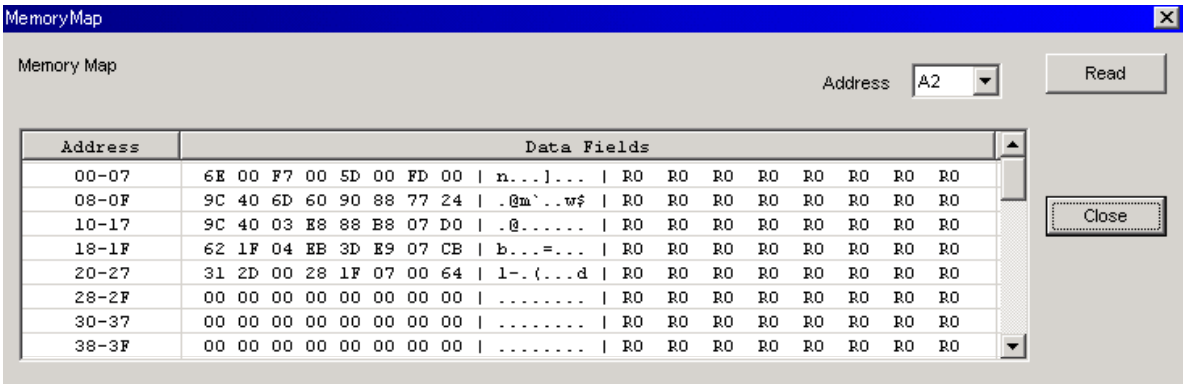


Fig. 4.2.2-2 MemoryMap dialog box

Table 4.2.2-2 Items in MemoryMap dialog box

Item	Function
Address (list box)	Specifies the Table of the SFP module internal memory.
Address (column)	Displays the address of the SFP module internal memory in hexadecimal format. To write data into the internal memory, select the target address area by double-clicking it. The MemoryMapEditor dialog box (see Fig. 4.2.2-3) is displayed.
Data Fields	Displays the data stored in the corresponding address in hexadecimal format (left) and ASCII format (right).
Read	Used to read the current state of the internal memory. When this button is clicked, the content of the Read port in the internal memory is read and updated.

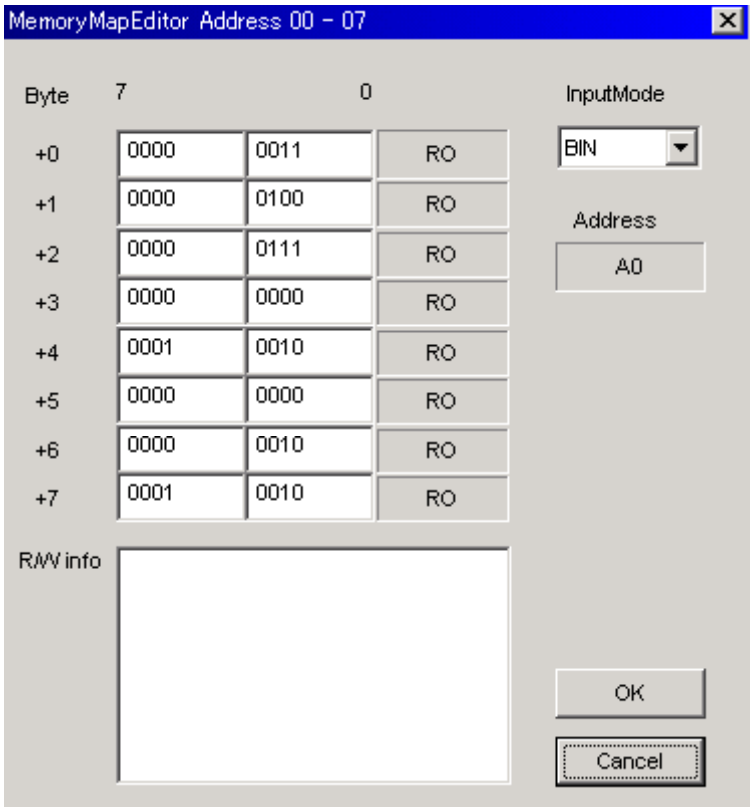


Fig. 4.2.2-3 MemoryMapEditor dialog box

Table 4.2.2-3 Items in MemoryMapEditor dialog box

Item	Function
Input Mode	Allows the input mode to be selected from this list box. Values can be entered in binary (BIN) or hexadecimal (HEX) format.
Byte	Displays the address selected in the MemoryMap dialog box. +0: Indicates the beginning of the selected address. +7: Indicates the end of the selected address.
R/O, R/W	Displays the internal memory type. RO: Read only R/W: Readable/writable WO: Write only The memory type may be set in bit units for some addresses. In this case, the details of the memory type are displayed in the R/W info field.
OK	After editing the data as necessary, click [OK] to write the edited data into the internal memory.

4.3 Operating Laser

Follow the procedure below when operating the MU181600A or MU181601A.

1. Prepare the MU181600A or MU181601A by referring to Section 2 "Preparation before Use."
2. In the operation window, click the Power Down button to set the normal operation mode (the button display becomes "Operation"), and then set the date rate in the Date Rate textbox. See Fig. 4.2.1-1 or 4.2.2-1 for details.
3. Select "ON" from the Optical Output list box in the operation window and set "ON" to the optical output ON/OFF button on the module function button (see Fig. 4.2.1-1 or 4.2.2-1).
   The optical signal is output from the Optical Output connector of the XFP or SFP module.

CAUTION

Controlling, adjusting, and/or operating the MU181600A/ MU161601A without observing the procedure described above may result in dangerous radiation exposure.

Section 5 Use Example

This section provides measurement examples using the MU181600A and MU181601A.

5.1 Measurement Example Using MU181600A

The following shows an example of how to measure the light receiving sensitivity of a device for the 9.9 G SDH/SONET interface, using the MU181600A.

5.1.1 Connection

A connection example of the test system using the MU181600A is shown below.

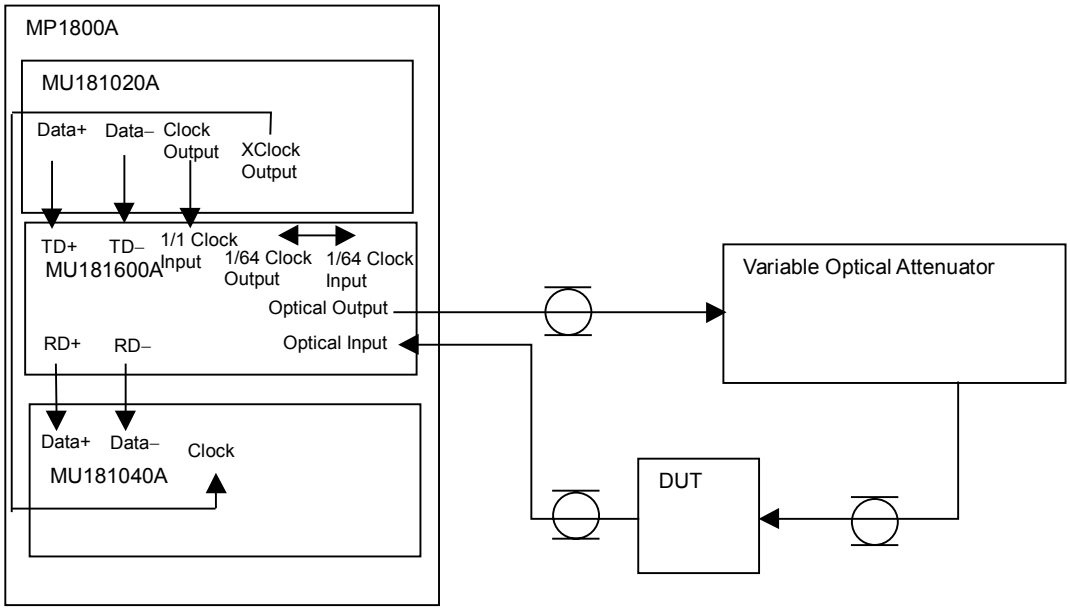


Fig. 5.1.1-1 Connection diagram

CAUTION ⚠

If an excessive voltage is applied to the input connector, the protective circuit may be damaged. Avoid any input beyond the rating. See Section 3.2 "Inter-Module Connection" for details.

5.1.2 Measurement procedure

1. Connect the Optical Input connector of the DUT (device under test) and the Optical Output connector of the MU181600A via an optical attenuator, and connect the O/E output connector of the DUT and the Data Input connector of the MU181040A (see Fig. 5.1.1-1).
2. Set the bit rate and test pattern (PRBS $2^{31} - 1$) for measurement to the MU181020A and MU181040A.
3. Set the attenuation level of the variable optical attenuator to be within the receivable range of the DUT.
4. Output optical signals from the MU181600A and check that no error occurs in the MU181040A.
5. Gradually increase the attenuation level of the variable optical attenuator to find a point where an error is detected.
6. Decrease the attenuation level to find a point where the measurement result at the MU181040A equals the specified error rate. The optical input average power to the DUT at that point is determined to be the light receiving sensitivity.

5.2 Measurement Example Using MU181601A

The following shows an example of how to measure the light receiving sensitivity of a device for the 2.5 G SDH/SONET interface, using the MU181601A.

5.2.1 Connection

A connection example of the test system using the MU181601A is shown below.

