MX181500A
Jitter/Noise Tolerance
Test Software
Operation Manual

11th 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 them before using the equipment.
- Keep this manual with the equipment.

ANRITSU CORPORATION

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.

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Equipment Certificate

Anritsu Corporation guarantees that this equipment was inspected at shipment and meets the published specifications.

Anritsu Warranty

- During the warranty period, Anritsu Corporation will repair or exchange this software free-of-charge if it proves defective when used as described in the operation manual.
- The warranty period is 6 months from the purchase date.
- The warranty period after repair or exchange will remain 6 months from the original purchase date, or 30 days from the date of repair or exchange, depending on whichever is longer.
- This warranty does not cover damage to this software caused by Acts of God, natural disasters, and misuse or mishandling by the customer.

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 damage or financial loss of the customer due to the use of or a failure to use this equipment, unless the damage or loss is caused due to Anritsu Corporation's intentional or gross negligence.

Anritsu Corporation Contact

In the event of this equipment malfunctions, please 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 PDF version.

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Please carefully read and accept this Software End-User License Agreement (hereafter this EULA) before using (includes executing, copying, installing, registering, etc.) this Software (includes programs, databases, scenarios, etc., used to operate, set, etc., Anritsu electronic equipment, etc.). By using this Software, you shall be deemed to have agreed to be bound by the terms of this EULA, and Anritsu Corporation (hereafter Anritsu) hereby grants you the right to use this Software with the Anritsu specified equipment (hereafter Equipment) for the purposes set out in this EULA.

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1. You may not to sell, transfer, rent, lease, lend, disclose, sublicense, or otherwise distribute this Software to third parties, whether or not paid therefor.
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3. You are not permitted to reverse engineer, disassemble, decompile, modify or create derivative works of this Software.
4. This EULA allows you to install one copy of this Software on one piece of Equipment.

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To the extent not prohibited by law, in no event shall Anritsu be liable for direct, or any incidental, special, indirect or consequential damages whatsoever, including, without limitation, damages for loss of profits, loss of data, business interruption or any other commercial damages or losses, and damages claimed by third parties, arising out of or related to your use or inability to use this Software, unless the damages are caused due to Anritsu's intentional or gross negligence.

Article 3.   Limitation of Liability

1. If a fault (bug) is discovered in this Software, failing this Software to operate as described in the operation manual or specifications even though you have used this Software as described in the manual, Anritsu shall at its own discretion, fix the bug, or replace the software, or suggest a workaround, free-of-charge, provided, however, that the faults caused by the following items and any of your lost or damaged data whatsoever shall be excluded from repair and the warranty.

   i)   If this Software is deemed to be used for purposes not described in the operation manual or specifications.

   ii) If this Software has been used in conjunction with other non-Anritsu-approved software.

   iii) If this Software or the Equipment has been modified, repaired, or otherwise altered without Anritsu's prior approval.

   iv) For any other reasons out of Anritsu's direct control and responsibility, such as but not limited to, natural disasters, software virus infections, or any devices other than this Equipment, etc.

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

3. The warranty period for faults listed in Section 1 of this Article shall be either 6 months from the date of purchase of this Software or 30 days after the date of repair or replacement, whichever is longer.

Article 4.   Export Restrictions

You shall not use or otherwise export or re-export directly or indirectly this Software except as authorized by the laws and regulations of Japan and the United States, etc. In particular, this Software shall not be exported or re-exported (a) into any Japan or US embargoed countries or (b) to anyone restricted by the Japanese export control regulations, or the US Treasury Department's list of Specially Designated Nationals or the US Department of Commerce Denied Persons List or Entity List. In using this Software, you warrant that you are not located in any such embargoed countries or on any such lists. You also agree that you will not use or otherwise export or re-export this Software for any purposes prohibited by the Japanese and US laws and regulations, including, without limitation, the development, design and manufacture or production of missiles or nuclear, chemical or biological weapons of mass destruction, and conventional weapons.

Article 5.   Change of Terms

Anritsu may change without your approval the terms of this EULA if the changes are for the benefit of general customers, or are reasonable in light of the purpose of this EULA and circumstances of the changes. At the time of change, Anritsu will inform you of those changes and its effective date, as a general rule 45 days, in advance on its website, or in writing or by e-mail.

Article 6.   Termination

1.   Anritsu may terminate this EULA immediately if you violate any conditions described herein. This EULA shall also be terminated immediately by Anritsu if there is any good reason that it is deemed difficult to continue this EULA, such as your violation of Anritsu copyrights, patents, etc. or any laws and ordinances, or if it turns out that you belong to an antisocial organization or has a socially inappropriate relationship with members of such organization.

2.   You and Anritsu may terminate this EULA by a written notice to the other party 30 days in advance.

Article 7.   Damages

If Anritsu suffers any damages or 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.

Article 8.   Responsibility after Termination

Upon termination of this EULA in accordance with Article 6, you shall cease all uses 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.

Article 9.   Negotiation for Dispute Resolution

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

Article 10. Governing Law and Court of Jurisdiction

This EULA shall be governed by and interpreted in accordance with the laws of Japan without regard to the principles of the conflict of laws thereof, and any disputes arising from or in relation to this EULA that cannot be resolved by negotiation described in Article 9 shall be subject to and be settled by the exclusive agreed jurisdiction of the Tokyo District Court of Japan.

Revision History:

February 29th, 2020

Protection Against Computer Virus Infections

Prior to the software installation

Before installing this software or any other software recommended or approved by Anritsu, run a virus scan on your computer, including removable media (e.g. USB flash drive and CF memory card) you want to connect to your computer.

When using this software and connecting with the measuring instrument
- Copying files and data
  On your computer, do not save any copies other than the following:
  - Files and data provided by Anritsu
  - Files created by this software
  - Files specified in this document
- Before copying these files and/or data, run a virus scan, including removable media (e.g. USB flash drive and CF memory card).
- Connecting to network
  Connect your computer to the network that provides adequate protection against computer viruses.

Cautions on Proper Operation of Software

This software may not operate normally if any of the following operations are performed on your computer:
- Simultaneously running any software other than that recommended or approved by Anritsu
- Closing the lid (Laptop computer)
- Turning on the screen saver function
- Turning on the battery-power saving function (Laptop computer)

For how to turn off the functions, refer to the operation manual that came with your computer.

About This Manual

A testing system comprised of the Signal Quality Analyzer MP1800A, 4-Slot Chassis MT1810A, module(s), and control software is called the Signal Quality Analyzer series. A set of operation manuals of the Signal Quality Analyzer series consists of separate documents about installation guide, the mainframe, remote control operation, module(s), control software, and extended applications as shown below.
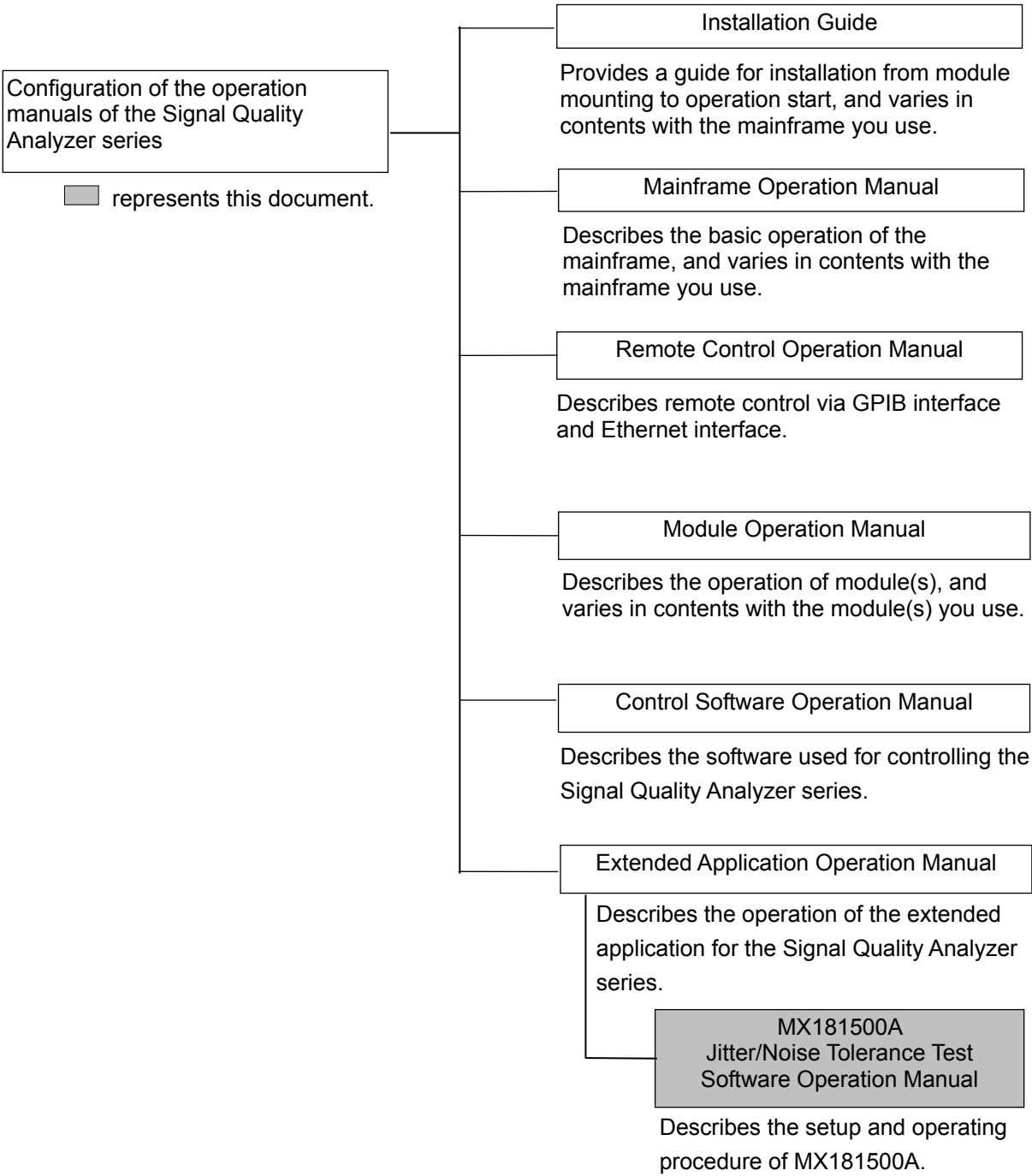
Configuration of the operation manuals of the Signal Quality Analyzer series	**Installation Guide**
	Provides a guide for installation from module mounting to operation start, and varies in contents with the mainframe you use.

░ represents this document.

Mainframe Operation Manual

Describes the basic operation of the mainframe, and varies in contents with the mainframe you use.

Remote Control Operation Manual

Describes remote control via GPIB interface and Ethernet interface.

Module Operation Manual

Describes the operation of module(s), and varies in contents with the module(s) you use.

Control Software Operation Manual

Describes the software used for controlling the Signal Quality Analyzer series.

Extended Application Operation Manual

Describes the operation of the extended application for the Signal Quality Analyzer series.

**MX181500A
Jitter/Noise Tolerance Test
Software Operation Manual**

Describes the setup and operating procedure of MX181500A.

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Appendix

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IV.

Chapter 1 Outline

This chapter explains an outline of the product and the product composition.

1

Outline

1.1 Outline

The MX181500A Jitter/Noise Tolerance Test Software (hereafter MX181500A) controls the following equipment to measure jitter tolerance according to the standards in the 10 Gbit/s and 20 Gbit/s bands.

- MP1800A Signal Quality Analyzer or
  MT1810A 4-slot Chassis
- MU181000A 12.5 GHz Synthesizer or
  MU181000B 12.5 GHz 4-port Synthesizer
- MU181500B Jitter Modulation Source
- MU181020A 12.5 GHz Pulse Pattern Generator or
  MU181020B 14 GHz Pulse Pattern Generator
- MU181040A 12.5 GHz Error Detector or
  MU181040B 14 GHz Error Detector
- MU182020A 25 Gbit/s 1ch MUX or
  MU182021A 25 Gbit/s 2ch MUX
- MU182040A 25 Gbit/s 1ch MUX or
  MU182041A 25 Gbit/s 2ch MUX
- MU183020A 28G/32G bit/s PPG or
  MU183021A 28G/32G bit/s 4ch PPG
- MU183040A 28G/32G bit/s ED or
  MU183041A 28G/32G bit/s 4ch ED
- MU183040B 28G/32G bit/s High Sensitivity ED or
  MU183041B 28G/32G bit/s 4ch High Sensitivity ED
- MP1821A 50G/56G bit/s MUX
- MP1822A 50G/56G bit/s DEMUX
- MP1861A 56G/64G bit/s MUX
- MP1862A 56G/64G bit/s DEMUX

MX181500A controls MP1800A or MT1810A via Ethernet. It measures a bit error rate or bit errors while varying a jitter frequency and jitter modulation of MU181500B.
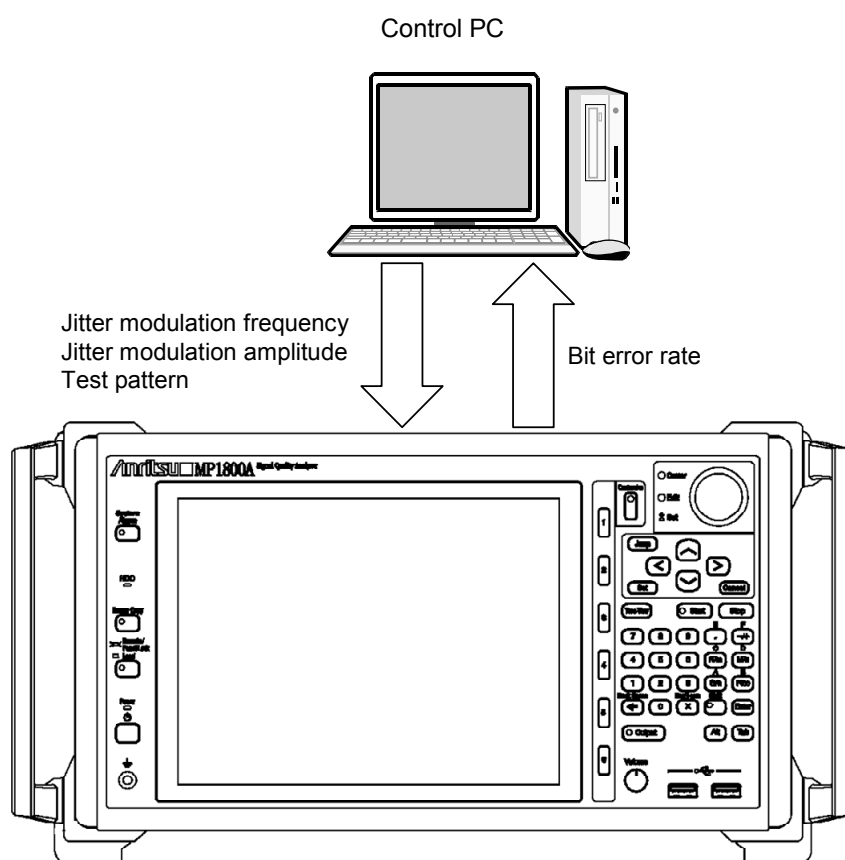
Figure 1.1-1   Setup and measurement items of MX181500A

Jitter tolerance measurement (Jitter Tolerance)

In jitter tolerance measurement, jitter modulated data is sent to a device under test to find the tolerance limit at the maximum jitter amplitude within a specified bit error rate.

Jitter modulation frequencies and jitter amplitudes are illustrated in the figure and table below.
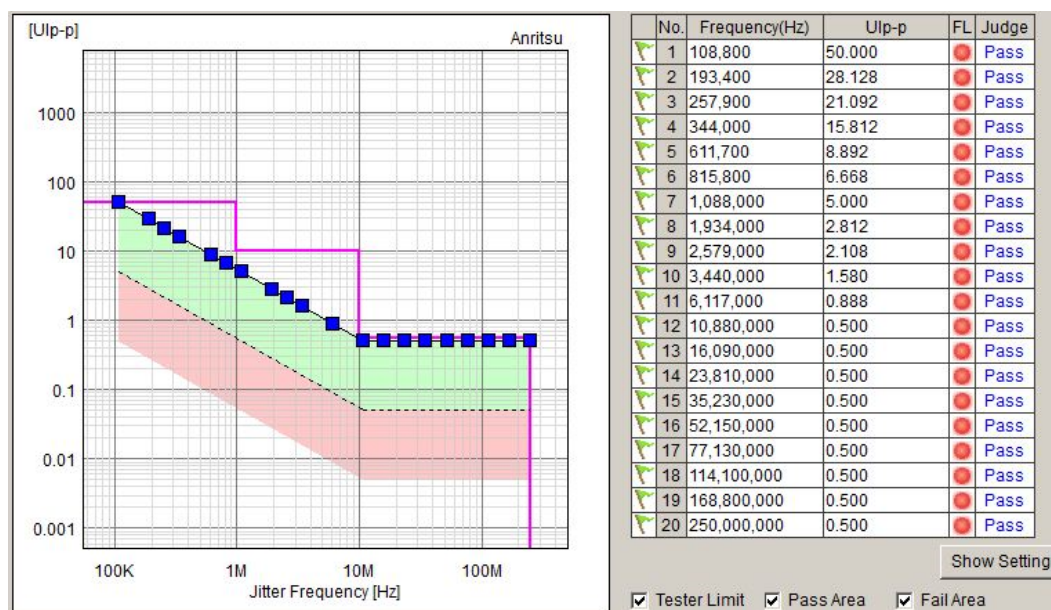
No.	Frequency(Hz)	UIp-p	FL	Judge
1	108,800	50.000	🔴	Pass
2	193,400	28.128	🔴	Pass
3	257,900	21.092	🔴	Pass
4	344,000	15.812	🔴	Pass
5	611,700	8.892	🔴	Pass
6	815,800	6.668	🔴	Pass
7	1,088,000	5.000	🔴	Pass
8	1,934,000	2.812	🔴	Pass
9	2,579,000	2.108	🔴	Pass
10	3,440,000	1.580	🔴	Pass
11	6,117,000	0.888	🔴	Pass
12	10,880,000	0.500	🔴	Pass
13	16,090,000	0.500	🔴	Pass
14	23,810,000	0.500	🔴	Pass
15	35,230,000	0.500	🔴	Pass
16	52,150,000	0.500	🔴	Pass
17	77,130,000	0.500	🔴	Pass
18	114,100,000	0.500	🔴	Pass
19	168,800,000	0.500	🔴	Pass
20	250,000,000	0.500	🔴	Pass

Show Setting

☑ Tester Limit ☑ Pass Area ☑ Fail Area

Figure 1.1-2   Jitter tolerance measurement result screen

Jitter sweep (Jitter Sweep)

In jitter sweep, a jitter modulation frequency and jitter amplitude are varied according to the specified mask standard to measure a bit error rate.

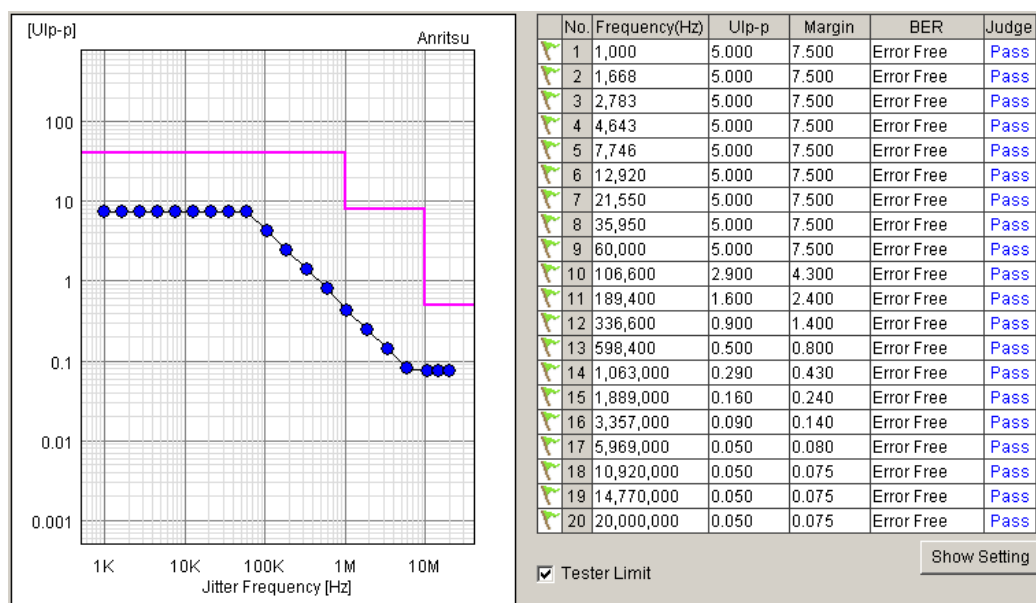Jitter modulation frequencies and bit error rates are illustrated in the figure and table below.

No.	Frequency(Hz)	UIp-p	Margin	BER	Judge
1	1,000	5.000	7.500	Error Free	Pass
2	1,668	5.000	7.500	Error Free	Pass
3	2,783	5.000	7.500	Error Free	Pass
4	4,643	5.000	7.500	Error Free	Pass
5	7,746	5.000	7.500	Error Free	Pass
6	12,920	5.000	7.500	Error Free	Pass
7	21,550	5.000	7.500	Error Free	Pass
8	35,950	5.000	7.500	Error Free	Pass
9	60,000	5.000	7.500	Error Free	Pass
10	106,600	2.900	4.300	Error Free	Pass
11	189,400	1.600	2.400	Error Free	Pass
12	336,600	0.900	1.400	Error Free	Pass
13	598,400	0.500	0.800	Error Free	Pass
14	1,063,000	0.290	0.430	Error Free	Pass
15	1,889,000	0.160	0.240	Error Free	Pass
16	3,357,000	0.090	0.140	Error Free	Pass
17	5,969,000	0.050	0.080	Error Free	Pass
18	10,920,000	0.050	0.075	Error Free	Pass
19	14,770,000	0.050	0.075	Error Free	Pass
20	20,000,000	0.050	0.075	Error Free	Pass

Show Setting

☑ Tester Limit

Figure 1.1-3   Jitter sweep measurement result screen

1.2 Features

MX181500A has the following features.

- In jitter tolerance measurement, MX181500A controls MU181500B to execute variable SJ measurement with an additional fixed value jitter such as RJ, BUJ or others.
- Jitter tolerance measurement provides three methods for varying jitter amplitude depending on the characteristics of Serdes, as shown below.
  Binary search
  Downward search from the upper limit value to the lower limit value
  Upward search from the lower limit value to the upper limit value
- In jitter sweep measurement, MX181500A controls MU181500B to make PASS/FAIL judgment based on various jitter mask standards with an additional fixed value jitter such as RJ, BUJ, or others. Further a margin can be set in a range of 10 to 100% to the standard mask.
- Mask measurement according to various standards is available.
- MX181500A can control up to three MP1800A signal quality analyzers or 4-slot-chassis MT1810A.
- Up to 25 Gbit/s jitter test is available.
  (25G MUX and DEMUX are used.)
- Up to 42 Gbit/s jitter test is available.
  (50G MUX and DEMUX are used.)
- Measurement results can be output in the html or CSV format.
- Up to 32.1 Gbit/s jitter test is available.
  (32G PPG and 32G ED are used.)
- Up to 56 Gbit/s jitter test is available.
  (56G MUX and 64G DEMUX are used.)

1.3 Intended Use

MX181500A is intended to use for Jitter tolerance measurement of Serdes devices that comply with the standards in the following bands:

- Less than 10 Gbit/s
- 10 Gbit/s
- 20 Gbit/s
- 8 to 56 Gbit/s bands

1.4 Glossary

The following table contains the abbreviations used in this document and MX181500A.

Table 1.4-1   Abbreviation

Abbreviation	Full Term
BER	Bit Error Rate
BUJ	Bounded Uncorrelated Jitter
CSV	Comma Separated Value
DEMUX	De-multiplexer
ED	Error Detector
HPF	High Pass Filter
HTML	Hyper Text Markup Language
LPF	Low Pass Filter
MUX	Multiplexer
PPG	Pulse Pattern Generator
PRBS	Pseudorandom Bit Sequence
RJ	Random Jitter
Serdes	Serializer/Deserializer
SSC	Spread Spectrum Clock
SJ	Sinusoidal Jitter
UI	Unit Interval

Chapter 2   Before Use

This chapter describes preparation required before using MX181500A.

2

Before Use

2.1   Unpacking

At unpacking, refer to the standard configuration list shown in Table A-1 "Configuration" in Appendix A to make sure all items are included. Contact your Anritsu Service and Sales Office or an agent if any part is missing or damaged.

2.2   Operating Environment

As for the operating environment   of a control personal computer (PC), refer to Table A-2 "Operation Environment" in Appendix A.

MX181500A can be run on a control PC as well as on the Signal Quality Analyzer MP1800A (hereafter, MP1800A). When you install MX181500A on MP1800A, use the mouse to operate the software.

⚠ CAUTION

When either one of the following operations starts during the startup process of MX181500A, it might not work well.
- **Running another application at the same time**
- **Closing the lid of a laptop PC**
- **Using Screen Saver**
- **Battery saving operation in a laptop PC**

Refer to the PC operation manual to disable each feature.

2.3 Installation/Uninstallation

MX181500A can be used in two installation modes: installation on MP1800A and installation on an external PC.

Given below is an installation procedure in each mode.

2.3.1 Installing MX181500A on MP1800A

1. Copy the installation execution file of MX181500A to USB memory via PC. Note that USB memory should have a capacity of 512 MB or more.
   The file to be copied is contained in the following folder in the CD-ROM of MX181500A.

   \Installer\MX181500A_VER_x_xx_xx.exe

   where x_xx_xx represents a version of the software.
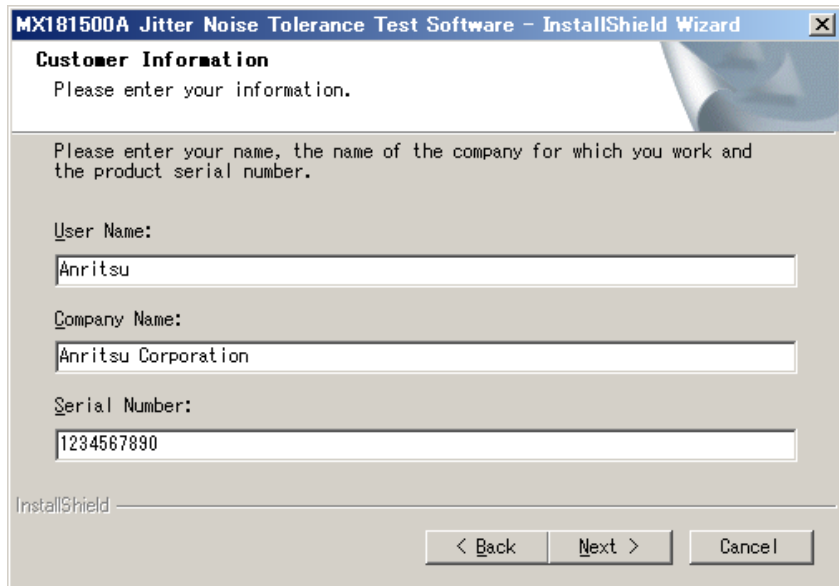
2. Insert the USB memory into MP1800A and copy the file to the internal HDD.

3 End all active applications. End Main application, and click the **Close (X)** button on the Selector screen.

4. Execute MX181500A_VER_x_xx_xx. exe to start installation.

   If MX181500A is already installed, the message dialog "Reinstall all program features installed by the previous setup." appears to warn you of overwriting. To continue installation, click **YES**. (The procedure skips Steps (6) to (9) and directly goes to Step (10).)
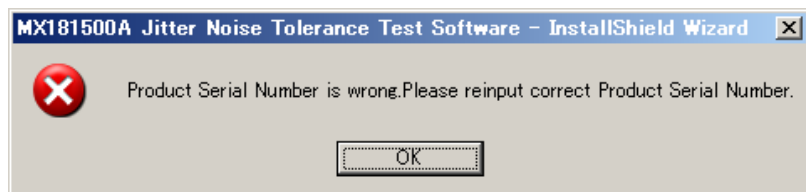
5. The installer is activated. Click **Next**.
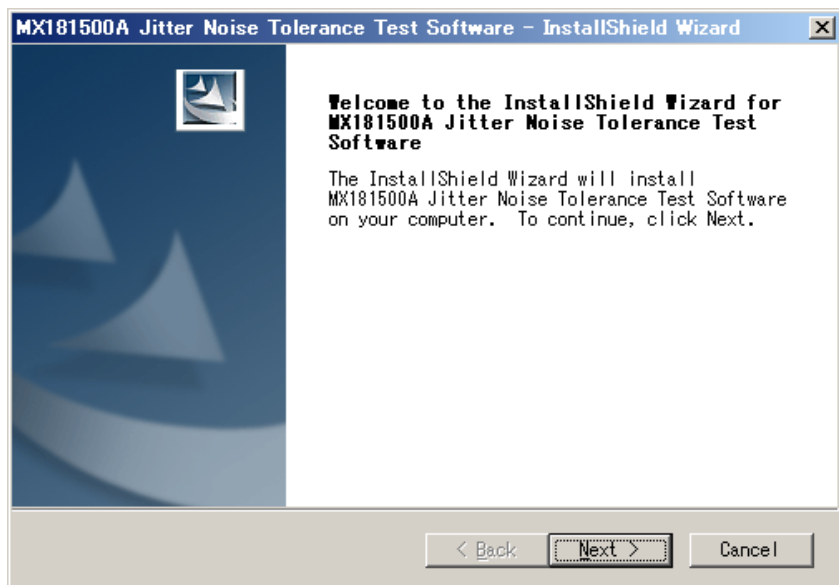
6. Enter User Name, Company Name, and Serial Number and then click **Next**. The Serial Number means the 10-digit serial number of the MP1800A being controlled by MX181500A.

7. If you enter a wrong Serial Number, you will see the following dialog when clicking **Next**. Confirm the Serial Number to reenter the right number.
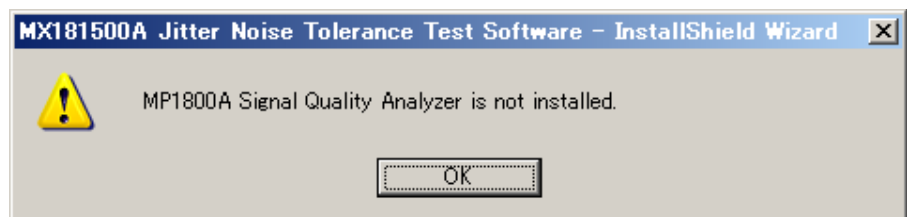
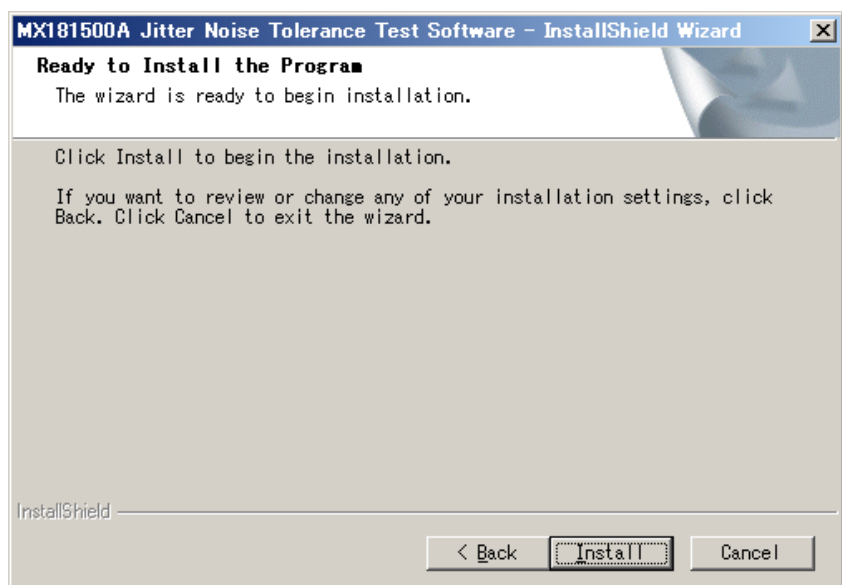8.   Select the product on which MX181500A has been installed. Select MP1800A and then click **Next**.
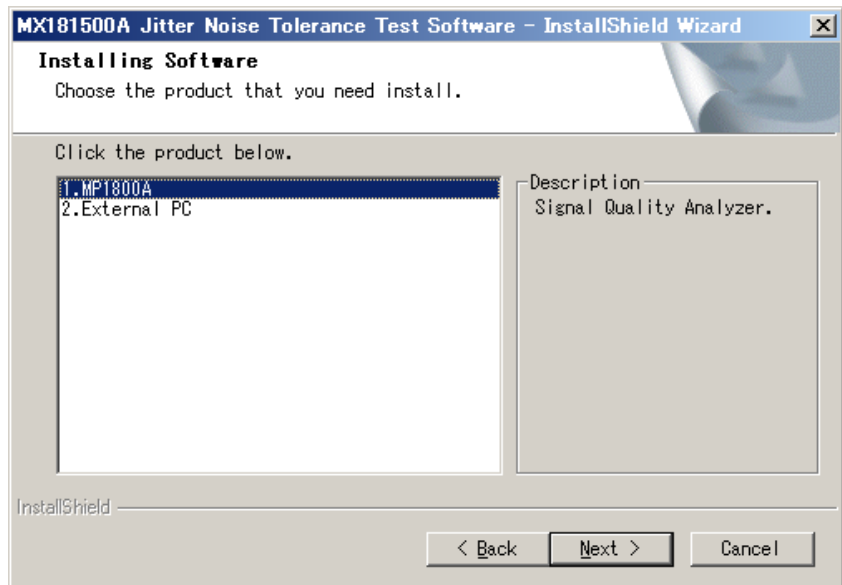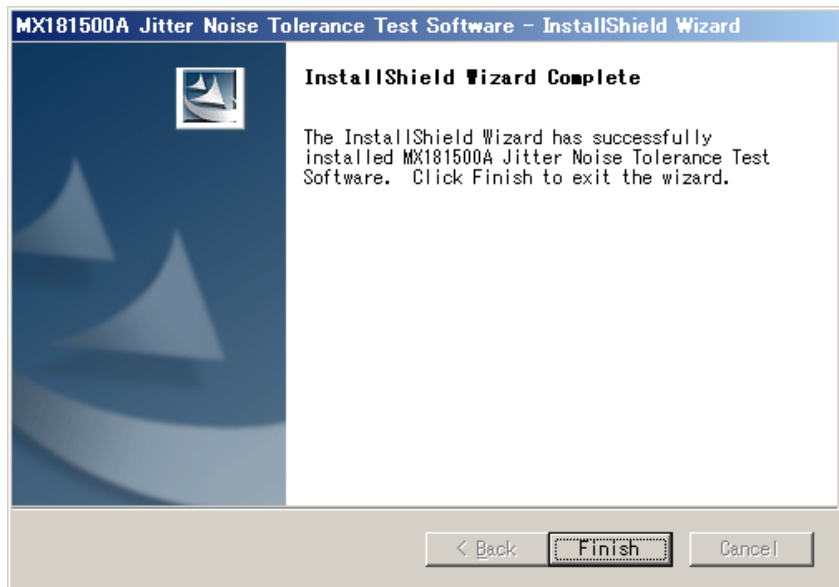

If MX181500A is not installed in MP1800A but in others, the following dialog appears.

9.   When preparation is complete, click **Install** to start installation.

10. When the installation completes successfully, the following window appears. Click **Finish** to end installation.

## 2.3.2 Installing MX181500A on external PC

1. End all active applications.

2. Insert the CD-ROM of MX181500A in the drive.

3. Open the **Run** dialog in the **Start menu** to execute the following file shown in the CD-ROM drive.
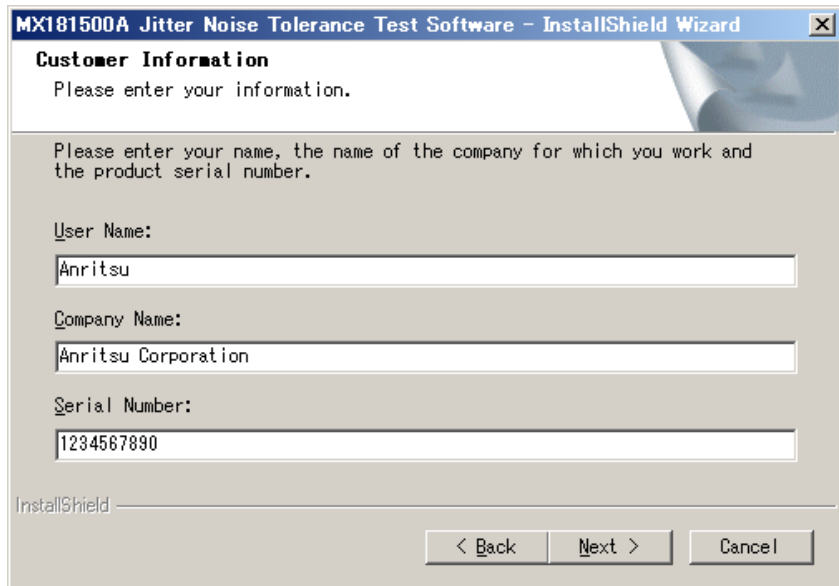
   \Installer\MX181500A_VER_x_xx_xx.exe

   where x_xx_xx represents a version of the software.