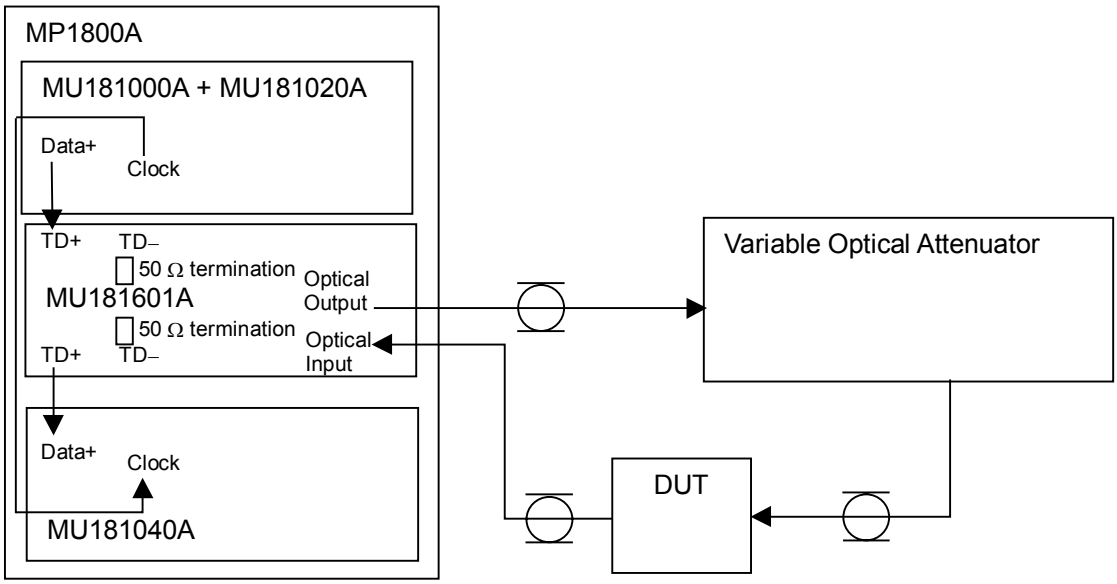


Fig. 5.2.1-1 Connection diagram

5.2.2 Measurement procedure

1. Connect the Optical Input connector of the DUT (device under test) and the Optical Output connector of the MU181601A via an optical attenuator, and connect the O/E output connector of the DUT and the Data Input connector of the MU181040A (see Fig. 5.2.1-1).
2. Set the bit rate and test pattern (PRBS $2^{31} - 1$) for measurement to the MU181020A and MU181040A.
3. Set the attenuation level of the variable optical attenuator to be within the receivable range of the DUT.
4. Output optical signals from the MU181601A and check that no error occurs in the MU181040A.
5. Gradually increase the attenuation level of the variable optical attenuator to find a point where an error is detected.
6. Decrease the attenuation level to find a point where the measurement result at the MU181040A equals the specified error rate. The optical input average power to the DUT at that point is determined to be the light receiving sensitivity.

Section 6 Performance Tests

This section describes the performance testing of the MU181600A and the MU181601A.

6.1 Overview

Performance tests are executed to check that the major functions of the MU181600A and MU181601A meet the required specifications. Execute performance tests at acceptance inspection, operation check after repair, and periodic (once every six months) testing.

6.2 Devices Required for Performance Tests

Before starting performance tests, warm up the MU181600A/MU181601A and the measuring instruments for at least 30 minutes. Tables 6.2-1 and 6.2-2 show the devices required for performance tests.

Table 6.2-1 Devices required for MU181600A performance test

Device	Required Performance	
Synthesizer (MP1800A+MU181000A)	Operating frequency: Clock output amplitude:	9.5 to 12.5 GHz 0.4 to 2.0 Vp-p
Pulse pattern generator (MP1800A+MU181020A)	Operating frequency: NRZ data output amplitude: 1/1 clock output amplitude: 1/1 clock output amplitude: Clock synchronization signal output:	9.5 to 12.5 GHz 0.1 to 0.4 mVp-p For error detector input For 0.25 to 0.8 Vp-p XFP reference clock generation For sampling oscilloscope trigger
Error detector (MP1800A+MU181040A)	Operating frequency: Data input sensitivity:	9.9 to 12.5 GHz 0.1 Vp-p or more
Sampling oscilloscope	Optical interface: Electrical interface:	9 GHz or more band 20 GHz or more band
Optical power meter (MT9810B+MU931422A)	Wavelength range: Linearity:	750 to 1700 nm ±0.05 dB or more
Variable optical attenuator	Maximum attenuation: Attenuation accuracy:	40 dB ±0.1 dB
Optical spectrum analyzer (MS9780A)	Wavelength range:	750 to 1700 nm

Table 6.2-2 Devices required for MU181601A performance test

Device	Required Performance	
Synthesizer (MP1800A+MU181000A)	Operating frequency: Clock output amplitude:	0.1 to 5.0 GHz 0.4 to 2.0 Vp-p
Pulse pattern generator (MP1800A+MU181020A)	Operating frequency: NRZ data output amplitude: 1/1 clock output amplitude: Clock synchronization signal output:	0.1 to 5.0 GHz 0.25 to 0.6 Vp-p For error detector input For sampling oscilloscope trigger
Error detector (MP1800A+MU181040A)	Operating frequency: Data input sensitivity:	0.1 to 5.0 GHz 0.1 Vp-p or more
Sampling oscilloscope	Optical interface: Electrical interface:	5 GHz band or greater 10 GHz band or greater
Optical power meter (MT9810B+MU931422A)	Wavelength range: Linearity:	750 to 1700 nm ±0.05 dB or greater
Variable optical attenuator	Maximum attenuation: Attenuation accuracy:	40 dB ±0.1 dB
Optical spectrum analyzer (MS9780A)	Wavelength range:	750 to 1700 nm

Note:

Before starting the performance tests, warm up the device under test and the measuring instruments for at least 30 minutes and wait until they become sufficiently stabilized, unless otherwise specified. Additional conditions are required for maximum measurement accuracy: measurements must be performed at room temperature, fluctuations of AC power supply voltage must be small, and noise, vibration, dust, and humidity must be insignificant.

6.3 Performance Test Items

This section describes the following test items.

(1) 1/64 clock output level, rise/fall time, and duty standards (MU181600A only)

(2) Transmitter optical output Eye mask and extinction ratio

(3) Transmitter optical output power

(4) Transmitter optical output center wavelength, RMS spectral width, and side-mode suppression ratio

(5) Data output differential output level

(6) Receiver sensitivity and LOS assert level

6.3.1 Performance tests for MU181600A

6.3.1.1 1/64 clock output level, rise/fall time, and duty

(1) Specifications

Table 6.3.1.1-1 Specifications for 1/64 clock output level, rise/fall time, and duty

Level	0.5 Vp-p ±0.18 V
Rise/fall time	300 ±100 ps (20 to 80%)
Duty	50 ±10%

(2) Connection

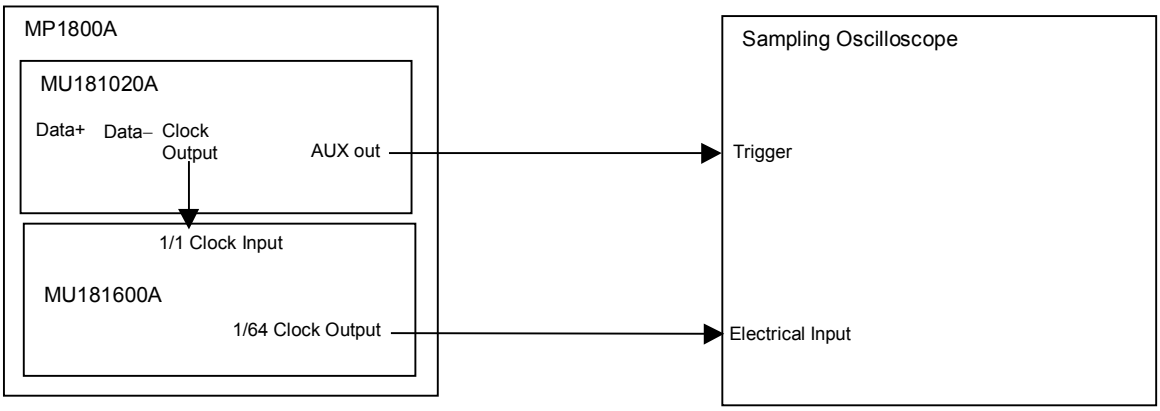


Fig. 6.3.1.1-1 Connection diagram for 1/64 clock output level, rise/fall time, and duty measurement

(3) Procedure

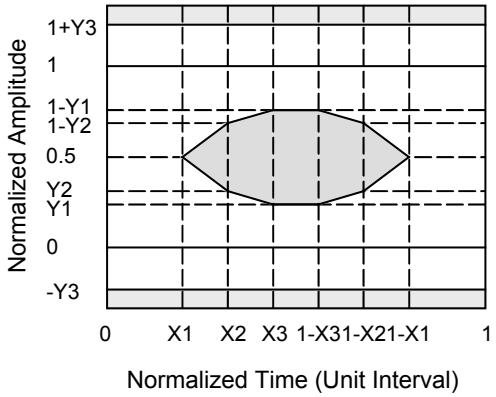
1. Install the modules into the MP1800A, connect the cables except for the optical fiber cable, and then turn on the power.
2. Turn on the sampling oscilloscope, and warm up the measuring instruments.
3. Set the Clock Output frequency of the MU181020A to 10.3125 GHz, and amplitude to 0.25 Vp-p.
4. Select the 1/64-divided clock for the AUX output.
5. Set the MU181020A signal output to ON to output signals.
6. Check that the measured results of the 1/64 clock output level, rise/fall time, and duty meet the specification requirements.