   If MX181500A is already installed, the message dialog "Reinstall all program features installed by the previous setup." appears to warn you of overwriting. To continue installation, click **YES**. (The procedure skips Steps (5) to (10) and directly goes to Step (11).)

4. The installer is activated. Click **Next**.
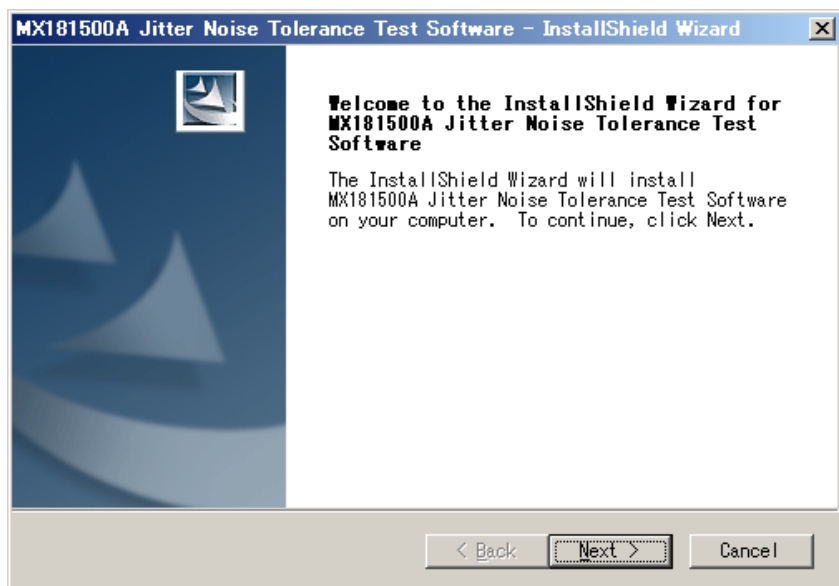
5.   Enter User Name, Company Name, and Serial Number and then
click **Next**. Enter the 10-digit serial number of the MP1800A to be
controlled by MX181500A in the Serial Number box.

6.   If you enter a wrong Serial Number, you will see the following dialog
when clicking **Next**. Confirm the Serial Number to reenter the right
number.

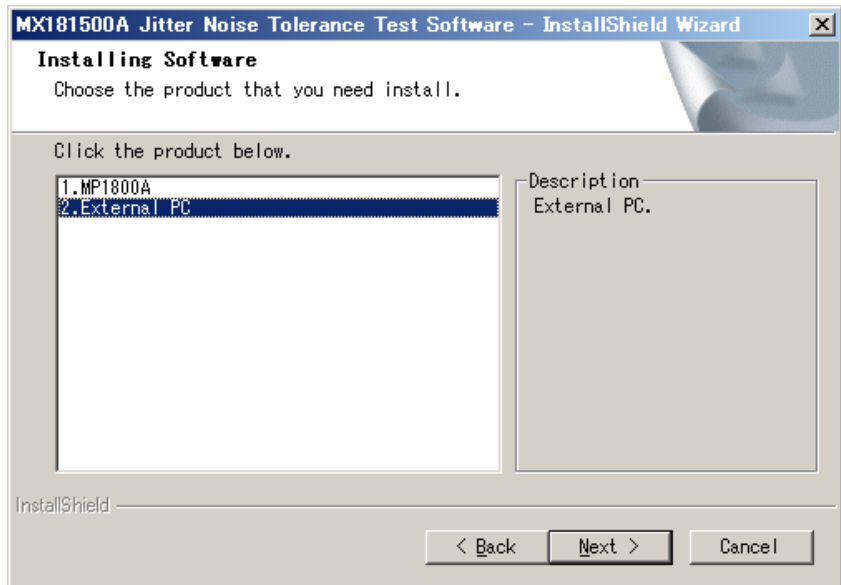7.   Select the product on which MX181500A has been installed.

Select **External PC** and then click **Next**.

8.   When you want to change an installation directory, Click **Change** (Go to Step 9). When you do not change a directory, click **Next** (Go to Step 10).
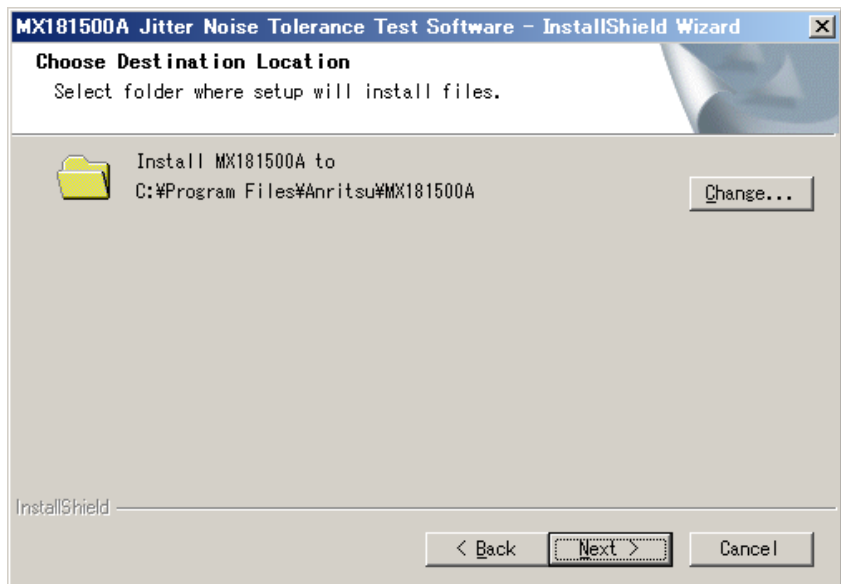
9.   Specify an installation folder and click **OK**.
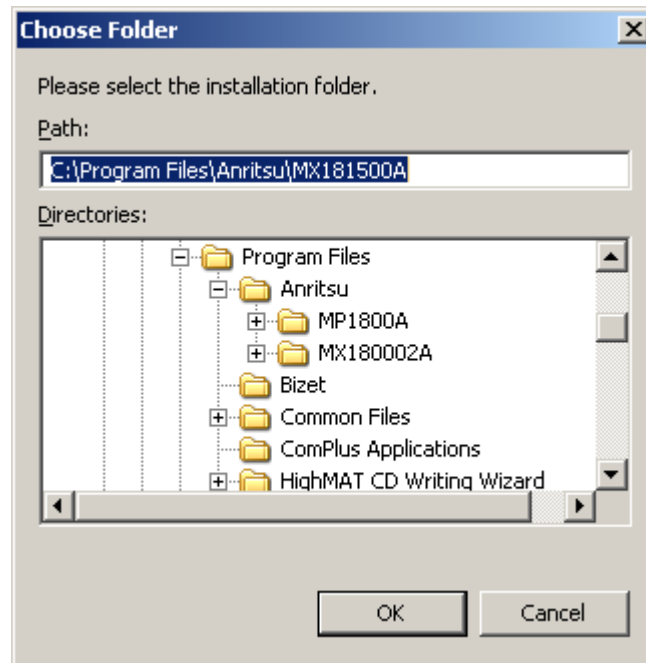
⚠ CAUTION

Be sure to create a new folder for MX181500A. If you specify an existing folder, note that the existing folder is deleted when you click Yes in response to the message "Ok to delete all files in the installation folder?" that is displayed at uninstallation.

10. To create the shortcut for MX181500A on the desktop, select the
     "Make a shortcut on Desktop" check box and click **Next**.
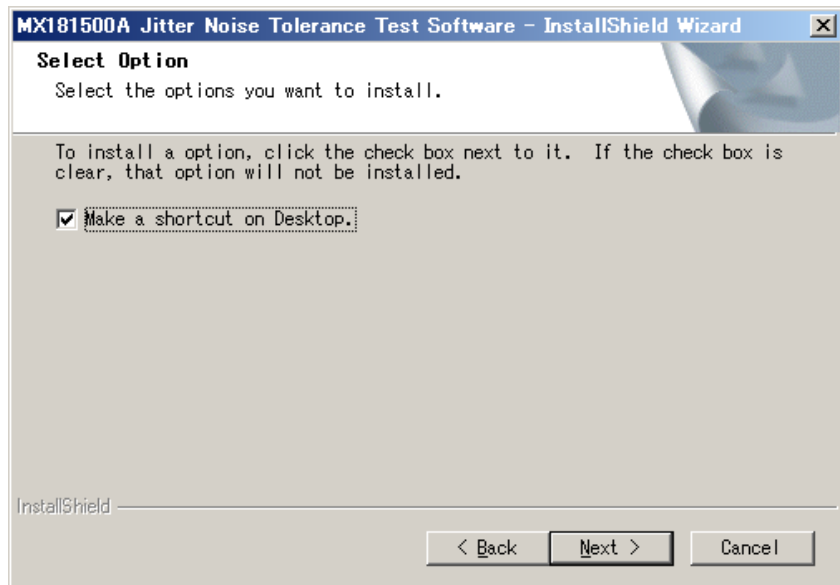
11. When preparation is complete, click **Install** to start installation.
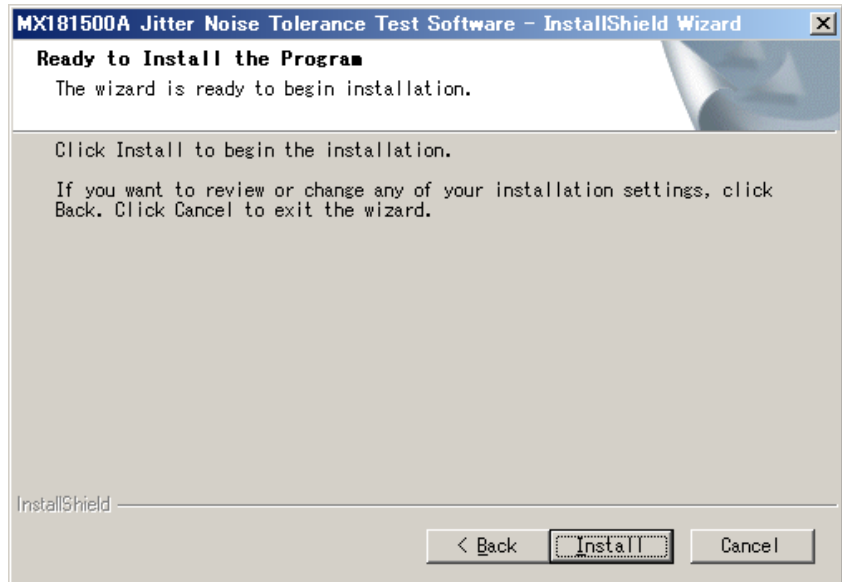
12. When the installation completes successfully, the following window
     appears. Click **Finish** to end installation.
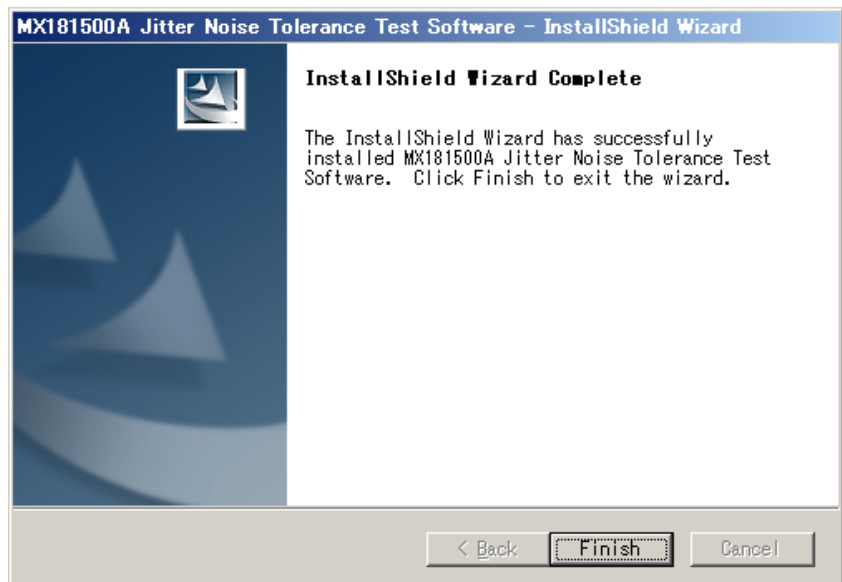
2.3.3 Uninstallation

This section describes the procedure for uninstalling MX181500A . Do the following procedure in MP1800A or external PC.

1. Select **Control Panel** in the **Start** menu to open the Control Panel.

2. Double-click **Add/Remove Programs** in the Control Panel.

3. Select MX181500A in the list box and click **Delete** to start uninstallation.

    When the following dialogs appear, click **Yes** on each dialog.

MX181500A Jitter Noise Tolerance Test Software - InstallShield Wizard ☒

Do you want to completely remove the selected application and all of its features?

Yes   No

MX181500A Jitter Noise Tolerance Test Software - InstallShield Wizard ☒

Ok to delete all files in the installation folder?

Yes   No
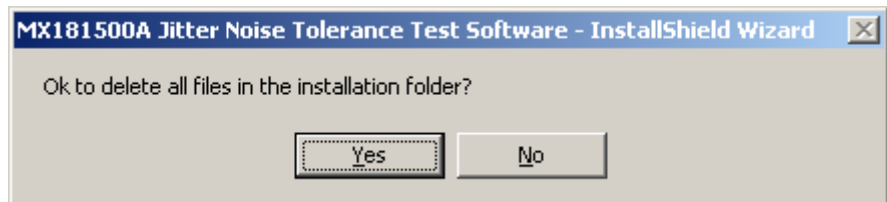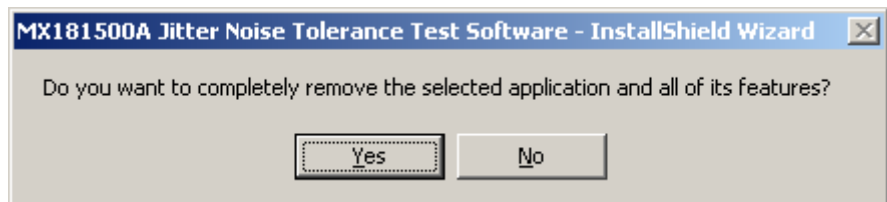
⚠ CAUTION

Once the software is uninstalled, all the files in the installation folder are deleted. Note that any file you have saved in the installation folder is also deleted.

Chapter 3 Connecting Equipment

This chapter describes the types of equipment to be controlled by MX181500A and connecting procedures.

3

Connecting Equipment

3.1 Target Equipment

Shown below are the models of equipment to be controlled by MX181500A and the number of equipment required for each connection. Equipment marked as "-" in the Quality column are not used.

Table 3.1-1 Equipment configuration for each measurement type
(when MP1800A is used)

Equipment Type	Model	Options	Quantity for each connecting procedure					
			10Gbit/s1-Channel	10Gbit/s 2-Channel	28Gbit/s 1-Channel	28Gbit/s 2 Channel	32Gbit/s 2-Channel	32Gbit/s 4-Channel
Signal Quality Analyzer	MP1800A	x02, x14	1	(1) *1	(1) *1	(1) *1	1 *5	(1) *6
		x02, x15 or x02, x16	–	2 (1) *2	2 (1) *2	3 (2) *2	1*5	2 (1) *7
Synthesizer	MU181000A/B*3	x01	1	1	1	1	1	1
Jitter Source	MU181500B		1	1	1	1	1	1
PPG	MU181020A MU181020B	x02, x11 x02, x30	1 –	2 –	– 2	– 4		
ED	MU181040A MU181040B	x01 x02, x30	1 –	2 –	– 2	– 4		
MUX	MU182020A	x01, x30 x10/x11/x13*4	–	–	1	–		
	MU182021A	x01, x30 x10/x11/x13*4	–	–	–	1		
DEMUX	MU182040A	x01, x30	–	–	1	–		
	MU182041A	x01, x30	–	–	–	1		
32G PPG	MU183020A	x01, x22 or x23					1	–
	MU183021A	x01,					–	1
32G ED	MU183040A/B MU183041A/B	x01, x20 x01					1 –	– 1

*1: MP1800A-x02/x14 can be used with MU181000A/B and MU181500B mounted on it.

*2: Quantity required when one set of MP1800A-x02/x14 is used for MU181000A/B and MU181500B.

*3: Direct control by MX181500A is not available.

*4: Either one of x10, x11, and x13 is required.

*5:   Either one of MP1800A-x02/x14, and MP1800A-x02/x15/x16 is used.

*6:   MP1800A-x02/x14 can be used with MU183041A/B mounted on it.

*7:   Quantity required when one set of MP1800A-x02/x14 is used for MU183041A/B.

3

Connecting Equipment

Table 3.1-2   Equipment configuration for each measurement type (when MT1810A is used)

Equipment Type	Model	Options	Quantity for each connecting procedure				
			10Gbit/s 1 Channel	10Gbit/s 2 Channel	28Gbit/s 1 Channel	32Gbit/s 2 Channel	32Gbit/s 4 Channel
Signal Quality Analyzer	MT1810A	x02, x14	2	1	1	2	1*2
		x02, x15	–	1	2	–	1
Synthesizer	MU181000A/B	x01	1	1	–	1	1
Jitter Source	MU181500B		1	1	1	1	1
PPG	MU181020A	x01, x11	1	2	–	–	–
	MU181020B	x02, x30	–	–	2	–	–
ED	MU181040A	x01	1	2	–	–	–
	MU181040B	x02, x30	–	–	2	–	–
MUX	MU182020A	x01, x10/x11/x13*1	–	–	1	–	–
DEMUX	MU182040A	x01, x30	–	–	1	–	–
32G PPG	MU183020A	x01, x22 or x23	–	–	–	1	–
	MU183021A	x01	–	–	–	–	1
32G ED	MU183040A/B	x01, x20	–	–	–	1	–
	MU183041A/B	x01	–	–	–	–	1

*1:   Either one of x10, x11, and x13 is required.

*2:   MP1800A-x02/x14 can be used with MU181000A/B and MU181500B mounted on it.

Note:

MT1810A does not support 28 Gbit/s 2-channel control.

Table 3.1-3   Equipment configuration for each measurement type
(When using MP1800A and MP1861A/MP1862A)

Equipment Type	Model	Options	Quantity for each connecting procedure 64Gbit/s 1 Channel
Signal Quality Analyzer	MP1800A	x02, x16	1
Synthesizer	MU181000A		1
Jitter Source	MU181500B		1
64G MUX	MP1861A	x01, x11 or x13, x30	1
64G DEMUX	MP1862A	x01	1
32G PPG	MU183020A	x01, x22 or x23 x31	1
32G ED	MU183040A/B	x01, x20	1

3

Connecting Equipment

3.2   10 Gbit/s, 1-channel System Configuration

Figure 3.2-1   10 Gbit/s, 1-channel System Configuration

MU181020A and MU181040A may be replaced with MU181020B and MU181040B.

1. When MX181500A is installed on a control PC, connect the control PC to MP1800A with an Ethernet cable.
    MP1800A requires the MP1800A-x02 LAN option.

2. Set MP1800A remote control to **Ethernet** on the Remote Control tab of the Setup Utility screen.

3. Connect the **Clock Output** connector of MU181000A/B-x01 to the **Ext Clock Input** connector of MU181500B with a coaxial cable.

4. Connect the **Ext I, Q** connector of MU181000A/B-x01 to the **I, Q Output** connector of MU181500B with a pair of coaxial cables.

5. Connect the **Jittered Clock Output** connector of MU181500B to the **Ext Clock Input** connector of MU181020A/B-x02 with a coaxial cable.

6. Connect the **Data Output, $\overline{\text{Data}}$ Output** connectors of MU181020A/B-x02 to the **Data Input, $\overline{\text{Data}}$ Input** connectors of a device under test with a pair of coaxial cables.

7. Connect the **Data Output, $\overline{\text{Data}}$ Output** connectors of a device under test to the **Data Input, $\overline{\text{Data}}$ Input** connectors of MU181040A/B-x02 with a pair of coaxial cables.

8. Activate MX180000A and set Data Pattern Generator of MU181500B to **PPG**.

3

Connecting Equipment

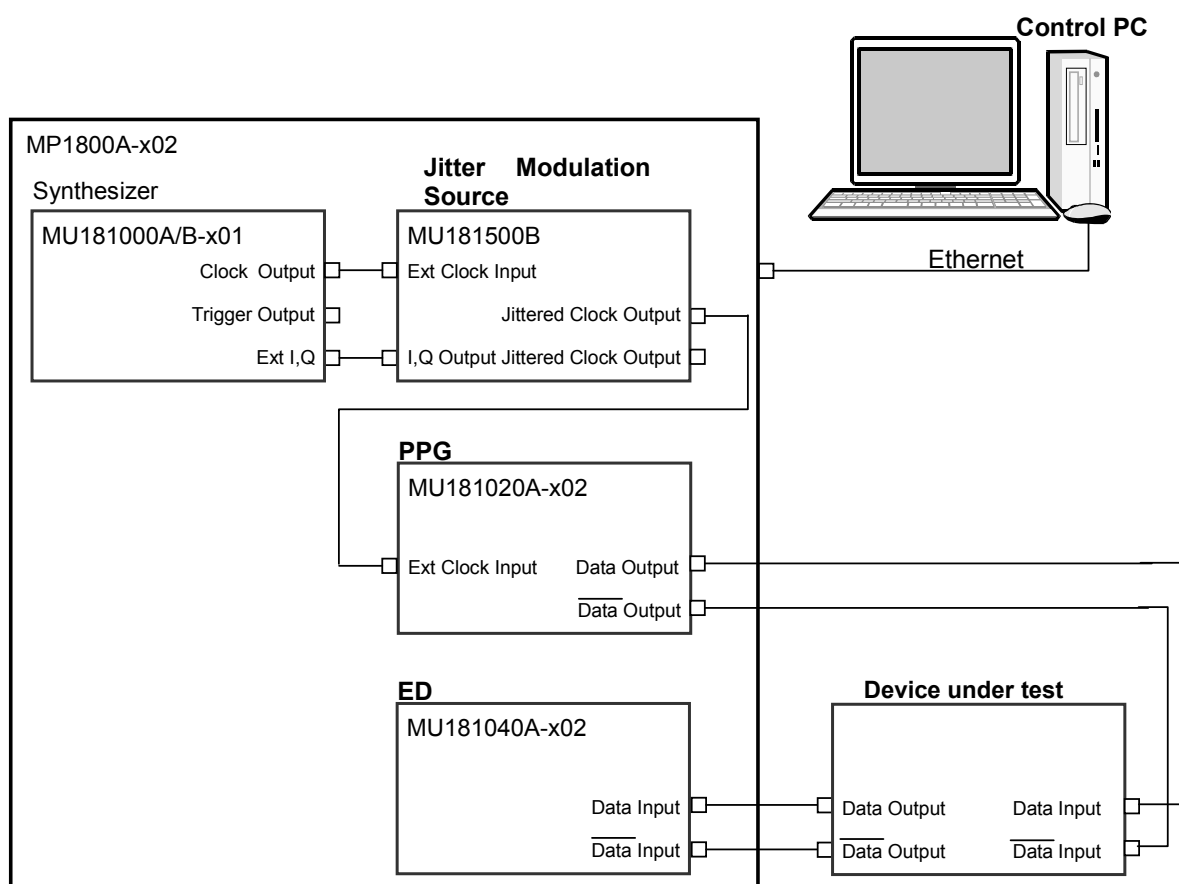# 3.3 10 Gbit/s, 2-channel System Configuration
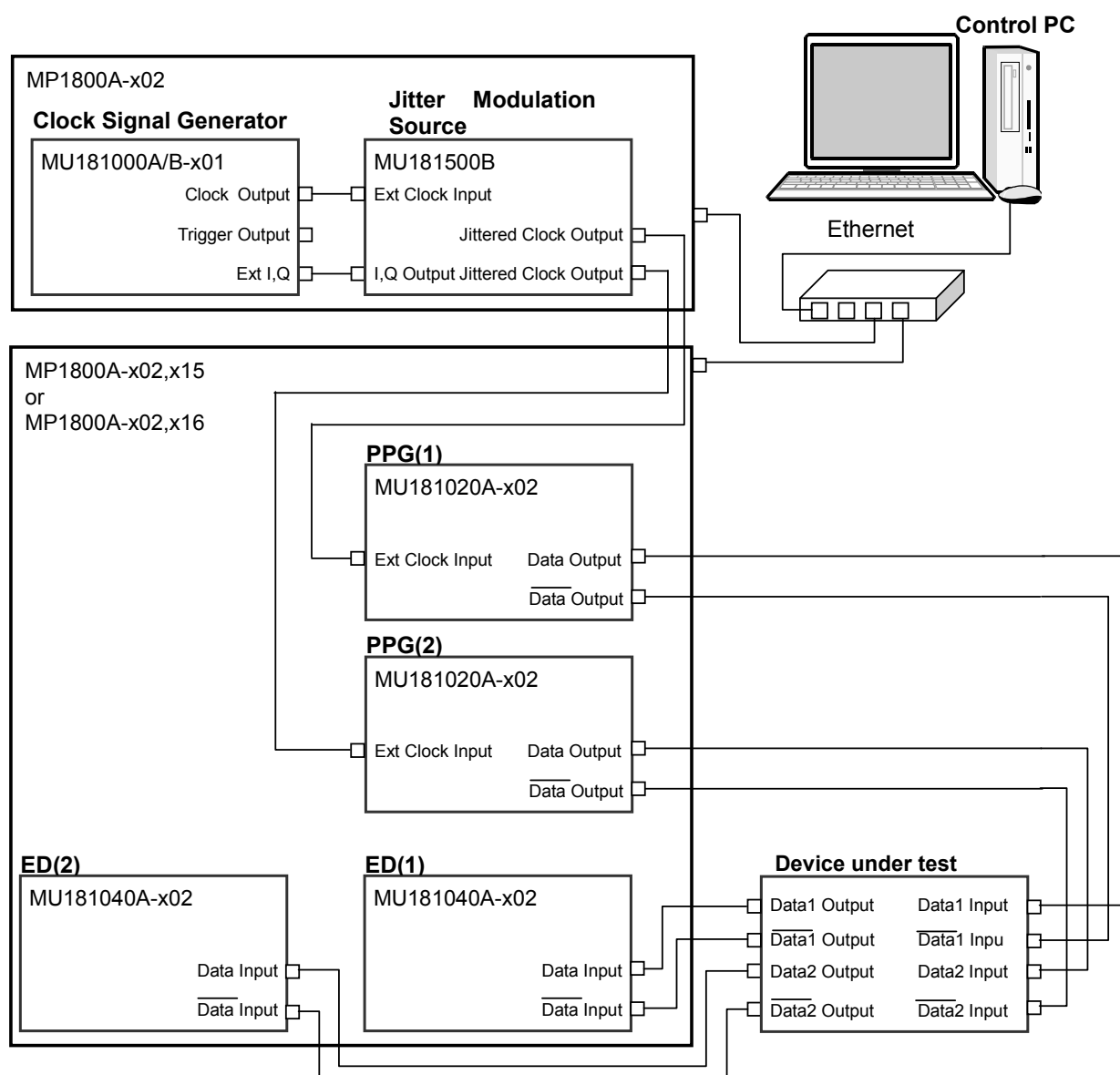

Figure 3.3-1   10 Gbit/s, 2-channel System Configuration

MU181020A and MU181040A may be replaced with MU181020B and MU181040B.

1.   When MX181500A is installed on a control PC, connect the control PC through a hub to a couple of MP1800As with a pair of Ethernet cables .
     When MX181500A is installed on one of the two MP1800As, connect the both with an Ethernet cable.
     Each MP1800A requires MP1800A-x02 LAN option.

2.   Set remote control of both MP1800As to **Ethernet** on the Remote Control tab of the Setup Utility screen.

3.   Mount MU181000A/B-x01 and MU181500B in MP1800A-x02.

4.   Mount MU181020A/B-x02 in Slot 1 and 2 of MP1800A-x02, x15, respectively.

5.   Mount MU181040A/B-x02 in Slot 3 and 4 of MP1800A-x02, x15, respectively.

6.   Connect the **Clock Output** connector of MU181000A/B-x01 to the **Ext Clock Input** connector of MU181500B with a coaxial cable.

7.   Connect the **Ext I,Q** connector of MU181000A/B-x01 to the **I,Q Output** connector of MU181500B with a pair of coaxial cable.

8.   Connect the **Jittered Clock Output** connectors of MU181500B to the each **Ext Clock Input** connector of MU181020A-x02 with a couple of coaxial cables.

9.   Connect the **Data Output, $\overline{\text{Data}}$ Output** connectors of MU181020A/B-x02 to the **Data Input, $\overline{\text{Data}}$ Input** connectors of a device under test with four coaxial cables.

10. Connect the **Data Output, $\overline{\text{Data}}$ Output** connectors of a device under test to the **Data Input, $\overline{\text{Data}}$ Input** connectors of MU181040A/B-x02 with four coaxial cables.

11. Activate MX180000A and set Data Pattern Generator of MU181500B to **PPG**.

3

Connecting Equipment

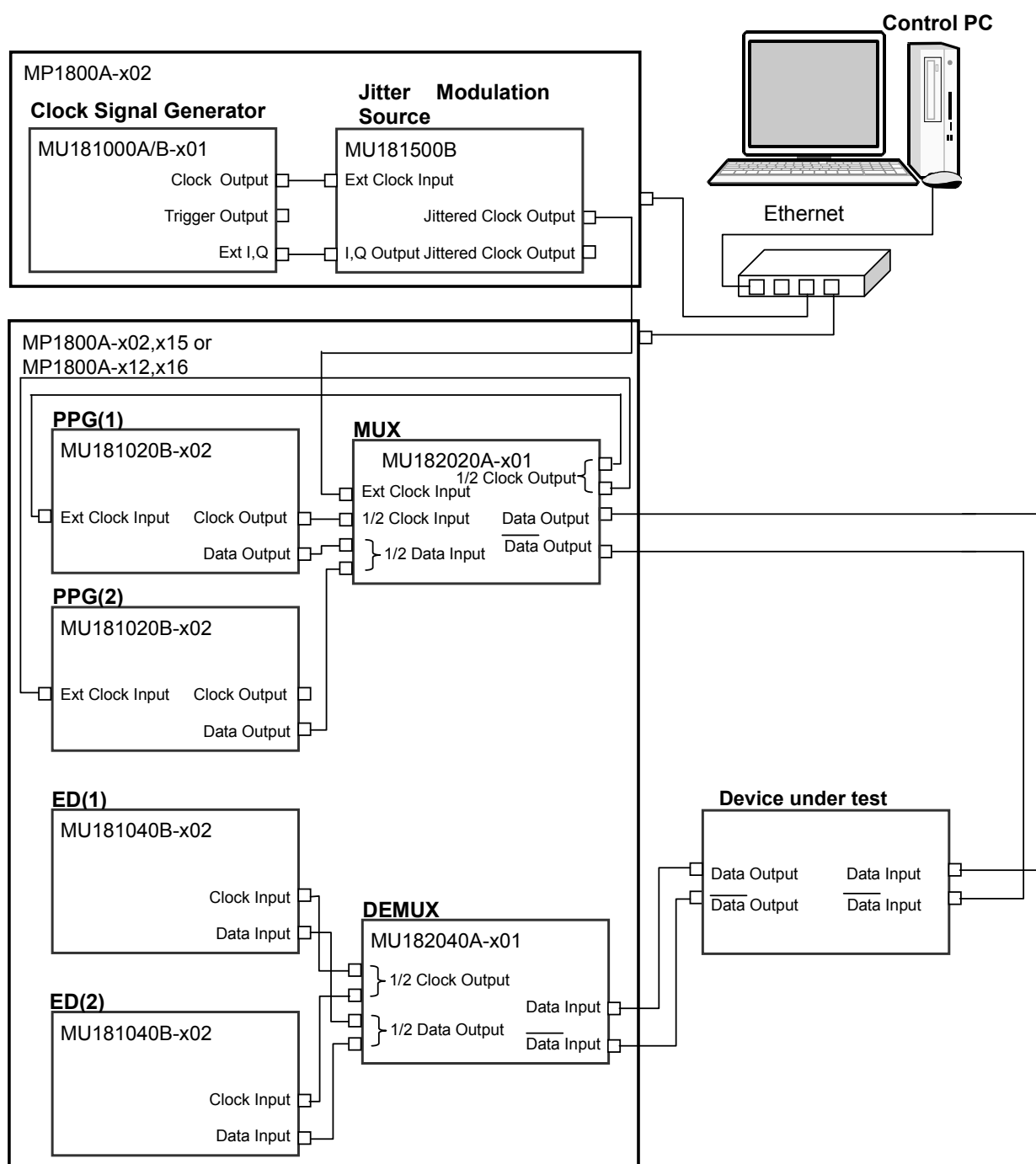# 3.4 28 Gbit/s, 1-channel System Configuration

Figure 3.4-1   28 Gbit/s, 1-channel System Configuration

1.   When MX181500A is installed on a control PC, connect the control PC through a hub to a couple of MP1800As with a pair of Ethernet cables.
      When MX181500A is installed on one of two MP1800As, connect the both with an Ethernet cable.
      Each MP1800A requires the MP1800A-x02 LAN option.

2.   Set remote control of both MP1800A to **Ethernet** on the Remote Control tab of the Setup Utility screen.

3.   Mount MU181000A/B-x01 and MU181500B in MP1800A-x02.

4.   Mount MU181020A/B-x02 in Slot 1 and 2 of MP1800A-x02, x15, respectively.

5.   Mount MU182020A-x01 in Slot 3 and MU182040A-x01 in Slot 4 of MP1800A-x02, x15, respectively.

6.   Mount MU181040A/B-x02 in Slot 5 and 6 of MP1800A-x02, x15, respectively.

7.   Connect the **Clock Output** connector of MU181000A/B-x01 to the **Ext Clock Input** connector of MU181500B with a coaxial cable.

8.   Connect the **Ext I, Q** connector of MU181000A/B-x01 to the **I, Q Output** connector of MU181500B with a pair of coaxial cable.

9.   Connect the **Jittered Clock Output** connector of MU181500B to the **Ext Clock Input** connector of MU182020A-x01 with a coaxial cable.

10.   Connect the **Data Output** connector of each MU181020A/B-x02 to the **1/2 Data Input** connectors of MU182020A-x01 with a pair of coaxial cables.

11.   Connect the **1/2 Clock Output** connectors of MU182020A-x01 to the **Ext. Clock Input** connector of each MU181020A/B-x02 with a pair of coaxial cables.

12.   Connect the **Clock Output** connector of one of the two MU181020A/B-x02 to the **1/2 Clock Input** connector of MU182020A-x01 with a coaxial cable.

13.   Connect the **Data Output, $\overline{\textbf{Data}}$ Output** connectors of MU182020A-x01 to the **Data Input, $\overline{\textbf{Data}}$ Input** connectors of a device under test with a pair of coaxial cables.

14.   Connect the **Data Output, $\overline{\textbf{Data}}$ Output** connectors of a device under test to the **Data Input, $\overline{\textbf{Data}}$ Input** connectors of MU182040A-x01 with a pair of coaxial cables.

15.   Connect the **1/2 Clock Output** connectors of MU182040A-x01 to the each **Clock Input** connector of both MU181040A/B-x02 with a pair of coaxial cables.

3

Connecting Equipment

16. Connect the **1/2 Data Output** connectors of MU182040A-x01 to the each **Data Input** connector of both MU181040A/B-x02 with a pair of coaxial cables.