6.3.1.2 Transmitter optical output Eye mask and extinction ratio

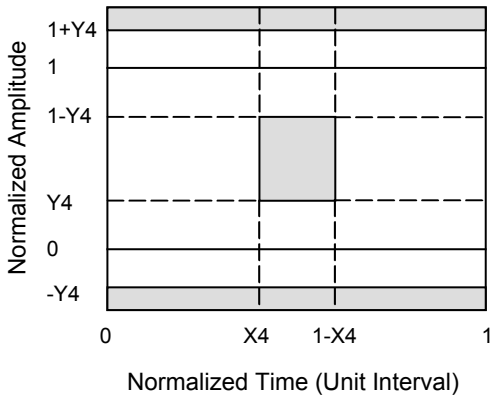
(1) Specifications

Table 6.3.1.2-1 Specifications for Eye mask and extinction ratio

XFP module	Eye Mask	Extinction Ratio
G0174A 850 nm XFP	{X1, X2, X3, Y1, Y2, Y3} {0.25, 0.40, 0.45, 0.25, 0.28, 0.40}	≥3.0 dB
G0175A 1310 nm XFP	{X1, X2, X3, Y1, Y2, Y3} {0.25, 0.40, 0.45, 0.25, 0.28, 0.40} {X4, Y4} {0.4, 0.25}	≥6.0 dB
G0176A 1550 nm XFP	{X1, X2, X3, Y1, Y2, Y3} {0.25, 0.40, 0.45, 0.25, 0.28, 0.40} {X4, Y4} {0.4, 0.25}	≥8.2 dB



Test conditions
Bit rate: 10.3125 Gbit/s
Test pattern: $PRBS2^{31} - 1$
Mark ratio: 1/2
Bessel filter: 75% of Bit rate



Test conditions
Bit rate: 10.3125 Gbit/s
Test pattern: $PRBS2^{31} - 1$
Mark ratio: 1/2
Bessel filter: 75% of Bit rate

Fig. 6.3.1.2-1 Transmitter optical output Eye mask

(2) Connection

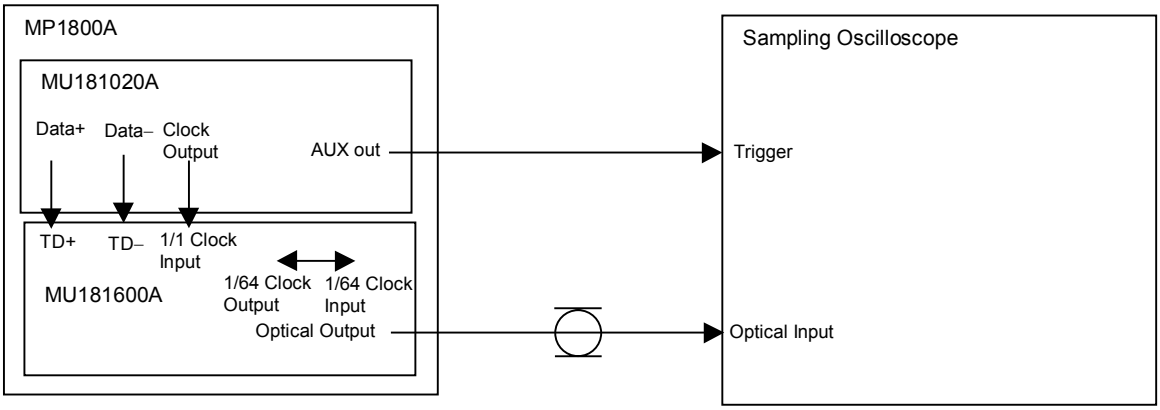


Fig. 6.3.1.2-2 Connection diagram for transmitter optical output Eye mask and extinction ratio measurement

(3) Procedure

1. Install the modules into the MP1800A, connect the cables except for the optical fiber cable, and then turn on the power.
2. Turn on the sampling oscilloscope, and warm up the measuring instruments.
3. Set the bit rate to 10.3125 Gbit/s, amplitude to 0.25 Vp-p, test pattern to PRBS2^{31} – 1, and mark ratio to 1/2 for the Data Output signal of the MU181020A.
4. Select the 1/64-divided clock for the AUX output.
5. Set the MU181020A signal output to ON to output signals.
6. After checking that the optical output power of the MU181600A does not exceed the optical input rating of the sampling oscilloscope, connect the optical output connector of the MU181600A and the optical input connector of the sampling oscilloscope.
7. Insert the Bessel LPF with a bandwidth of 75% of the specified bit rate, and check that the observed waveform meets the specification (Eye pattern mask).
8. Based on the observed waveform, calculate the extinction ratio using the following expression, and check that the obtained extinction ratio meets the specification requirements (Extinction ratio).

(4) Calculation of extinction ratio

Extinction ratio = 10 × log (A/B)

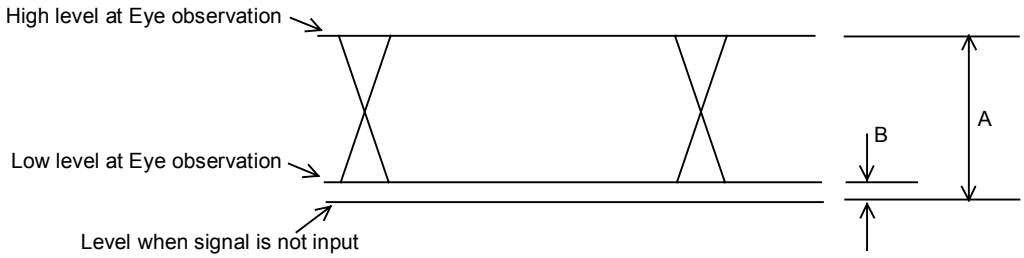


Fig. 6.3.1.2-3 Calculating extinction ratio

6.3.1.3 Transmitter optical output power

(1) Specifications

Table 6.3.1.3-1 Specifications for transmitter optical output power

XFP module	Power
G0174A 850 nm XFP	Min. –4.0 dBm, Max. –1.08 dBm at center wavelength 850nm
G0175A 1310 nm XFP	Min. –6.0 dBm, Max. –1.0 dBm
G0176A 1550 nm XFP	Min. –1.0 dBm, Max. –2.0 dBm

(2) Connection

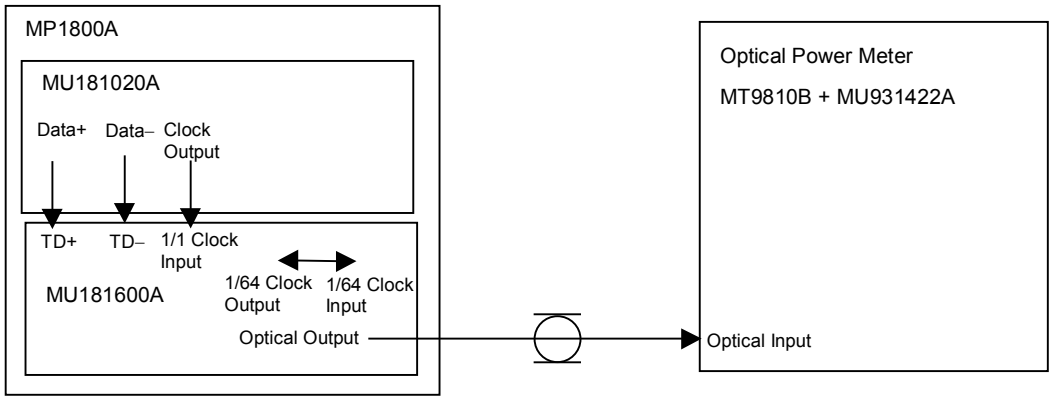


Fig. 6.3.1.3-1 Connection diagram for transmitter optical output power measurement

(3) Procedure

1. Install the plug-in units into the MP1800A, connect the cables, and then turn on the power.
2. Turn on the optical power meter, and warm up the measuring instruments.
3. Set the target wavelength for measurement to the optical power meter.
4. Set the bit rate to 10.3125 Gbit/s, amplitude to 0.25 Vp-p, test pattern to PRBS2^{31} – 1, and mark ratio to 1/2 for the Data Output signal of the MU181020A.
5. Set the MU181020A signal output to ON to output signals.
6. Check that the measured transmitter optical power meets the specification requirements.

6.3.1.4 Transmitter optical output Center wavelength, RMS spectral width, and side-mode suppression ratio

(1) Specifications

Table 6.3.1.4-1 Specifications for transmitter optical output center wavelength, RMS spectral width, and side-mode suppression ratio

XFP module	Center Wavelength	RMS Spectral Width	Side-Mode Suppression Ratio
G0174A 850 nm XFP	Min. 840 nm, Max. 860 nm	≤0.45 nm	–
G0175A 1310 nm XFP	Min. 1290 nm, Max. 1330 nm	–	≥30.0 dB
G0176A 1550 nm XFP	Min. 1530 nm, Max. 1565 nm	–	≥30.0 dB

(2) Connection

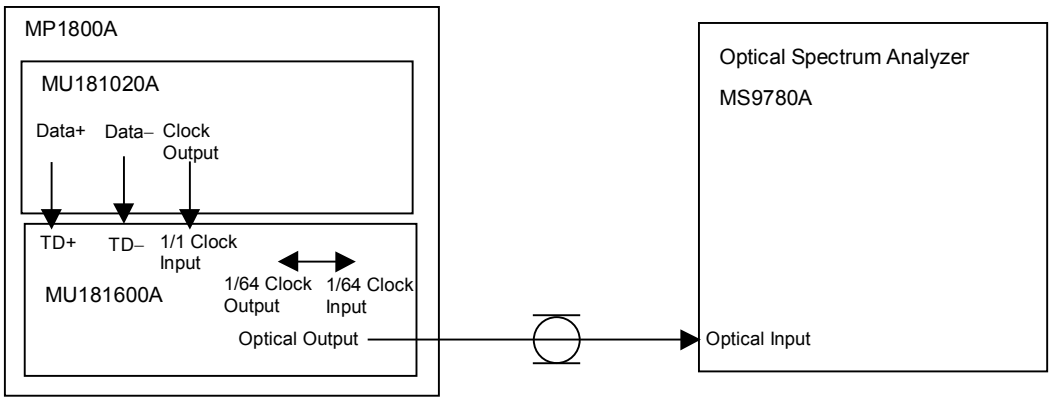


Fig. 6.3.1.4-1 Connection diagram for transmitter optical output center wavelength, RMS spectrum width, and side-mode suppression ratio measurement

(3) Procedure

1. Install the modules into the MP1800A, connect the cables, and then turn on the power.
2. Turn on the optical spectrum analyzer, and warm up the measuring instruments.
3. Set the target wavelength for measurement to the optical spectrum analyzer.
4. Set the bit rate to 10.3125 Gbit/s, amplitude to 0.25 Vp-p, test pattern to PRBS2^{31} – 1, and mark ratio to 1/2 for the Data Output signal of the MU181020A.
5. Set the MU181020A signal output to ON to output signals.