17. Activate MX180000A and set Data Pattern Generator of MU181500B to **Half-rate (MUX)**.

   ☞ 3.5 "Data Output Setup" in the *MU181500B Jitter Modulation Source Operation Manual*

18. Specify Combination of MU182020A-x01 using MX180000A.

   ☞ 5.5 "Multi Channel Feature" in the *MU181020A 12.5Gbit/s Pulse Pattern Generator/MU181020B 14Gbit/s Pulse Pattern Generator Operation Manual*

19. Specify Combination of MU182040A-x01 using MX180000A.

   ☞ 5.14 "Multi Channel Feature" in the *MU181040A 12.5Gbit/s Error Generator/ MU181040B 14Gbit/s Error Generator Operation Manual*

3.5 28 Gbit/s, 2-channel System Configuration
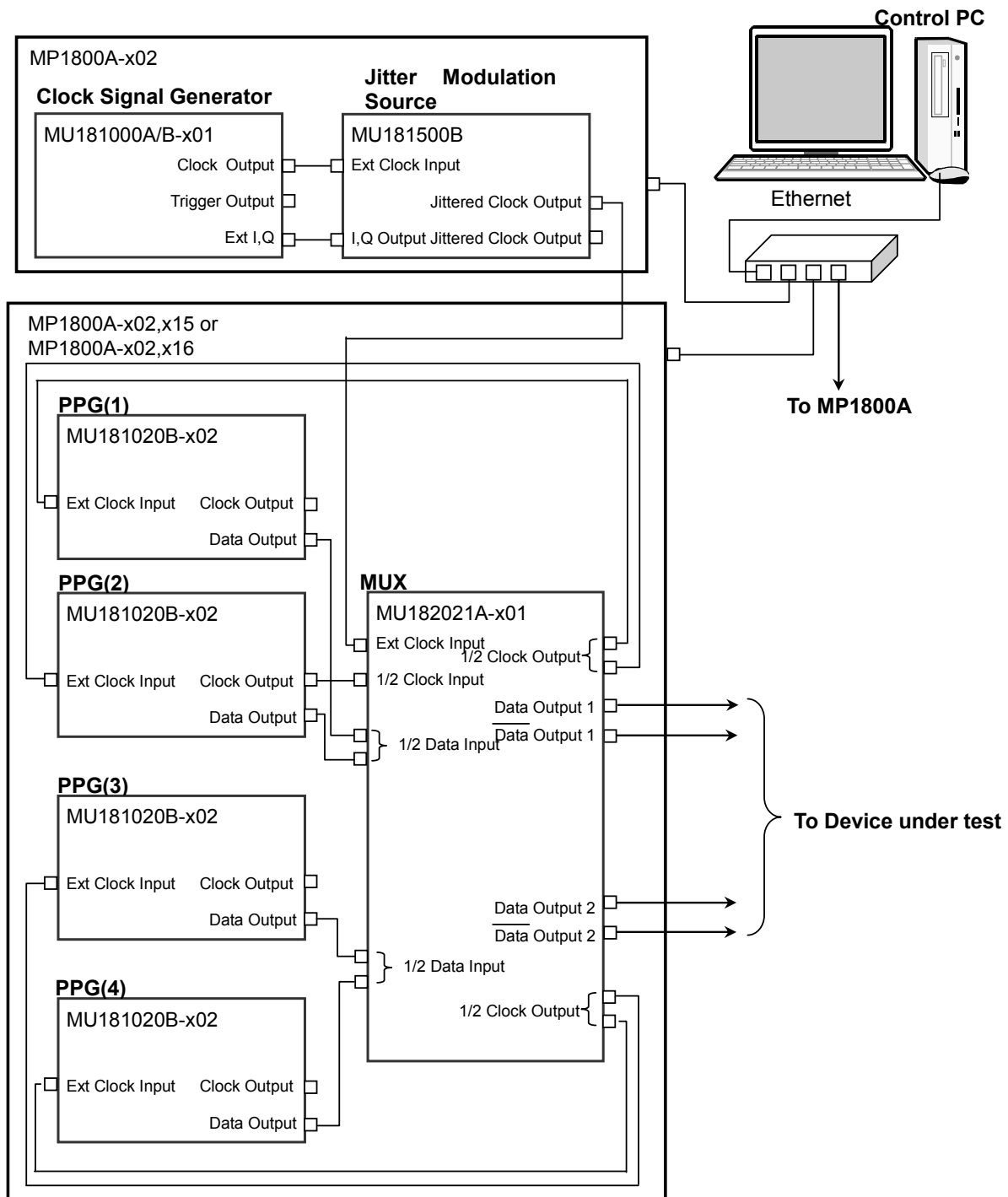
Figure 3.5-1   28 Gbit/s, 2-channel System Configuration

3

Connecting Equipment

Device under test

To MU182021A
- Data1 Input ← Data1 Output
- $\overline{\text{Data1}}$ Input ← $\overline{\text{Data1}}$ Output
- Data2 Input ← Data2 Output
- $\overline{\text{Data2}}$ Input ← $\overline{\text{Data2}}$ Output

To control PC

Ethernet

MP1800A-x02,x15 or
MP1800A-x02,x16

ED(1)
MU181040B-x02
- Clock Input
- Data Input

ED(2)
MU181040B-x02
- Clock Input
- Data Input

DEMUX
MU182041A-x01
- 1/2 Clock Output
- 1/2 Data Output
- 1/2 Clock Output
- 1/2 Data Output
- Data Input 1
- $\overline{\text{Data Input 1}}$
- Data Input 2
- $\overline{\text{Data Input 2}}$

ED(3)
MU181040B-x02
- Clock Input
- Data Input

ED(4)
MU181040B-x02
- Clock Input
- Data Input

Figure 3.5-2   28 Gbit/s, 2-channel System Configuration (2)

1. When MX181500A is installed on a control PC, connect the control PC through a hub to each of three MP1800As with Ethernet cables. When MX181500A is installed on one of the three MP1800As, connect all MP1800As with Ethernet cables through a hub. Each MP1800A requires the MP1800A-x02 LAN option.

2. Set remote control of each MP1800A to **Ethernet** on the Remote Control tab of the Setup Utility screen.

3. Mount MU181000A/B-x01 and MU181500B in MP1800A-x02.

4. Mount MU181020A/B-x02 in Slot 1 to 4 of MP1800A-x02, x15, respectively.

5. Mount MU181021A-x01 in Slot 5 and 6 of MP1800A-x02, x15.

6. Mount MU181040A/B-x02 in Slot 1 to 4 of the other MP1800A-x02, x15, respectively.

7. Mount MU182041A-x01 in Slot 5 and 6 of the other MP1800A-x02, x15.

8. Connect the **Clock Output** connector of MU181000A/B-x01 to the **Ext Clock Input** connector of MU181500B with a coaxial cable.

9. Connect the **Ext I, Q** connector of MU181000A/B-x01 to the **I, Q Output** connector of MU181500B with a couple of coaxial cable.

10. Connect the **Jittered Clock Output** connector of MU181500B to the **Ext Clock Input** connector of MU182041A-x01 with a coaxial cable.

11. Connect the **Data Output** connector of each MU181020A/B-x02s to the 1/2 **Data Input** connectors of MU182041A-x01 with four coaxial cables.

12. Connect the **1/2 Clock Outpu**t connectors of MU182041A-x01 to the **Ext. Clock Input** connector of each MU181020A/B-x02 with four coaxial cables.

13. Connect the **Clock Output** connector of one of the four MU181020A/B-x02 to the **1/2 Clock Input** connectors of MU182021A-x01 with a coaxial cable.

14. Connect the **Data Output, $\overline{\text{Data}}$ Output** connectors of MU182021A-x01 to the **Data Input, $\overline{\text{Data}}$ Input** connectors of a device under test with four coaxial cables.

15. Connect the **Data Output, $\overline{\text{Data}}$ Output** connectors of a device under test to the **Data Input, $\overline{\text{Data}}$ Input** connectors of MU182041A-x01 with four coaxial cables.

16. Connect the 1/2 Clock Output connectors of MU182041A-x01 to the Clock Input connectors of each MU181040A/B-x02 with four coaxial cables.

17. Connect the 1/2 Data Output connectors of MU182041A to the Data Input connector of each MU181040A/B with four coaxial cables.

3

Connecting Equipment

18. Activate MX180000A and set Data Pattern Generator of MU181500B to **Half-rate (MUX)**.

☞ 3.5 "Data Output Setup" in the *MU181500B Jitter Modulation Source Operation Manual*

19. Specify Combination of MU182021A-x01 using MX180000A.

☞ 5.5 "Multi Channel Feature" in the *MU181020A 12.5Gbit/s Pulse Pattern Generator/MU181020B 14Gbit/s Pulse Pattern Generator Operation Manual*
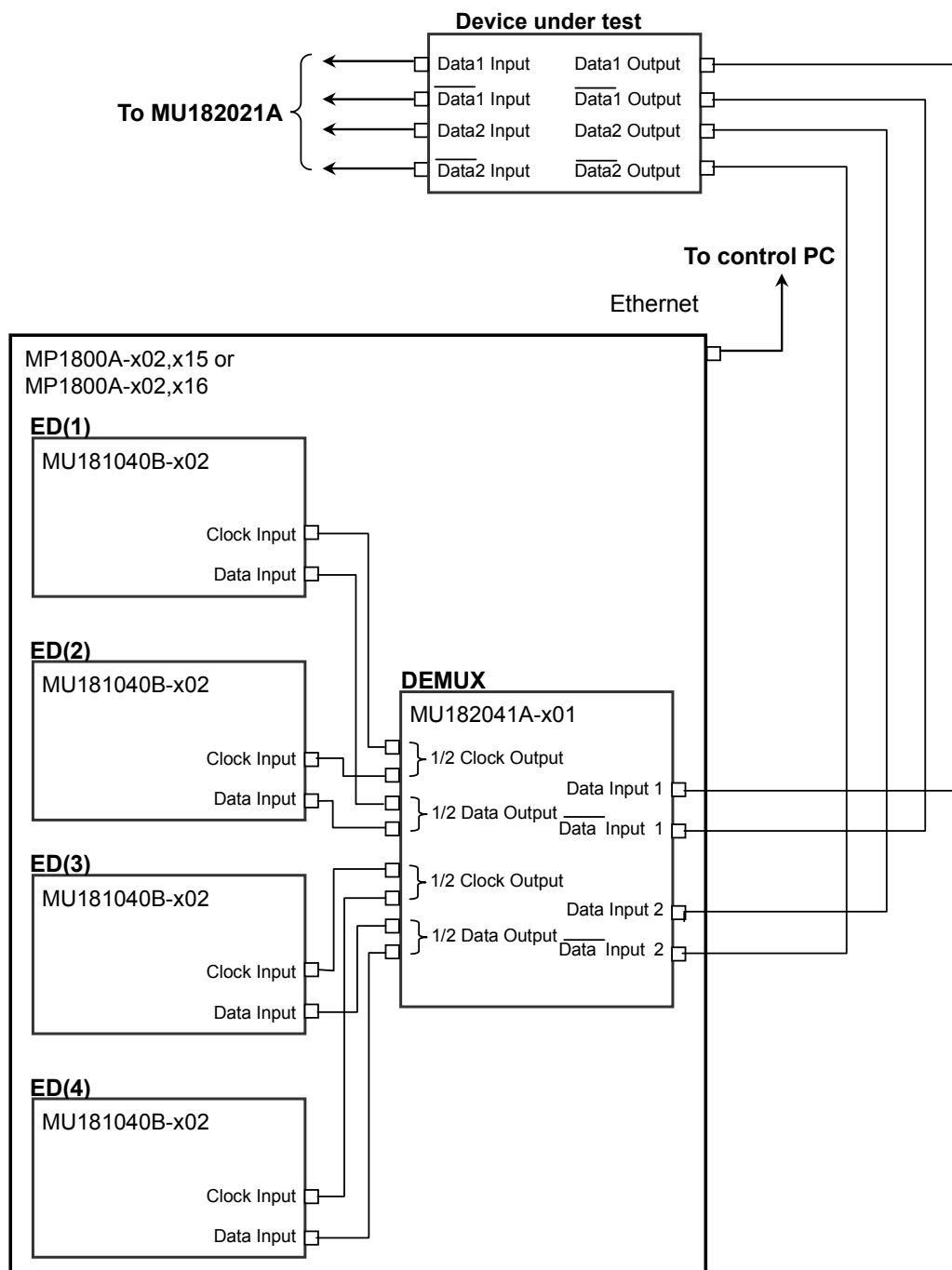
20. Specify Combination of MU182041A-x01 using MX180000A.

☞ 5.14 "Multi Channel Feature" in the *MU181040A 12.5Gbit/s Error Generator/ MU181040B 14Gbit/s Error Generator Operation Manual*

3.6 32 Gbit/s, 2-channel System Configuration

Figure 3.6-1   32 Gbit/s, 2-channel System Configuration

3

Connecting Equipment

1. When MX181500A is installed on a control PC, connect the control PC to MP1800A with an Ethernet cable.
    When MX181500A is installed on MP1800A, Ethernet cable connection is not required.
    MP1800A requires the MP1800A-x02 LAN option.

2. Set MP1800A remote control to **Ethernet** on the Remote Control tab of the Setup Utility screen.

3. Mount MU181000A/B-x01 and MU181500B in MP1800A-x02, x15.

4. Mount MU183020A-x01, x23 in Slot 3 of MP1800A-x02, x15.

5. Mount MU183040A/B-x01, x20 in Slot 4 of MP1800A-x02, x15.

6. Connect the **Clock Output** connector of MU181000A/B-x01 to the **Ext Clock Input** connector of MU181500B with a coaxial cable.

7. Connect the **Ext I,Q** connector of MU181000A/B-x01 to the **I,Q Output** connector of MU181500B with a pair of coaxial cable.
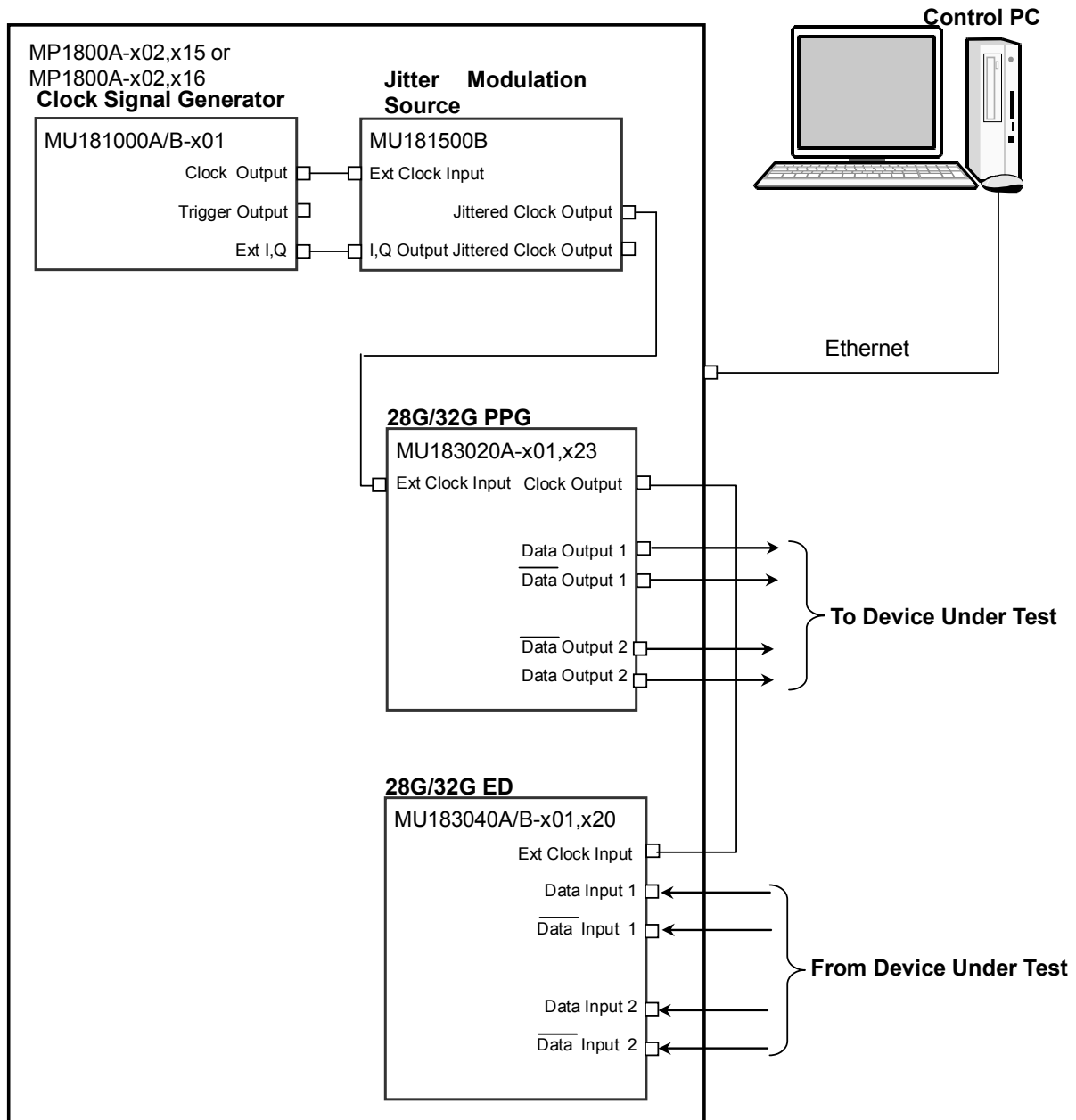
8. Connect the Jittered Clock Output connectors of MU181500B to the each Ext Clock Input connector of MU183020A-x01, x23 with a couple of coaxial cables.

9. Connect the Clock Output connector of MU183020A/B-x01, x23 to the Ext Clock Input connector of MU183040A/B-x01, x20 with a couple of coaxial cable.

10. Connect the **Data Output, $\overline{\text{Data}}$ Output** connectors of MU183020A/B-x01, x23 to the **Data Input, $\overline{\text{Data}}$ Input** connectors of a device under test with four coaxial cables.

11. Connect the **Data Output, $\overline{\text{Data}}$ Output** connectors of a device under test to the **Data Input, $\overline{\text{Data}}$ Input** connectors of MU183040A/B-x01, x20 four coaxial cables.