6. Check that the measured results of the center wavelength, RMS spectral width (850 nm), and side-mode suppression ratio (1310 nm, 1550 nm) meet the specification requirements.

6.3.1.5 Data output differential output level

(1) Specifications

Table 6.3.1.5-1 Specifications for data output differential output level

Differential Output Level
Min. 0.3 Vp-p, Max. 0.9 Vp-p (within the input power range of the recommended XFP module)

(2) Connection

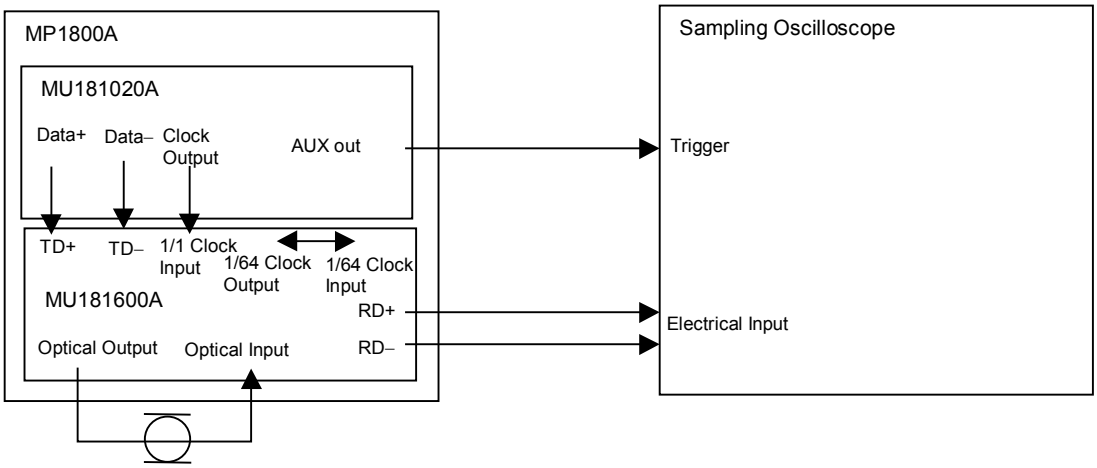


Fig. 6.3.1.5-1 Connection diagram for receiver output level measurement

(3) Procedure

1. Install the modules into the MP1800A, connect the cables, and then turn on the power.
2. Turn on the sampling oscilloscope, and warm up the measuring instruments.
3. Set the bit rate to 10.3125 Gbit/s, amplitude to 0.25 Vp-p, test pattern to PRBS2^{31} – 1, and mark ratio to 1/2 for the Data Output signal of the MU181020A.
4. Select 1/64-divided clock for the AUX output.
5. Set the MU181020A signal output to ON to output signals.
6. Check that the measured receiver output level meets the specification requirements.

6.3.1.6 Receiver minimum light receiving sensitivity and LOS assert level

(1) Specifications

Table 6.3.1.6-1 Specifications for receiver sensitivity and LOS assert level

XFP module	Minimum Light Receiving Sensitivity	LOS assert level
G0174A 850 nm XFP	≤–9.9 dBm (Average, BER ≤ 10–12)	≤–14.0 dBm
G0175A 1310 nm XFP	≤–14.4 dBm (Average, BER ≤ 10–12)	≤–20.0 dBm
G0176A 1550 nm XFP	≤–15.8 dBm (Average, BER ≤ 10–12)	≤–20.0 dBm

(2) Connection

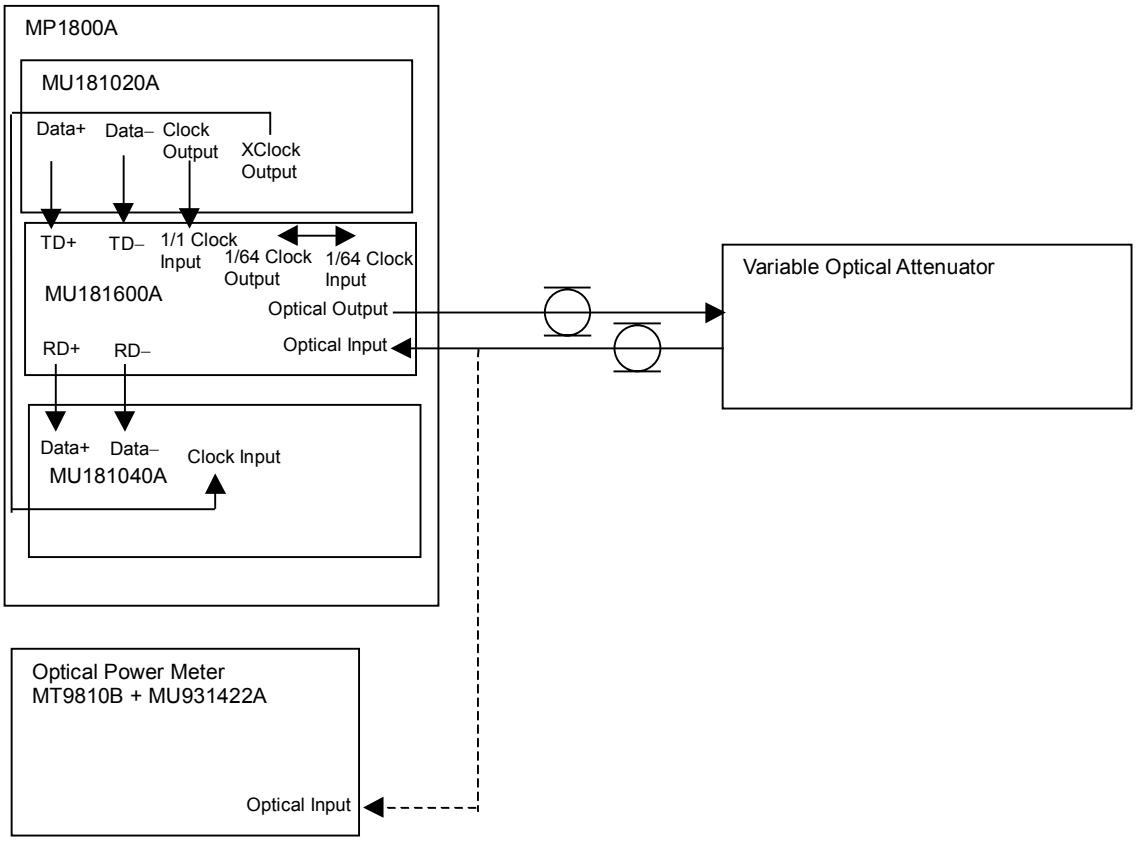


Fig. 6.3.1.6-1 Connection diagram for receiver minimum light receiving sensitivity and LOS assert level measurement

(3) Procedure

1. Install the modules into the MP1800A, connect the cables, and then turn on the power.
2. Turn on the variable optical attenuator and optical power meter, and warm up the measuring instruments.
3. Set the target wavelength for measurement to the variable optical attenuator and optical power meter.

4. Set the bit rate to 10.3125 Gbit/s, amplitude to 0.25 Vp-p, test pattern to PRBS2^{31} – 1, and mark ratio to 1/2 for the Data Output signal of the MU181020A.
5. Set the MU181020A signal output to ON to output signals.
6. Operate the variable optical attenuator so that the optical power at the optical input connector of the MU181600A becomes the specification value.
7. Check that the bit error rate at this time is no greater than 1.0E – 12 (sensitivity).
8. Check that the LOS indicator on the front panel illuminates when the fiber connected to the Optical Input connector of the MU181600A is removed (LOS assert level).