12. Select MU181500B in Clock Setting of the **Misc2** tab of MU183020A-x01, x23.

    ☞ 5.6 "Misc2 Function" in the *MU183020A 28G/32G PPG MU183021A 28G/32G 4ch PPG Operation Manual*

13. Set Combination of MU183020A in Combination Setting of the **Misc2** tab of MU183020A-x01, x23.

    ☞ 5.6 "Misc2 Function" in the *MU183020A 28G/32G PPG MU183021A 28G/32G 4ch PPG Operation Manual*

14. Set Combination of MU183040A/B in Combination Setting of the **Misc2** tab of MU183040A/B-x01, x20.

    ☞ 5.6 "Misc2 Function" in the *MU183040A 28G/32G bit/s ED MU183041A 28G/32G bit/s 4ch ED MU183040B 28G/32G bit/s High Sensitivity ED MU183041B 28G/32G bit/s 4ch High Sensitivity ED Operation Manual*

3.7   32 Gbit/s, 4-channel System Configuration

Figure 3.7-1   32 Gbit/s, 4-channel System Configuration

Device Under Test

Data1 Input	Data1 Output
$\overline{\text{Data}}$1 Input	$\overline{\text{Data}}$1 Output
Data2 Input	Data2 Output
$\overline{\text{Data}}$2 Input	$\overline{\text{Data}}$2 Output
Data3 Input	Data3 Output
$\overline{\text{Data}}$3 Input	$\overline{\text{Data}}$3 Output
Data4 Input	Data4 Output
$\overline{\text{Data}}$4 Input	$\overline{\text{Data}}$4 Output

To MU183021A

To Control PC

Ethernet

MP1800A-x02,x15 or
MP1800A-x02,x16

28G/32G bit/s 4ch ED

MU183041A-x01

Ext Clock Input

Aux Input

Clock Output

Data Input 1

$\overline{\text{Data}}$ Input 1

Data Input 2

$\overline{\text{Data}}$ Input 2

Data Input 3

$\overline{\text{Data}}$ Input 3

Data Input 4

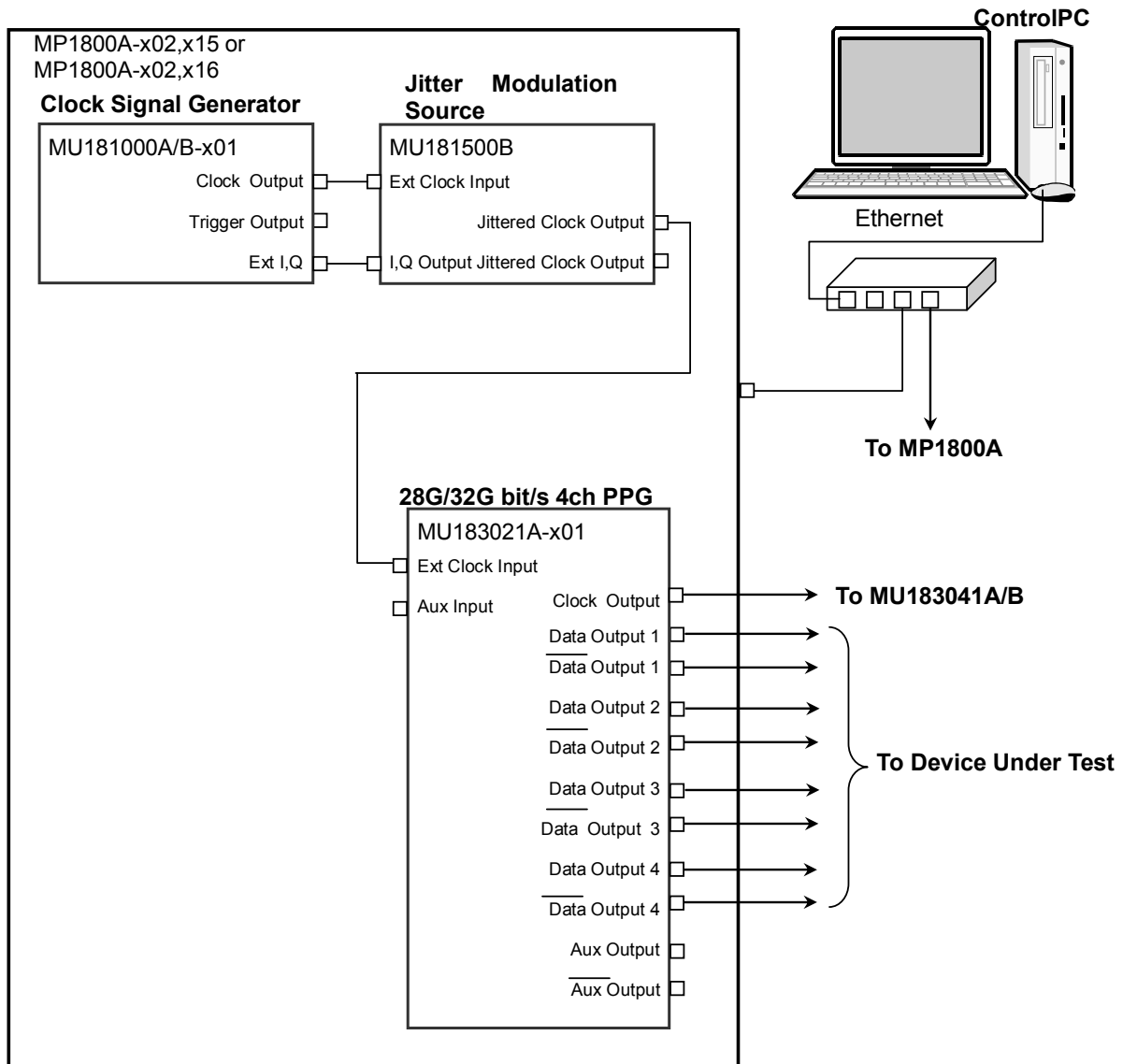$\overline{\text{Data}}$ Input 4

Aux Output
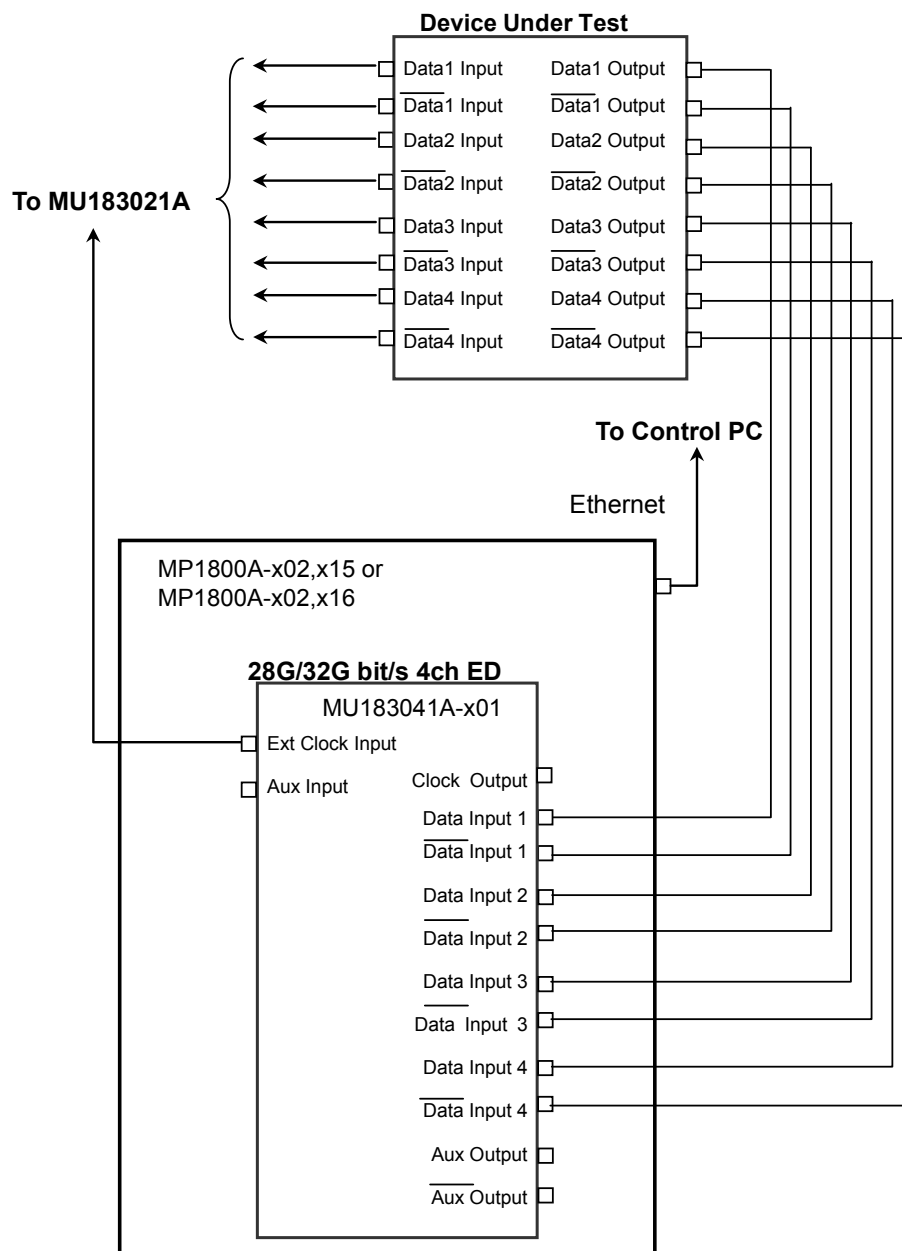
$\overline{\text{Aux}}$ Output

Figure 3.7-2   32 Gbit/s, 4-channel System Configuration (2)

1. When MX181500A is installed on a control PC, connect the control PC through a hub to a couple of MP1800As with a pair of Ethernet cables .
    When MX181500A is installed on one of the two MP1800As, connect the both with an Ethernet cable.
    Each MP1800A requires MP1800A-x02 LAN option.

2. Set remote control of both MP1800As to **Ethernet** on the Remote Control tab of the Setup Utility screen.

3. Mount MU181000A/B-x01, MU181500B and MU183021A-x01 in MP1800A-x02, x15.

4. Mount MU183041A/B-x01 in Slot 1 to 2 of the other MP1800A-x02, x15.

5. Connect the **Clock Output** connector of MU181000A/B-x01 to the **Ext Clock Input** connector of MU181500B with a coaxial cable.

6. Connect the **Ext I,Q** connector of MU181000A/B-x01 to the **I,Q Output** connector of MU181500B with a pair of coaxial cable.

7. Connect the Jittered Clock Output connector of MU181500B to the **Ext Clock Input** connector of MU183021A-x01 with a coaxial cable.

8. Connect the Clock Output connectors of MU183021A-x01 to the Ext. Clock Input connector of MU183041A/B-x01 with coaxial cable.

9. Connect the **Data Output, $\overline{\text{Data}}$ Output** connectors of MU183021A-x01 to the **Data Input, $\overline{\text{Data}}$ Input** connectors of a device under test with eight coaxial cables.

10. Connect the **Data Output, $\overline{\text{Data}}$ Output** connectors of a device under test to the **Data Input, $\overline{\text{Data}}$ Input** connectors of MU183041A/B-x01 with eight coaxial cables.

11. Select MU181500B in Clock Setting of the **Misc2** tab of MU183021A-x01.

    ☞ 5.6 "Misc2 Function" in the *MU183020A 28G/32G PPG MU183021A 28G/32G 4ch PPG Operation Manual*

12. Set Combination of MU183021A in Combination Setting of the **Misc2** tab of MU183021A-x01.

    ☞ 5.6 "Misc2 Function" in the *MU183020A 28G/32G PPG MU183021A 28G/32G 4ch PPG Operation Manual*

13. Set Combination of MU183041A/B in Combination Setting of the **Misc2** tab of MU183041A/B-x01.

    ☞ 5.6 "Misc2 Function" in the *MU183040A 28G/32G bit/s ED MU183041A 28G/32G bit/s 4ch ED MU183040B 28G/32G bit/s High Sensitivity ED MU183041B 28G/32G bit/s 4ch High Sensitivity ED Operation Manual*

3

Connecting Equipment

3.8 System Configuration with MP1821A

3.8.1 Less than 30 Gbit/s, 1-channel system configuration

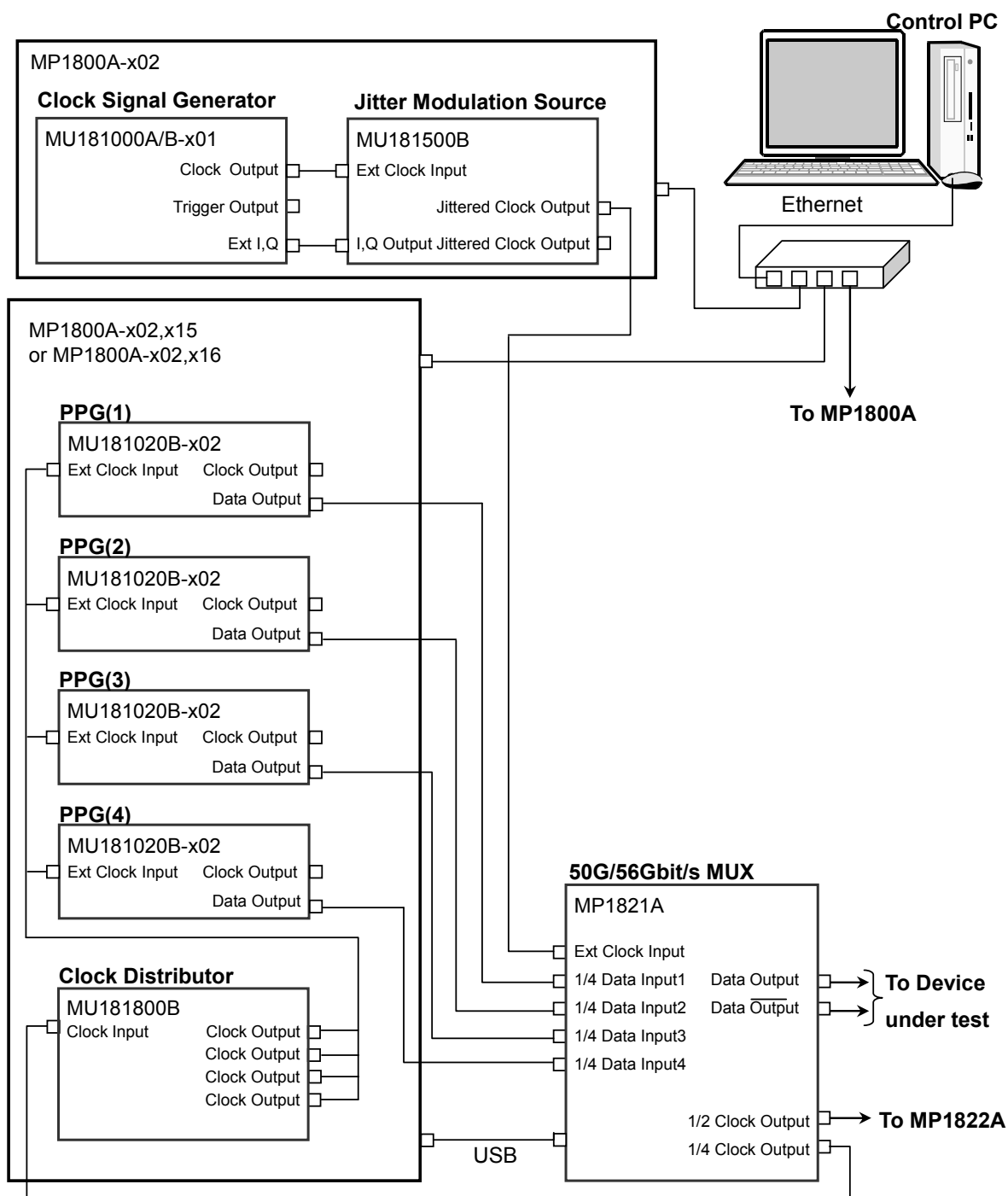This section describes how to set the system when measuring at 20 Gbit/s bit rate.

Figure 3.8.1-1   1-Channel System Configuration with MP1821A When Measuring at Less than 30 Gbit/s (1)

Device under test

To MP1821A

To Control PC

MP1800A-x02,x15
or MP1800A-x02,x16

ED(1)
MU181040A/B-x02
Ext Clock Input   Data Input

To MP1821A

ED(2)
MU181040A/B-x02
Ext Clock Input   Data Input

ED(3)
MU181040A/B-x02
Ext Clock Input   Data Input

ED(4)
MU181040A/B-x02
Ext Clock Input   Data Input

50G/56Gbit/s DEMUX
MP1822A

Ext Clock Input
1/4 Data Output1   Data Input
1/4 Data Output2   Data Input
1/4 Data Output3
1/4 Data Output4

Clock Distributor
MU181800A/B
Clock Input   Clock Output
              Clock Output
              Clock Output
              Clock Output

USB

1/4 Clock Output

Figure 3.8.1-2   1-Channel System Configuration with MP1821A When Measuring at Less than 30 Gbit/s (2)

3

Connecting Equipment

1. When MX181500A is installed on a control PC, use a hub and Ethernet cables to connect the control PC to MP1800As (3 connections).
   When MX181500A is installed on any one of three MP1800As, use a hub and Ethernet cables to connect three MP1800As.
   MP1800A requires the MP1800A-x02 LAN option.

2. Set remote control of MP1800As to Ethernet on the Remote Control tab of the Setup Utility screen.

3. Mount MU181000A/B-x01 and MU181500B in MP1800A-x02.

4. Mount four MU181020A/B-x02 to Slots 1 to 4 of MP1800A-x02, x15.

5. Mount MU181800A/B to Slot 5 of MP1800A-x02, x15.

6. Mount four MU181040A/B-x02 to Slots 1 to 4 of another MP1800A-x02, x15.

7. Mount MU181800A/B to Slot 5 of the same MP1800A-x02, x15 that is described in step 6.

8. Use a coaxial cable to connect the Clock Output connector of the MU181000A/B-x01 and the Ext. Clock Input connector of the MU181500B.

9. Use coaxial cables to connect the Ext.I,Q connector of the MU181000A/B-x01 and the I,Q Output connector of the MU181500B. (2 connections)

10. Use a coaxial cable to connect the Jittered Clock Output connector of the MU181500B and the Ext. Clock Input connector of the MP1821A.

11. Use coaxial cables to connect the Data Output connector of the MU181020A/B-x02 and the 1/4 Data Input connector of the MP1821A. (4 connections)

12. Use a coaxial cable to connect the Clock Output connector of the MP1821A and the Clock Input connector of the MU181800A/B.

13. Use coaxial cables to connect the Clock Output connector of the MU181800A/B and the Ext. Clock Input connector of the MU181020A/B-x02. (4 connections)

14. Use coaxial cables to connect the Data Output and $\overline{\text{Data}}$ Output connectors of the MP1821A and the Data Input and $\overline{\text{Data}}$ Input connectors of the DUT.

15. Use coaxial cables to connect the Data Output and $\overline{\text{Data}}$ Output connectors of the DUT and the Data Input and $\overline{\text{Data}}$ Input connectors of the MP1822A.

16. Use a coaxial cable to connect the 1/4 Clock Output connector of the MP1822A and the Clock Input connector of the MU181800A/B.

17. Use coaxial cables to connect the Clock Output connector of the
     MU181800A/B and the Clock Input connector of the
     MU181040A/B-x02. (4 connections)

18. Use coaxial cables to connect the 1/4 Data Output connector of the
     MP1822A and the Data Input connector of the MU181040A/B-x02. (4
     connections)

19. Use a coaxial cable to connect the 1/2 Clock Output connector of the
     MP1821A and the Ext. Clock Input connector of the MP1822A.

20. From the MX180000A, set the Center Frequency of the MU181500B
     to "10 000 000 kHz". (When measuring at a bit rate of less than 30
     Gbit/s, set 1/2 frequency to the bit rate.)