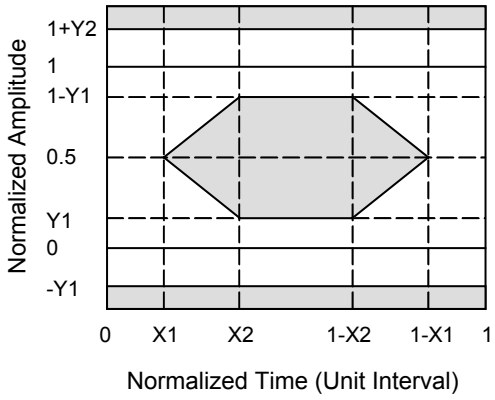
6.3.2 Performance tests for MU181601A

6.3.2.1 Transmitter optical output Eye mask, OMA, and extinction ratio

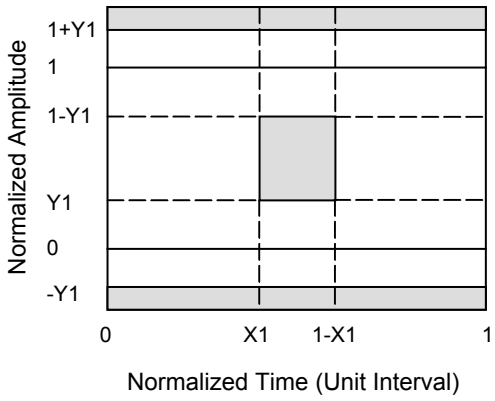
(1) Specifications

Table 6.3.2.1-1 Specifications for transmitter optical Eye mask, OMA, and extinction ratio

SFP module	Eye Mask	OMA	Extinction Ratio
G0177A 850 nm SFP	{X1, X2, Y1, Y2 } {0.22, 0.4, 0.2, 0.3}	≥247 μW	–
G0178A 1310 nm SFP	{X1, Y1} {0.4, 0.25}	–	≥8.2 dB
G0179A 1550 nm SFP	{X1, Y1} {0.4, 0.25}	–	≥8.2 dB



Test conditions
Bit rate: 4.25 Gbit/s (850 nm)
Test pattern: PRBS2^{23} – 1
Mark ratio: 1/2
Bessel filter: 75% of Bit rate



Test conditions
Bit rate: 2.48832 Gbit/s(1310 nm, 1550 nm)
Test pattern: PRBS2^{23} – 1
Mark ratio: 1/2
Bessel filter: 75% of Bit rate

Fig. 6.3.2.1-1 Transmitter optical output Eye mask

(2) Connection

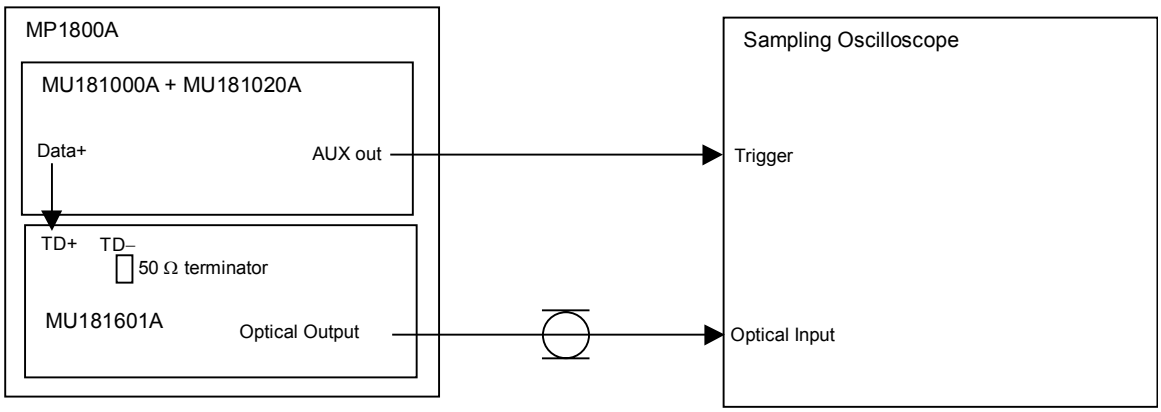


Fig. 6.3.2.1-2 Connection diagram for transmitter optical output Eye mask, OMA, and extinction ratio measurement

(3) Procedure

1. Install the modules into the MP1800A, connect the cables except for the optical fiber cable, and then turn on the power.
2. Turn on the sampling oscilloscope, and warm up the measuring instruments.
3. Set the bit rate to 4.25 Gbit/s (for 850 nm) or 2.48832 Gbit/s (for 1310 nm, 1550 nm), amplitude to 0.5 Vp-p, test pattern to $PRBS2^{23} - 1$, and mark ratio to 1/2 for the Data Output signal of the MU181020A.
4. Select 1/64-divided clock for the AUX output.
5. Set the MU181020A signal output to ON to output signals.
6. After checking that the optical output power of the MU181601A does not exceed the optical input rating of the sampling oscilloscope, connect the optical output connector of the MU181601A and the optical input connector of the sampling oscilloscope.
7. Insert the Bessel LPF with a bandwidth of 75% of the specified bit rate, and check that the observed waveform meets the specification (Eye pattern mask).
8. Measure OMA or the extinction ratio.

   8-1. When wavelength is 850 nm, measure OMA.
   Change the test pattern for the MU181020A to an 8-bit repetition pattern of "1111 0000", and observe the waveform. Calculate the OMA using the expression shown in (4), and check that the measured OMA meets the specification requirements.

8-2. When wavelength is 1310 nm or 1550 nm, measure the extinction ratio.
Based on the observed waveform, calculate the extinction ratio using the expression shown in (5), and check that the obtained extinction ratio meets the specification requirements.

(4) Calculation of OMA
OMA = P1 – P0 (μW)

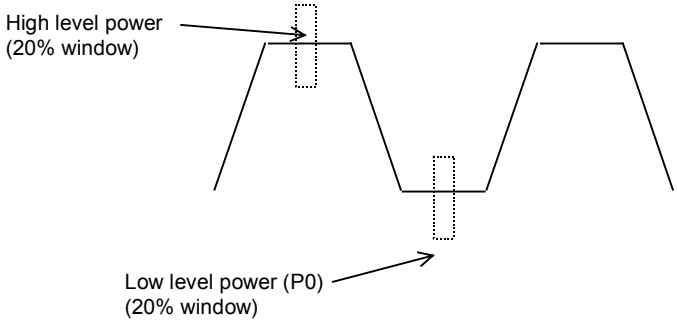


Fig. 6.3.2.1-3 Calculating OMA

(5) Calculation of extinction ratio
Extinction ratio = 10 × log (A/B)

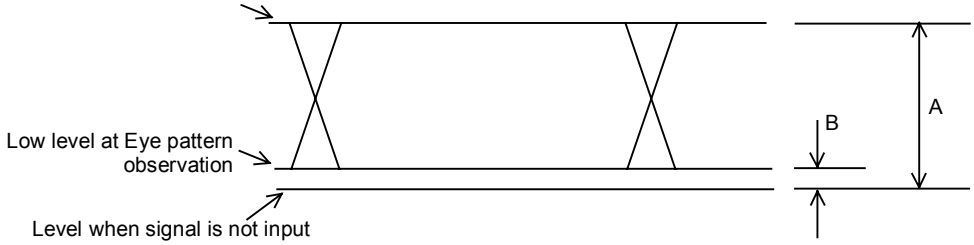


Fig. 6.3.2.1-4 Calculating extinction ratio

6.3.2.2 Transmitter optical output power

(1) Specifications

Table 6.3.2.2-1 Specifications for transmitter optical output power

SFP module	Power
G0177A 850 nm SFP	Min. –9.0 dBm, Max. –2.5 dBm
G0178A 1310 nm SFP	Min. –5.0 dBm, Max. 0.0 dBm
G0179A 1550 nm SFP	Min. –5.0 dBm, Max. 0.0 dBm

(2) Connection

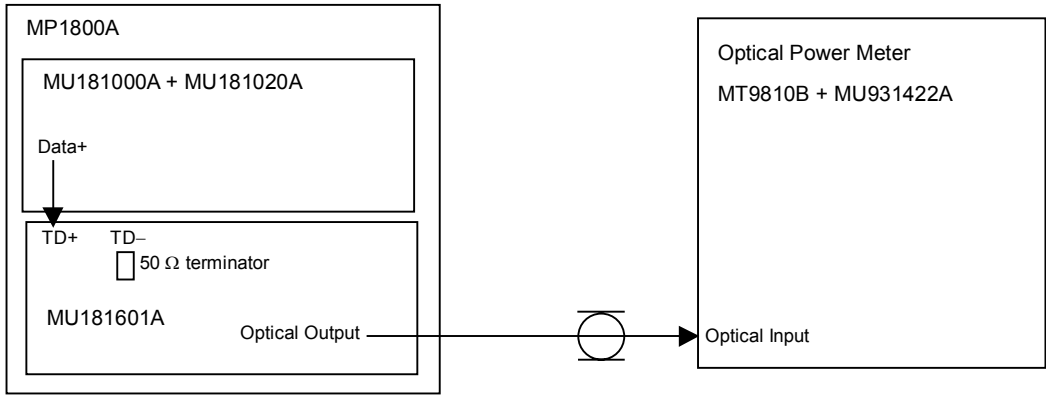


Fig. 6.3.2.2-1 Connection diagram for transmitter optical output power measurement

(3) Procedure

1. Install the modules into the MP1800A, connect the cables, and then turn on the power.
2. Turn on the optical power meter, and warm up the measuring instruments.
3. Set the target wavelength for measurement to the optical power meter.
4. Set the bit rate to 4.25 Gbit/s (for 850 nm) or 2.48832 Gbit/s (for 1310 nm, 1550 nm), amplitude to 0.5 Vp-p, test pattern to PRBS2^{23} – 1, and mark ratio to 1/2 for the Data Output signal of the MU181020A.
5. Set the MU181020A signal output to ON to output signals.
6. Check that the measured transmitter optical power meets the specification requirements.

6.3.2.3 Transmitter optical output center wavelength, RMS spectral width, and side-mode suppression ratio

(1) Specifications

Table 6.3.2.3-1 Specifications for transmitter optical output canter wavelength, RMS spectral width, and side-mode suppression ratio

SFP module	Canter Wavelength	RMS Spectral Width	Side-Mode Suppression Ratio
G0177A 850 nm SFP	Min. 830 nm, Max. 860 nm	≤0.85 nm	–
G0178A 1310 nm SFP	Min. 1270 nm, Max. 1360 nm	–	≥30.0 dB
G0179A 1550 nm SFP	Min. 1430 nm, Max. 1580 nm	–	≥30.0 dB

(2) Connection

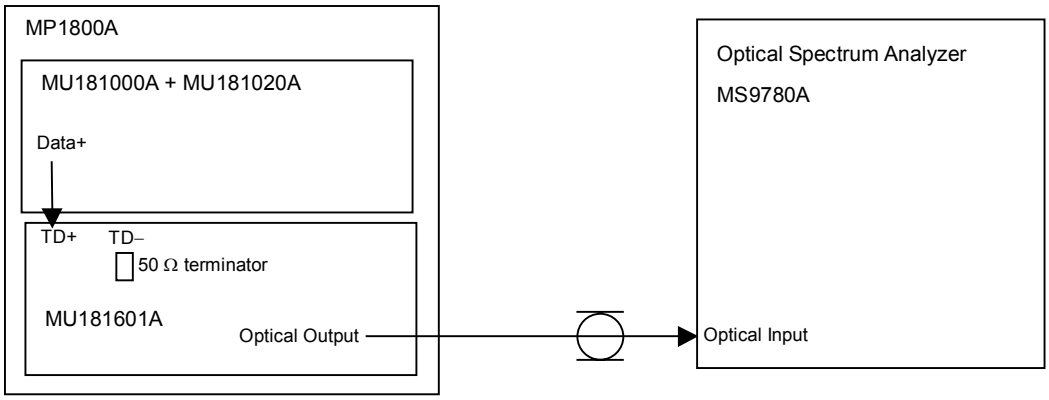


Fig. 6.3.2.3-1 Connection diagram for transmitter optical output canter wavelength, RMS spectrum width, and side-mode suppression ratio measurement

(3) Procedure

1. Install the modules into the MP1800A, connect the cables, and then turn on the power.
2. Turn on the optical spectrum analyzer, and warm up the measuring instruments.
3. Set the target wavelength for measurement to the optical spectrum analyzer.
4. Set the bit rate to 4.25 Gbit/s (for 850 nm) or 2.48832 Gbit/s (for 1310 nm, 1550 nm), amplitude to 0.5 Vp-p, test pattern to $PRBS2^{23} - 1$, and mark ratio to 1/2 for the Data Output signal of the MU181020A.
5. Set the MU181020A signal output to ON to output signals.

6. Check that the measured results of the center wavelength, RMS spectral width (850 nm), and side-mode suppression ratio (1310 nm, 1550 nm) meet the specification requirements.

6.3.2.4 Receiver output level

(1) Specifications

Table 6.3.2.4-1 Specifications for receiver output level

Receiver Output Level
Min. 0.18 Vp-p, Max. 1.0 Vp-p (within the input power range of the recommended SFP module)

(2) Connection

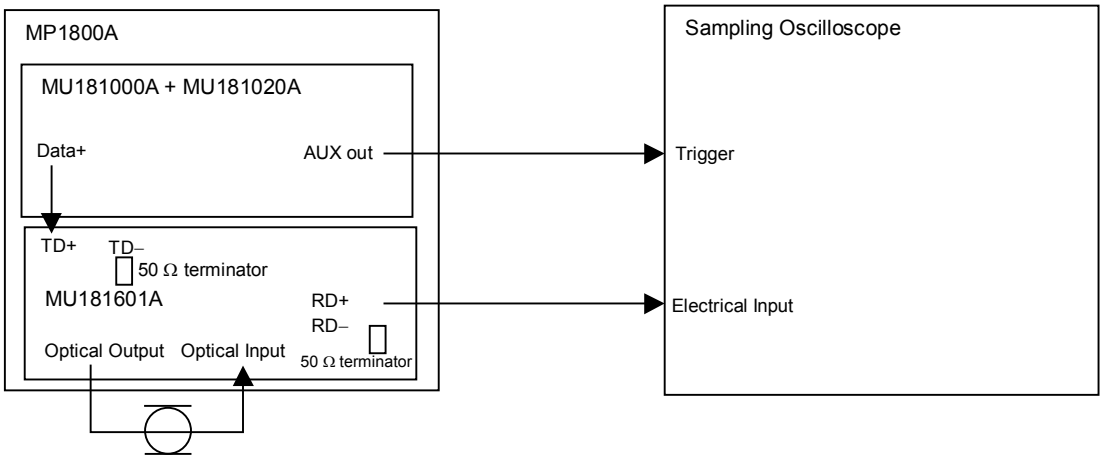


Fig. 6.3.2.4-1 Connection diagram for receiver output level measurement

(3) Procedure

1. Install the modules into the MP1800A, connect the cables except for optical fiber cables, and then turn on the power.
2. Turn on the sampling oscilloscope, and warm up the measuring instruments.
3. Set the bit rate to 4.25 Gbit/s (for 850 nm) or 2.48832 Gbit/s (for 1310 nm, 1550 nm), amplitude to 0.5 Vp-p, test pattern to PRBS2^{23} – 1, and mark ratio to 1/2 for the Data Output signal of the MU181020A.
4. Select 1/64-divided clock for the AUX output.
5. Set the MU181020A signal output to ON to output signals.
6. Check that the measured receiver output level meets the specification requirements.

6.3.2.5 Receiver minimum light receiving sensitivity and LOS detection

(1) Specifications

Table 6.3.2.5-1 Specifications for receiver minimum light receiving sensitivity and LOS detection

SFP module	Minimum Light Receiving Sensitivity	LOS detection
G0177A 850 nm SFP	≤–15.0 dBm (Average, BER ≤ 10^{-10})	≤–20.0 dBm
G0178A 1310 nm SFP	≤–18.0 dBm (Average, BER ≤ 10^{-10})	≤–18.0 dBm
G0179A 1550 nm SFP	≤–18.0 dBm (Average, BER ≤ 10^{-10})	≤–18.0 dBm

(2) Connection

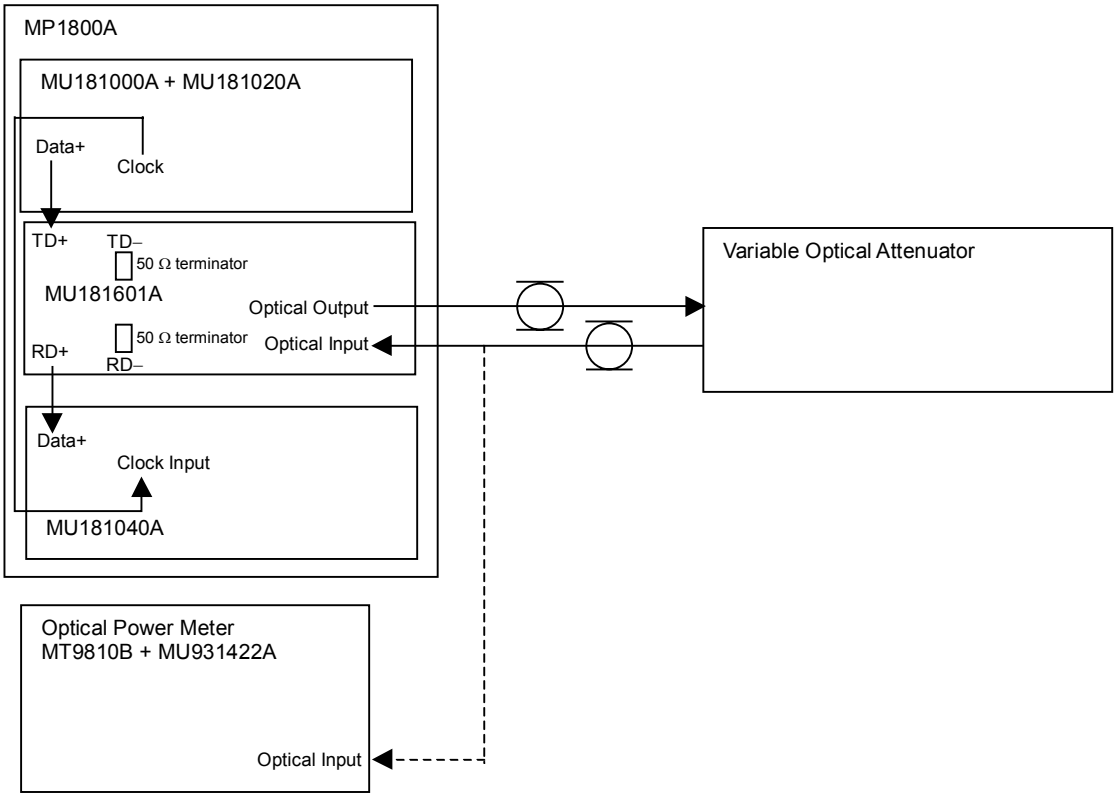


Fig. 6.3.2.5-1 Connection diagram for receiver sensitivity and LOS assert level measurement

(3) Procedure

1. Install the modules into the MP1800A, connect the cables, and then turn on the power.
2. Turn on the variable optical attenuator and optical power meter, and warm up the measuring instruments.
3. Set the target wavelength for measurement to the variable optical attenuator and optical power meter.