     ☞ 3.3 "Input Signal Settings" in the *MU181500B Jitter Modulation
     Source Operation Manual*

21. Set the Data Pattern Generator of the MU181500B to
     "Half-rate(MUX)".

☞ 3.5 "Setting Data Output" in the *MU181500B Jitter Modulation Source
     Operation Manual*

22. From the MX180000A, set the Combination of the
     MU181020A/B-x02 to "4Ch Combination".

     ☞ 5.5 "Multi Channel Function" in the *MU181020A 12.5 Gbit/s
     PPG/MU181020B 14 Gbit/s PPG Operation Manual*

23. From the MX180000A, set the Combination of the
     MU181040A/B-x02 to "4Ch Combination".

     ☞ 5.14 "Multi Channel Function" in the *MU181040A 12.5 Gbit/s
     ED/MU181040B 14 Gbit/s ED Operation Manual*

24. From the MX180000A, switch on the MUX-PPG Link button of the
     MP1821A.

     ☞ 4.3.1 "Setting Data/XData" in the *MP1821A 50G/56Gbit/s MUX
     Operation Manual*

25. When the MP1821A-x02 is mounted, from the MX180000A, set the
     Clock Input Band Switch of the MP1821A to "Half Rate Clock".

     ☞ 4.3.1 "Setting clock" in the *MP1821A 50G/56Gbit/s MUX
     Operation Manual*

26. From the MX180000A, switch on the DEMUX-ED Link button of the
     MP1822A.

     ☞ 4.3.1 "Interface setting items" in the *MP1822A 50G/56Gbit/s DEMUX
     Operation Manual*

27. When the MP1822A-x02 is mounted, from the MX180000A, set the
     Clock Input Band Switch of the MP1822A to "Half Rate Clock".

     ☞ 4.4.1 "Input setting items" in the *MP1822A 50G/56Gbit/s DEMUX
     Operation Manual*

3.8.2   30 Gbit/s or more, 1-channel system configuration

Use the Frequency Doubler Module when measuring at a bit rate of 30 Gbit/s or more.

This section describes how to set the system when measuring at 40 Gbit/s bit rate.
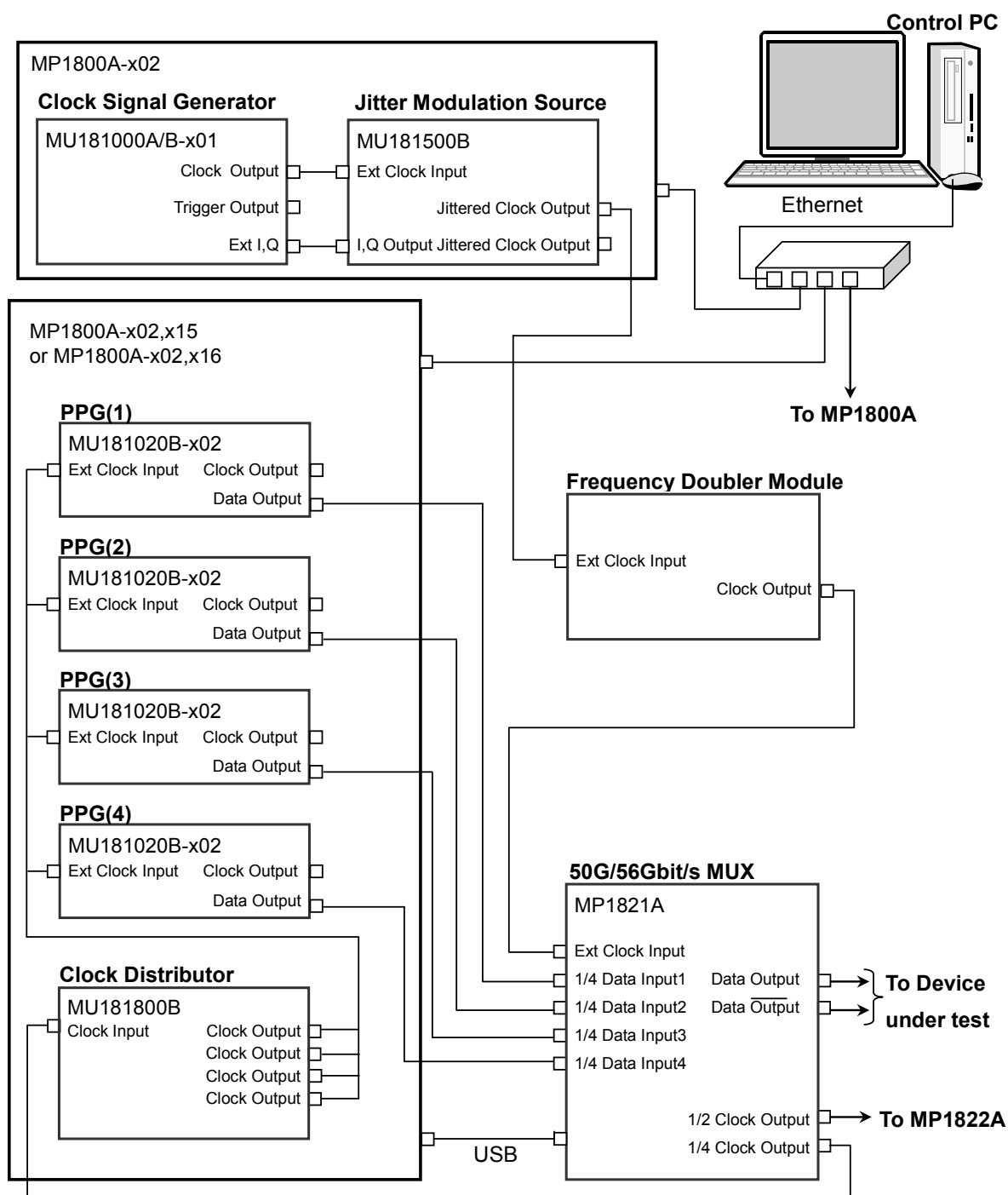
Figure 3.8.2-1   1-Channel System Configuration with MP1821A

When Measuring at 30 Gbit/s or More (1)
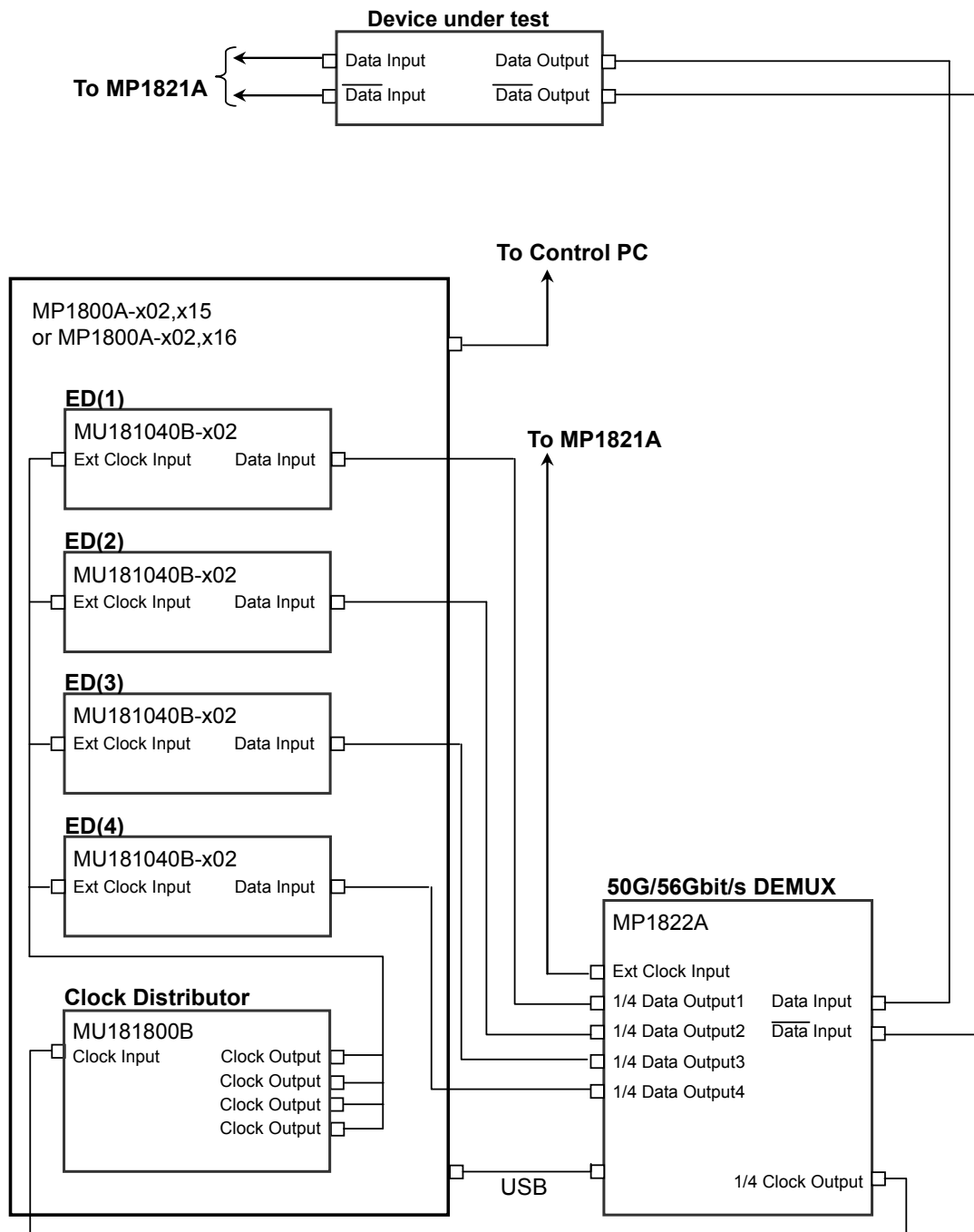
**Figure 3.8.2-2   1-Channel System Configuration with MP1821A
When Measuring at 30 Gbit/s or More (2)**

1. When MX181500A is installed on a control PC, use a hub and
    Ethernet cables to connect the control PC to MP1800As (3
    connections).
    When MX181500A is installed on any one of three MP1800As, use a
    hub and Ethernet cables to connect three MP1800As.
    MP1800A requires the MP1800A-x02 LAN option.

2. Set remote control of MP1800As to Ethernet on the Remote Control tab of the Setup Utility screen.

3. Mount MU181000A/B-x01 and MU181500B in MP1800A-x02.

4. Mount four MU181020A/B-x02 to Slots 1 to 4 of MP1800A-x02, x15.

5. Mount MU181800A/B to Slot 5 of MP1800A-x02, x15.

6. Mount four MU181040A/B-x02 to Slots 1 to 4 of another MP1800A-x02, x15.

7. Mount MU181800A/B to Slot 5 of the same MP1800A-x02, x15 that is described in step 6.

8. Use a coaxial cable to connect the Clock Output connector of the MU181000A/B-x01 and the Ext. Clock Input connector of the MU181500B.

9. Use coaxial cables to connect the Ext.I,Q connector of the MU181000A/B-x01 and the I,Q Output connector of the MU181500B. (2 connections)

10. Use a coaxial cable to connect the Jittered Clock Output connector of the MU181500B and the Ext. Clock Input connector of the Frequency Doubler.

11. Use a coaxial cable to connect the Clock Output connector of the Frequency Doubler and the Ext. Clock Input connector of the MP1821A.

12. Use coaxial cables to connect the Data Output connector of the MU181020A/B-x02 and the 1/4 Data Input connector of the MP1821A. (4 connections)

13. Use a coaxial cable to connect the 1/4 Clock Output connector of the MP1821A and the Clock Input connector of the MU181800A/B.

14. Use coaxial cables to connect the Clock Output connector of the MU181800A/B and the Ext. Clock Input connector of the MU181020A/B-x02. (4 connections)

15. Use coaxial cables to connect the Data Output and $\overline{\text{Data}}$ Output connectors of the MP1821A and the Data Input and $\overline{\text{Data}}$ Input connectors of the DUT.

16. Use coaxial cables to connect the Data Output and $\overline{\text{Data}}$ Output connectors of the DUT and the Data Input and $\overline{\text{Data}}$ Input connectors of the MP1822A.

17. Use a coaxial cable to connect the 1/4 Clock Output connector of the MP1822A and the Clock Input connector of the MU181800A/B.

18. Use coaxial cables to connect the Clock Output connector of the MU181800A/B and the Clock Input connector of the MU181040A/B-x02. (4 connections)

19. Use coaxial cables to connect the 1/4 Data Output connector of the MP1822A and the Data Input connector of the MU181040A/B-x02. (4 connections)

20. Use a coaxial cable to connect the 1/2 Clock Output connector of the MP1821A and the Ext. Clock Input connector of the MP1822A.

21. Start the MX180000A, and then set the Center Frequency of the MU181500B to "10 000 000 kHz". (When measuring at a bit rate of 30 Gbit/s or more, set 1/4 frequency to the bit rate.)

 ☞ 3.5 "Setting Data Output" in the *MU181500B Jitter Modulation Source Operation Manual*

22. From the MX180000A, set the Data Pattern Generator of the MU181500B to "Quarter-rate (MUX)".

 ☞ 3.5 "Setting Data Output" in the *MU181500B Jitter Modulation Source Operation Manual*

23. From the MX180000A, set the Combination of the MU181020A/B-x02 to "4Ch Combination".

 ☞ 5.5 "Multi Channel Function" in the MU181020A 12.5 Gbit/s PPG/MU181020B 14 Gbit/s PPG Operation Manual

24. From the MX180000A, set the Combination of the MU181040A/B-x02 to "4Ch Combination".

 ☞ 5.14 "Multi Channel Function" in the *MU181040A 12.5 Gbit/s ED/ MU181040B 14 Gbit/s ED Operation Manual*

25. From the MX180000A, switch on the MUX-PPG Link button of the MP1821A.

 ☞ 4.3.1 "Setting Data/XData" in the *MP1821A 50G/56Gbit/s MUX Operation Manual*

26. When the MP1821A-x02 is mounted, from the MX180000A, set the Clock Input Band Switch of the MP1821A to "Half Rate Clock".

 ☞ 4.3.1 "Setting clock" in the *MP1821A 50G/56Gbit/s MUX Operation Manual*

27. From the MX180000A, switch on the DEMUX-ED Link button of the MP1822A.

 ☞ 4.3.1 "Interface setting items" in the *MP1822A 50G/56Gbit/s DEMUX Operation Manual*

28. When the MP1822A-x02 is mounted, from the MX180000A, set the Clock Input Band Switch of the MP1822A to "Half Rate Clock".

 ☞ 4.4.1 "Input setting items" in the *MP1822A 50G/56Gbit/s DEMUX Operation Manual*

3

Connecting Equipment

3.9 System Configuration with MP1861A/MP1862A
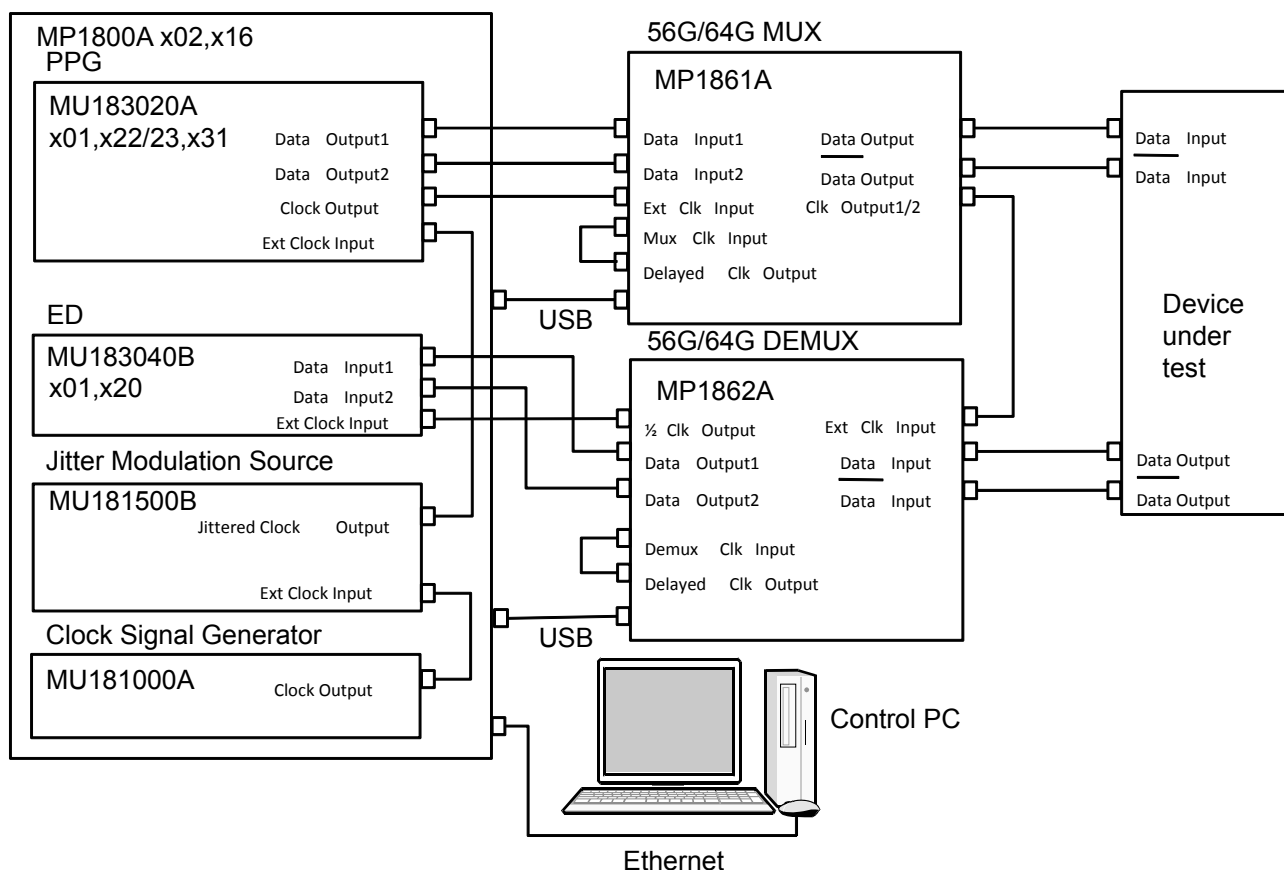
Figure 3.9-1   System Configuration with MP1861A/MP1862A

1. When MX181500A is installed on the Control PC, connect the
    Control PC and MP1800A using an Ethernet cable.
    The MP1800A-x02 LAN option needs to be added to MP1800A.

2. On the **Remote Control** tab of the **Setup Utility** screen, set remote
    control of MP1800A to **Ethernet**.

3. Mount MU183020A, MU183040B, MU181000A and MU181500B to
    Slot 1 to 6 of MP1800A-x02/x16.

4. Connect the **Clock Output** connector of MU181000A and the **Ext.
    Clock Input** connector of MU181500B by using the coaxial cable.

5. Connect the **Jittered Clock Output** connector of MU181500B and the
    Ext. Clock Input connector of MU183020A by using the coaxial
    cable.