4. Set the bit rate to 4.25 Gbit/s (for 850 nm) or 2.48832 Gbit/s (for 1310 nm, 1550 nm), amplitude to 0.5 Vp-p, test pattern to PRBS2^{23} – 1, and mark ratio to 1/2 for the Data Output signal of the MU181020A.
5. Set the MU181020A signal output to ON to output signals.
6. Operate the variable optical attenuator so that the optical power at the optical input connector of the MU181601A becomes the specification value.
7. Check that the bit error rate at this time is no greater than 1.0E – 10 (sensitivity).
8. Check that the LOS indicator on the front panel illuminates when the fiber connected to the Optical Input connector of the MU181601A is removed (LOS assert level).

Section 7 Maintenance

This section describes the maintenance of the MU181600A and MU181601A.

7.1 Daily Maintenance

- Wipe off any external stains with a cloth damped with diluted mild detergent.
- Vacuum away any accumulated dust or dirt with a vacuum cleaner.
- Tighten any loose parts fixed with screws, using the specified tools.

7.2 Cleaning Optical Connector and Optical Adapter

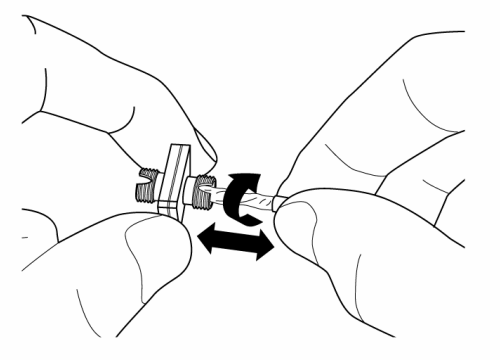
Cleaning optical adapter

When cleaning an optical adapter used for optical fiber cable connection, be sure to use an adapter cleaner that is specified as the application parts for the MU181600A and MU181601A (see Table 1.2.2-3 in Section 1).

The following shows how to clean an optical adapter, taking an FC adapter as an example. Clean other types of optical adapters in the same manner. The following method should also be used for cleaning the adapter, which is removed before cleaning the end surface of the MU181600A/MU181601A optical cable ferrule.

(1) Insert an adapter cleaner inside the split sleeve of the optical adapter.

(2) Rotate the adapter cleaner in one direction, while moving the optical adapter back and forth.



Note:

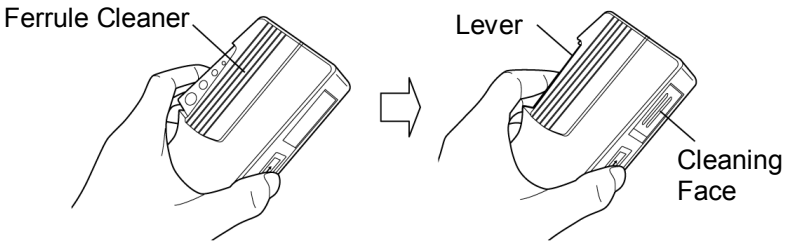
Be sure to check the ferrule diameter, and use a 1.25-mm or 2.5-mm diameter adapter cleaner.

Cleaning ferrule end surface of optical fiber cable

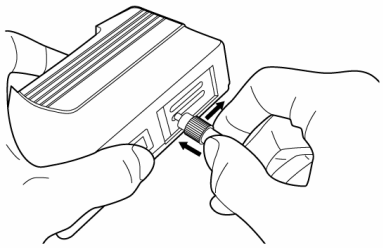
When cleaning the ferrule end surface of an optical fiber cable, be sure to use a ferrule cleaner that is specified as the application parts for the MU181600A and MU181601A (see Table 1.2.2-3 in Section 1).

The following shows how to clean the ferrule end surface, taking an FC connector as an example. Clean other types of optical connectors in the same manner.

(1) Push the lever of the ferrule cleaner to show the cleaning face.



(2) While holding the lever in a depressed position, press the ferrule end surface of the optical connector against the cleaning face, and slide it in one direction.



Cautions on cleaning

(1) Do not use used ferrule cleaners for cleaning.

(2) Do not use a cotton swab for final cleaning because cotton fiber may adhere to the ferrule.

(3) Place a cap onto the connector not in use.

WARNING

When cleaning and checking the ferrule end surface, check that there is no light being emitted.

CAUTION ⚠

Performance will be unsatisfactory if the MU181600A/ MU181601A is used with dust or dirt accumulated on the ferrule end surfaces. The ferrule end surfaces of the connected fibers and the MU181600A/MU181601A may burn if high-output lights are used with dust or dirt accumulated. Thoroughly clean the ferrule end surfaces of the connected fibers and the MU181600A/MU181601A before measurement.

7.3 Cautions on Storage

Wipe off any dust, soil, or stain on the MU181600A or MU181601A prior to storage. Avoid storing the MU181600A or MU181601A in any of the following locations:

- Where there is direct sunlight
- Where there is dust
- Where humidity is high and dew may accumulate
- Where chemically active gases are present
- Where the MU181600A or MU181601A may become oxidized
- Where strong vibrations are present
- Under the following temperature and humidity conditions:
  Temperature range of ≤–20°C or ≥ 60°C
  Humidity range of ≥85%

Recommended storage conditions

In addition to the abovementioned storage cautions, the following environment conditions are recommended for long-term storage.

- Temperature range of 5 to 30°C
- Humidity range of 40 to 75%
- Slight daily fluctuation in temperature and humidity

7.4 Transportation

Use the original packing materials, if possible, when packing the MU181600A or MU181601A for transport. If you do not have the original packing materials, pack the MU181600A or MU181601A according to the following procedure. When handling the MU181600A or MU181601A, always wear clean gloves, and handle it gently so as not to damage it.

<Procedure>

1. Use a dry cloth to wipe off any stain or dust on the exterior of the MU181600A or MU181601A.
2. Check for loose or missing screws.
3. Provide protection for structural protrusions and parts that can easily be deformed, and wrap the MU181600A or MU181601A with a sheet of polyethylene. Finally, cover with moisture-proof paper.
4. Place the wrapped MU181600A or MU181601A into a cardboard box, and tape the flaps with adhesive tape. Furthermore, store it in a wooden box as required by the transportation distance or method.

5. During transportation, place it under an environment that meets the conditions described in Section 7.3 “Cautions on Storage”.

7.5 Calibration

Regular maintenance such as periodic inspections and calibration is essential for the Signal Quality Analyzer Series for long-term stable performance. Regular inspection and calibration are recommended for using the Signal Quality Analyzer Series in its prime condition at all times. The recommended calibration cycle after delivery of the Signal Quality Analyzer Series is twelve months.

If you require support after delivery, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.

We may not provide calibration or repair if any of the following cases apply.

- Seven or more years have elapsed after production and parts for the instrument are difficult to obtain, or it is determined that reliability cannot be maintained after calibration/repair due to significant wear.
- Circuit changes, repair, or modifications are done without our approval.
- It is determined that the repair cost would be higher than the price of a new item.

7.6 Disposal

Confirm the notes described in the Signal Quality Analyzer Series Installation Guide and observe national and local regulations when disposing of the MU181600A or MU181601A.

Section 8 Troubleshooting

This section describes how to check whether a failure has arisen when an error occurs during the operation of the MU181600A or MU181601A.

8.1 Problems Discovered during XFP/SFP Module Replacement

Table 8.1-1 Remedies for problems discovered during replacement of XFP/SFP module

Symptom	Location to Check	Remedy
A module is not recognized.	Is the module installed properly?	Install the module again by referring to Section 2.3 "Installing and Removing Modules" in the installation guide.
	Is the module supported by the main frame?	Check the supported modules and the software version of the MU181600A and MU181601A at our Web site (http://www.anritsu.co.jp/E/MP1800A). If the module is supported, it may have failed. Contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.
The XFP/SFP module is not recognized.	Is the module inserted properly?	Install the module again by referring to Section 2.4 "Inserting/Removing XFP/SFP Modules While Power Is On".
	Is Power Down set to Operation? (MU181600A only)	Press the Power Down button to change to the Operation mode. If it is already set to "Operation", the MU181600A, MU181601A, or XFP/SFP module may have failed. Contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.
	Does the Tx Err LED light when Data or 1/64 Clock is not entered? (MU181600A only)	If it does not light, the MU181600A or XFP module may have failed. Contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.
	Does the Rx Err LED light when an optical signal is not input? (The Power Down button must be set to "Operation" for the MU181600A.)	If it does not light, the MU181600A, MU181601A, or XFP/SFP module may have failed. Contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.

8.2 Problems Discovered during use of MU181600A/ MU181601A

Table 8.2-1 Remedies for problems discovered during use of MU181600A/MU181601A

Symptom	Location to Check	Remedy
No light is emitted, or the optical output level is too low.	Are the end faces of the optical connector clean?	Use a ferrule cleaner to clean the connector end faces.
	Is the used fiber appropriate for the XFP/SFP module?	Replace the fiber with an applicable fiber for the XFP/SFP module.
	Is Optical Output ON?	Click the Optical Output button to set it to ON.
	Is the Output Control switch ON?	Click the Optical control switch button to set it to ON.
	Is the Laser Fault alarm displayed?	The MU181600A, MU181601A, or XFP/SFP module may have failed. Contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.
Optical output waveforms cannot be observed correctly.	Is the data rate set properly? (MU181600A only)	Set the Data Rate setting to the bit rate actually used.
	Is the reference clock connected properly? (MU181600A only)	A 1/64 clock of the operation bit rate must be connected as the reference clock. Check the interface in Sections 1.3 “Specifications” and 3.1 “Panel Layout”.
	Is the Unlock alarm displayed? (MU181600A only)	The XFP module may have failed. Contact the distributor of the XFP module.
	Are the input level and bit rate for Tx+Tx correct?	Check the interface in Sections 1.3 “Specifications” and 3.1 “Panel Layout”. If the input level and bit rate are correct, the MU181600A, MU181601A, or XFP/SFP module may have failed. Contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.
LOS is not detected correctly.	Are the end faces of the optical connector clean?	Use a ferrule cleaner to clean the connector end face.
	Is the used fiber appropriate for the XFP/SFP module?	Replace the fiber with an applicable fiber for the XFP/SFP module.

Table 8.2-1 Remedies for problems discovered during use of MU181600A/MU181601A (continued)

Symptom	Location to Check	Remedy
An error occurs.	Is the data rate set properly? (MU181600A only)	Set the Data Rate setting to the bit rate actually used.
	Is the reference clock connected properly? (MU181600A only)	A 1/64 clock of the operation bit rate must be connected as the reference clock. Check the interface in Sections 1.3 "Specifications" and 3.1 "Panel Layout".
An error occurs. (continued)	Is the CDR Unlock alarm displayed? (MU181600A only)	The XFP module may have failed. Contact the distributor of the XFP module.
	Are the optical input level and bit rate correctly set?	Check the specifications of the XFP/SFP modules again.
	Is the electric interface cable loose?	Tighten the connector.
	Is the unused output connector terminated?	Terminate it properly.
	Do the cables and connectors used have good high-frequency characteristics?	Use cables and connectors with good high-frequency characteristics. If the high-frequency characteristics are good, the MU181600A, MU181601A, or XFP/SFP module may have failed. Contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.

If a problem cannot be solved using any of the items listed above, perform initialization and check the items again. If the problem still occurs, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.

Appendix A Performance Test Result Sheet

A.1 Performance Test Result Sheet

A.1.1 Performance test result sheet for MU181600A

Device name: MU181600A Optical Transceiver (XFP)

Serial No.: _____

Ambient temperature: _____ °C

Relative humidity: _____ %

Table A.1.1-1 1/64 clock output test

Item	Specifications	Measured Result
Output level	0.5 Vp-p ±0.18 V	
Rise/fall time	300 ±100 ps (20 to 80%)	
Duty	50 ±10%	

Table A.1.1-2 Eye mask test

XFP module	Specifications	Measured Result
G0174A 850 nm XFP	{X1, X2, X3, Y1, Y2, Y3} {0.25, 0.40, 0.45, 0.25, 0.28, 0.40}	
G0175A 1310 nm XFP	{X1, X2, X3, Y1, Y2, Y3} {0.25, 0.40, 0.45, 0.25, 0.28, 0.40} {X4, Y4} {0.4, 0.25}	
G0176A 1550 nm XFP	{X1, X2, X3, Y1, Y2, Y3} {0.25, 0.40, 0.45, 0.25, 0.28, 0.40} {X4, Y4} {0.4, 0.25}	

Table A.1.1-3 Extinction ratio test

XFP module	Specifications	Measured Result
G0174A 850 nm XFP	≥3.0 dB	
G0175A 1310 nm XFP	≥6.0 dB	
G0176A 1550 nm XFP	≥8.2 dB	

Table A.1.1-4 Optical output power test

XFP module	Specifications	Measured Result
G0174A 850 nm XFP	Min. –4.0 dBm, Max. –1.08 dBm at center wavelength 850 nm	
G0175A 1310 nm XFP	Min. –6.0 dB, Max. –1.0 dB	
G0176A 1550 nm XFP	Min. –1.0 dB, Max. +2.0 dB	

Table A.1.1-5 Center wavelength test

XFP module	Specifications	Measured Result
G0174A 850 nm XFP	Min. 840 nm, Max. 860 nm	
G0175A 1310 nm XFP	Min. 1290 nm, Max. 1330 nm	
G0176A 1550 nm XFP	Min. 1530 nm, Max. 1565 nm	

Table A.1.1-6 RMS spectral width test

XFP module	Specifications	Measured Result
G0174A 850 nm XFP	≤0.45 nm	

Table A.1.1-7 Side-mode suppression ratio test

XFP module	Specifications	Measured Result
G0175A 1310 nm XFP	≥30.0 dB	
G0176A 1550 nm XFP	≥30.0 dB	

Table A.1.1-8 Receiver differential output level test

Item	Specifications	Measured Result
Receiver differential output level	Min. 0.3 Vp-p, Max. 0.9 Vp-p (within the input power range of the recommended XFP module)	

Table A.1.1-9 Receiver sensitivity test

XFP module	Specifications	Measured Result
G0174A 850 nm XFP	≤–9.9 dBm (Average, BER≤10^{-12})	
G0175A 1310 nm XFP	≤–13.4 dBm (Average, BER≤10^{-12})	
G0176A 1550 nm XFP	≤–15.8 dBm (Average, BER≤10^{-12})	

A.1.2 Performance test result sheet for MU181601A

Device name: MU181601A Optical Transceiver (SFP)

Serial No.: _____

Ambient temperature: _____ °C

Relative humidity: _____ %

Table A.1.2-1 Eye mask test

SFP module	Specifications	Measured Result
G0177A 850 nm SFP	{X1, X2, Y1, Y2} {0.22, 0.4, 0.2, 0.3}	
G0178A 1310 nm SFP	{X1, Y1} {0.4, 0.25}	
G0179A 1550 nm SFP	{X1, Y1} {0.4, 0.25}	

Table A.1.2-2 OMA test

SFP module	Specifications	Measured Result
G0177A 850 nm SFP	≥247 μW	

Table A.1.2-3 Extinction ratio test

SFP module	Specifications	Measured Result
G0178A 1310 nm SFP	≥8.2 dB	
G0179A 1550 nm SFP	≥8.2 dB	

Table A.1.2-4 Optical output power test

SFP module	Specifications	Measured Result
G0177A 850 nm SFP	Min. –9.0 dBm, Max. –2.5 dBm	
G0178A 1310 nm SFP	Min. –5.0 dBm, Max. 0.0 dBm	
G0179A 1550 nm SFP	Min. –5.0 dBm, Max. 0.0 dBm	

Table A.1.2-5 Center wavelength test

SFP module	Specifications	Measured Result
G0177A 850 nm SFP	Min. 830 nm, Max. 860 nm	
G0178A 1310 nm SFP	Min. 1270 nm, Max. 1360 nm	
G0179A 1550 nm SFP	Min. 1430 nm, Max. 1580 nm	

Table A.1.2-6 RMS spectral width test

SFP module	Specifications	Measured Result
G0177A 850 nm SFP	≤0.85 nm	

Table A.1.2-7 Side-mode suppression ratio test

SFP module	Specifications	Measured Result
G0178A 1310 nm SFP	≥30.0 dB	
G0179A 1550 nm SFP	≥30.0 dB	

Table A.1.2-8 Receiver differential output level test

Item	Specifications	Measured Result
Receiver differential output level	Min. 0.18 Vp-p, Max. 1.0 Vp-p (within the input power range of the recommended SFP module)	

Table A.1.2-9 Receiver minimum light receiving sensitivity test

SFP module	Specifications	Measured Result
G0177A 850 nm SFP	≤–15.0 dBm (Average, BER≤10^{-10})	
G0178A 1310 nm SFP	≤–18.0 dBm (Average, BER≤10^{-10})	
G0179A 1550 nm SFP	≤–18.0 dBm (Average, BER≤10^{-10})	

Appendix B List of Initial Setting Items

B.1 List of Initial Setting Items

B.1.1 Initial setting items for MU181600A

Table B.1.1-1 Initial setting items for MU181600A

XFP module	When G0174A 850nm XFP module (9.95 to 11.10 Gbit/s) is installed	
Item		Value
Tx & Rx	Optical Output	ON
	Data Rate	10.5 Gbit/s
	Wavelength	850 nm
	Power Down	Operation
XFP module	When G0175A 1310 nm XFP module (9.95 to 11.30 Gbit/s) is installed	
Item		Value
Tx & Rx	Optical Output	ON
	Data Rate	–
	Wavelength	1310 nm
	Power Down	Operation
XFP module	When G0176A 1550 nm XFP module (9.95 to 10.75 Gbit/s) is installed	
Item		Value
Tx & Rx	Optical Output	ON
	Data Rate	–
	Wavelength	1550 nm
	Power Down	Operation
XFP module	When any module other than those recommended is recognized	
Item		Value
Tx & Rx	Optical Output	ON
	Data Rate	Varies depending on the XFP module.
	Wavelength	–
	Power Down	Operation
XFP module	When no module is installed	
Item		Value
Tx & Rx	Optical Output	–
	Data Rate	–
	Wavelength	–
	Power Down	Standby

B.1.2 Initial setting items for MU181601A

Table B.1.2-1 Initial setting items for MU181601A

SFP module	When G0177A 850nm SFP module (1.062 to 4.25 Gbit/s) is installed	
Item		Value
Tx & Rx	Optical Output	ON
	Wavelength	850 nm
	Rx Rate Select	Full
SFP module	When G0178A 1310nm SFP module (0.155 to 2.67 Gbit/s) is installed	
Item		Value
Tx & Rx	Optical Output	ON
	Wavelength	1310 nm
	Rx Rate Select	–
SFP module	When G0179A 1550nm SFP module (0.155 to 2.67 Gbit/s) is installed	
Item		Value
Tx & Rx	Optical Output	ON
	Wavelength	1550 nm
	Rx Rate Select	–
SFP module	When any module other than those recommended is recognized	
Item		Value
Tx & Rx	Optical Output	ON
	Wavelength	–
	Rx Rate Select	Full
SFP module	When no module is installed	
Item		Value
Tx & Rx	Optical Output	–
	Wavelength	–
	Rx Rate Select	Full