6. Connect the **Data Output** connectors of MU183020A and the **Data Input1/2** connectors of MP1861A, respectively by using coaxial cables. (2 points)

7. Connect the **Clock Output** connector of MU183020A and the **Ext. Clk Input** connector of MP1861A by using the coaxial cable.

8. Connect the **Data Output** and $\overline{\text{Data}}$ **Output** connectors of MP1861A and the **Data Input** and $\overline{\text{Data}}$ **Input** connectors of the DUT by using coaxial cables.

9. Connect the **Data Output** and $\overline{\text{Data}}$ **Output** connectors of the DUT and the **Data Input** and $\overline{\text{Data}}$ **Input** connectors of MP1862A by using coaxial cables.

10. Connect the **Clock Output1/2** connector of MP1861A and the **Ext. Clk Input** connector of MP1862A by using the coaxial cable.

11. Connect the **1/2 Clk Output** connector of MP1862A and the **Ext Clock Input** connector of MU183040B by using the coaxial cable.

12. Connect the **Data Output1/2** connectors of MP1862A and the **Data Input** connectors of MU183040B by using the coaxial cables (2 points).

13. On the **Misc2** tab of MU183020A, select **MU181500B** in the **Clock Source** box.

☞ 5.6 "Misc2 Function" in the *MU183020A 28G/32G bit/s PPG MU183021A 28G/32G bit/s 4ch PPG Operation Manual*

14. On the **Misc2** tab of MU183020A, click **Setting** in the **Combination Setting** area, and then in the **Combination Setting** dialog box, click **2ch** in the **Combination** box.

☞ 5.6 "Misc2 Function" in the *MU183020A 28G/32G bit/s PPG MU183021A 28G/32G bit/s 4ch PPG Operation Manual*

15. On the **Misc2** tab of MU183040B, click **Setting** in the **Combination Setting** area, and then in the **Combination Setting** dialog box, click **2ch** in the **Combination** box.

☞ Section 5.7 "Misc2 Function" in the *MU183040A MU183041A/MU183040B/MU183041B Operation Manual*

16. From MX180000A, switch on the **MUX-PPG Link** button of MP1861A.

☞ 4.3 "Setting Output Interface" in the *MP1861A 56G/64Gbit/s MUX Operation Manual*

17. From MX180000A, switch on the **DEMUX-ED Link** button of MP1862A.

☞ 4.3 "Displaying Measurement Result" in the *MP1862A 56G/64Gbit/s DEMUX Operation Manual*

Chapter 4 Operation

This chapter describes the methods for measurement and the procedures for screen operation.

4

Operation

4.1 Measurement Method

4.1.1 Jitter Tolerance measurement method

Jitter Tolerance measures the tolerance of jitter per each listed jitter frequency.

Jitter tolerance is the maximum jitter amplitude at which the number of errors or the error rate becomes equal to or below the Pass/Fail Threshold. The following types of measurement methods are available:

• Binary Search

The binary search method is used to search for the target jitter amplitude.

The binary search method decreases its searching range of jitter amplitude by half for every measurement execution. If the error measurement value is equal to or below the value of Threshold, the jitter amplitude is increased; if it exceeds the value of Threshold, the jitter amplitude is decreased. The search ends when the amount of searching range becomes equal to or below the value of Step Resolution. In the figure below, the jitter amplitude of the fifth measurement represents the final measurement result.
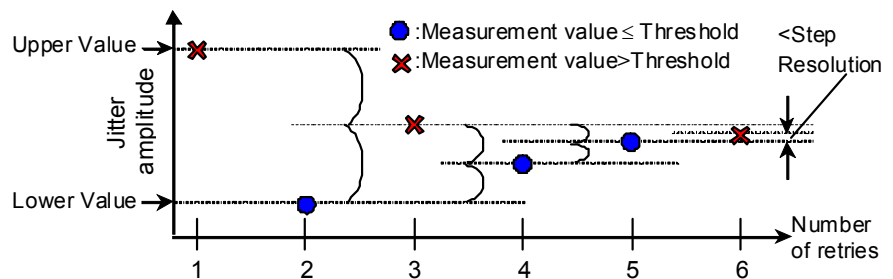
Figure 4.1.1-1   Procedure for the Binary Search measurement method

• Downwards

The jitter amplitude is decreased from the Start Value until the error measurement value becomes equal to or below the value of Threshold.
In the case of Downwards Linear, the jitter amplitude is decreased by the value set in Step.
In the case of Downwards Log, the jitter amplitude is decreased by the magnification set in Ratio.
In cases that the error measurement value still exceeds the Threshold even when the jitter amplitude becomes equal to or below Lower Value, the next step jitter amplitude will be taken as the final measurement value.
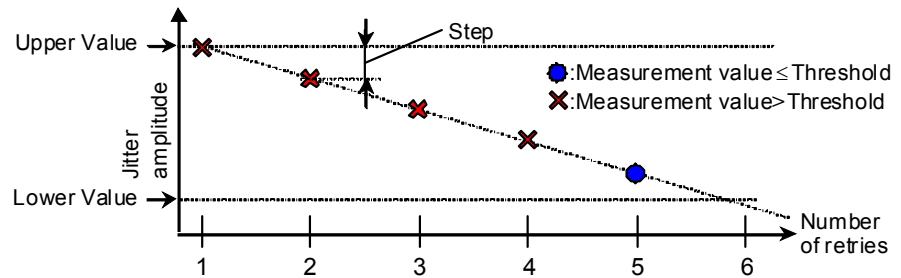
Figure 4.1.1-2   Procedure for Downwards Linear measurement
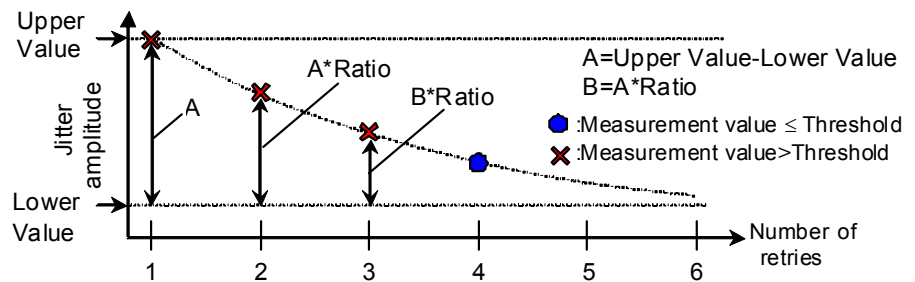
Figure 4.1.1-3   Procedure for Downwards Log measurement

- Upwards

The jitter amplitude is increased from the Start Value until the error measurement value exceeds the value of Threshold.

In the case of Upwards Linear, the jitter amplitude is increased by the value set in Step.

In the case of Upwards Log, the jitter amplitude is increased by the magnification set in Ratio.

In cases that the error measurement value still does not exceed the Threshold even when the jitter amplitude becomes equal to or above Upper Value, the next step jitter amplitude will be taken as the final measurement value.
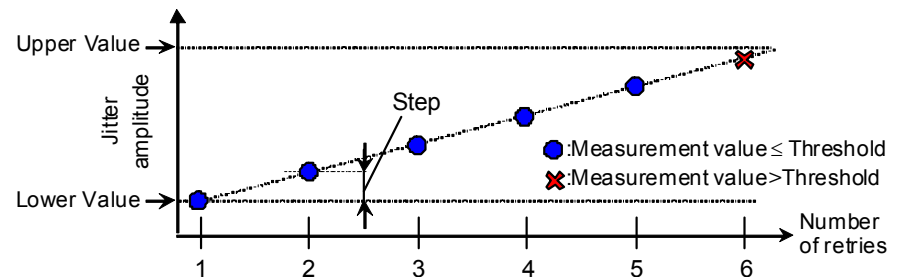
Figure 4.1.1-4   Procedure for Upwards Linear measurement
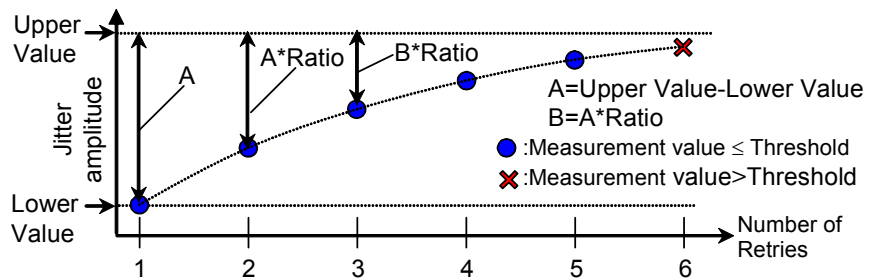
Figure 4.1.1-5   Procedure for Upwards Log measurement

- Binary + Linear

After searching the jitter amplitude from the lower value by the binary search method, the Upwards Linear measurement is executed.
From the point searched by the binary search method, the jitter amplitude is increased at a step of the value, which is a half of the value set for Step Resolution, until the error measurement value exceeds the Threshold value.
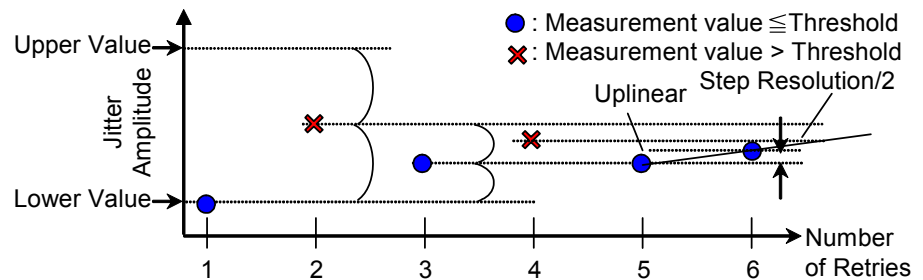
Figure 4.1.1-6   Procedure for Binary + Linear measurement

4.1.2 Jitter Sweep measurement method

Jitter Sweep measures the bit error rate by adding the sine wave of the listed frequencies and amplitudes.
Different from Jitter Tolerance, this method causes no change to the jitter amplitude during measurement.

In addition, Jitter Sweep can use as Threshold the value obtained by adding 0 to 100% margin to the standard value.

4.1.3 Measurement time

Both Jitter Tolerance and Jitter Sweep measurement methods repeat the process for measuring the bit error rate by changing the jitter frequency and jitter amplitude.

MX181500A setups the jitter frequency, the waiting time after changing the jitter amplitude, and the bit error rate measurement time under the following names:

Waiting Time: Waiting time after changing the jitter frequency

Settling Time: Waiting time after changing the jitter amplitude (Jitter Tolerance only)

Gating Time: Bit error rate measurement time

The time relationship in the Jitter Tolerance measurement is as shown in the figure below:
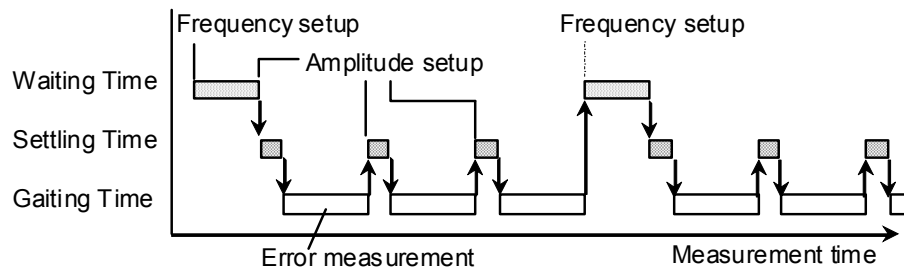
Figure 4.1.3-1   Setup time relationship (Jitter Tolerance)

The time relationship in the Jitter Sweep measurement is as given in the figure below:
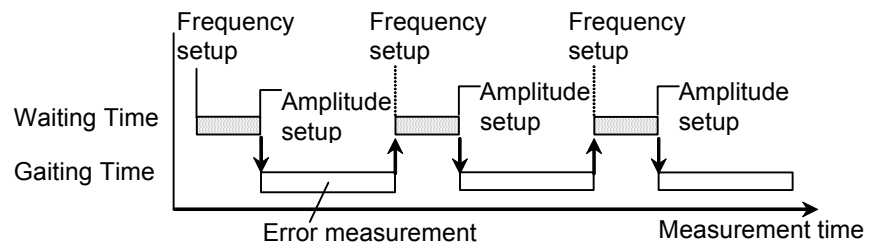
Figure 4.1.3-2   Setup time relationship (Jitter Sweep)

4.2 Setup Procedure

The basic setup procedure is as shown below:

```
                    ( Startup )                    Descriptions you find in this
                         |                         manual
                         v                      ┌─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
          ┌──────────────────────────┐          |  ┌──────────────────────────┐ |
          │ Set the IP address and   │          |  │ Set the test pattern.    │ |
          │ port number of MP1800A or│          |  └──────────────────────────┘ |
          │ MT1810A in the MX180000A │          |              |                |
          │ control software.        │          |              v                |
          └──────────────────────────┘          |  ┌──────────────────────────┐ |
                         |                       |  │ Select the jitter to be  │ |
                         v                       |  │ added and set parameters.│ |
          ┌──────────────────────────┐          |  └──────────────────────────┘ |
          │ Set the frequency of     │          |              |                |
          │ MU181500B in the MX180000A│         |              v                |
          │ control software.        │          |  ┌──────────────────────────┐ |
          └──────────────────────────┘          |  │ Set the BER measurement  │ |
                         |                       |  │  method.                 │ |
                         v                       |  └──────────────────────────┘ |
          ┌──────────────────┐  Yes              |              |                |
          │ Do you use MUX   │─────┐             |              v                |
          │ and DEMUX?       │     |             |  ┌──────────────────────────┐ |
          └──────────────────┘     v             |  │ Set the jitter frequency.│ |
                 | No     ┌──────────────┐       |  └──────────────────────────┘ |
                 |        │ Set          │       |              |                |
                 |        │ [Combination]│       |              v                |
                 |        │ in MX180000A.│       |  ┌──────────────────────────┐ |
                 |        └──────────────┘       |  │ Set the standard data.   │ |
                 |<──────────────┘               |  └──────────────────────────┘ |
```

Figure 4.2-1   Setup procedure

4.3 Start up and Exit

This section explains the startup and exit procedures for cases where MX181500A is installed on MP1800A and cases where it is installed on an external PC.

4.3.1 When using on MP1800A

Startup procedure

(1) Click the **Auto Measurement** button on the tool bar of the MX180000A Signal Quality Analyzer Control Software (hereafter, MX180000A). The Auto Measurement Select screen appears.

Figure 4.3.1-1   Auto Measurement button

(2) Click **Jitter/Noise Tolerance Test Software** on the Auto Measurement Select screen. MX181500A starts up and the Main screen appears.
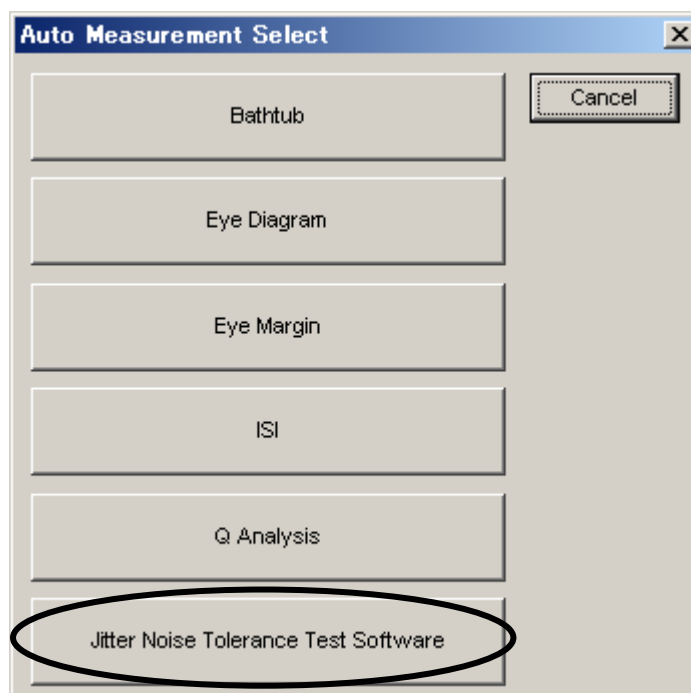
Figure 4.3.1-2   Auto Measurement Select screen

For the details of MX180000A, see *MX180000A Signal Quality Analyzer Control Software Operation Manual.*

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Operation

Exit procedure

(1)   Open the File menu and click **Exit**.

(2)   Click the **Close** button on the Main screen to exit MX181500A.

(3)   Turn off the power of all instruments.

Note:

Do not press the **Power** button on the front panel of MP1800A while using MX181500A installed on MP1800A to avoid falling into an unable state to exit MX181500A. Be sure to exit MX181500A before pressing the **Power** button.

4.3.2 When using on an external PC

Startup procedure
Start MX181500A by clicking **Start**, **All programs**, **MX181500A**, and then **Jitter/Noise Tolerance Test Software** in this order.
If you have created a shortcut on your desk top, double-click the shortcut.
Start MX181500A to display the Main screen.
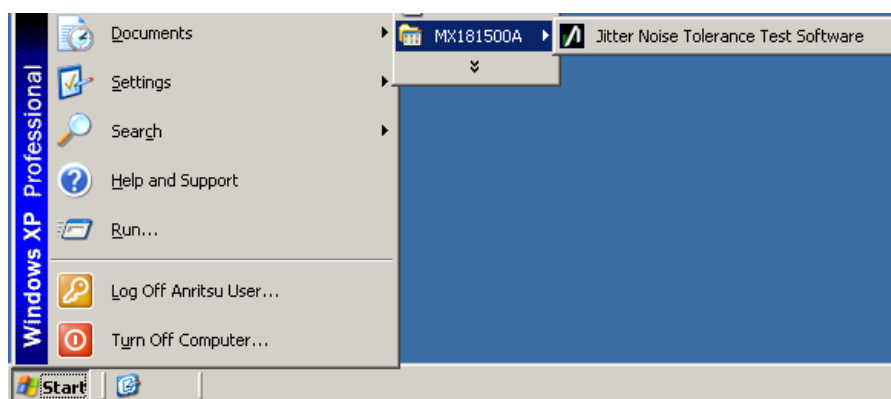
Figure 4.3.2-1   Startup procedure

Exit procedure

(1)   Open the File menu and then click **Exit**.

(2)   Click the **Close** button on the Main screen to exit MX181500A.

(3)   Turn off the power of all instruments.

4.4 Measurement System Configuration

Start MX181500A to display the Main screen. On the Main screen, you can configure the equipment connections, select the equipment to be connected, and select the measurement method.

Measurement method
selection button

MP1800A/MT1810A
connection setup area

Minimize button   **Exit** button

Equipment selection area   Status display   Search progress display   **Search Start** button
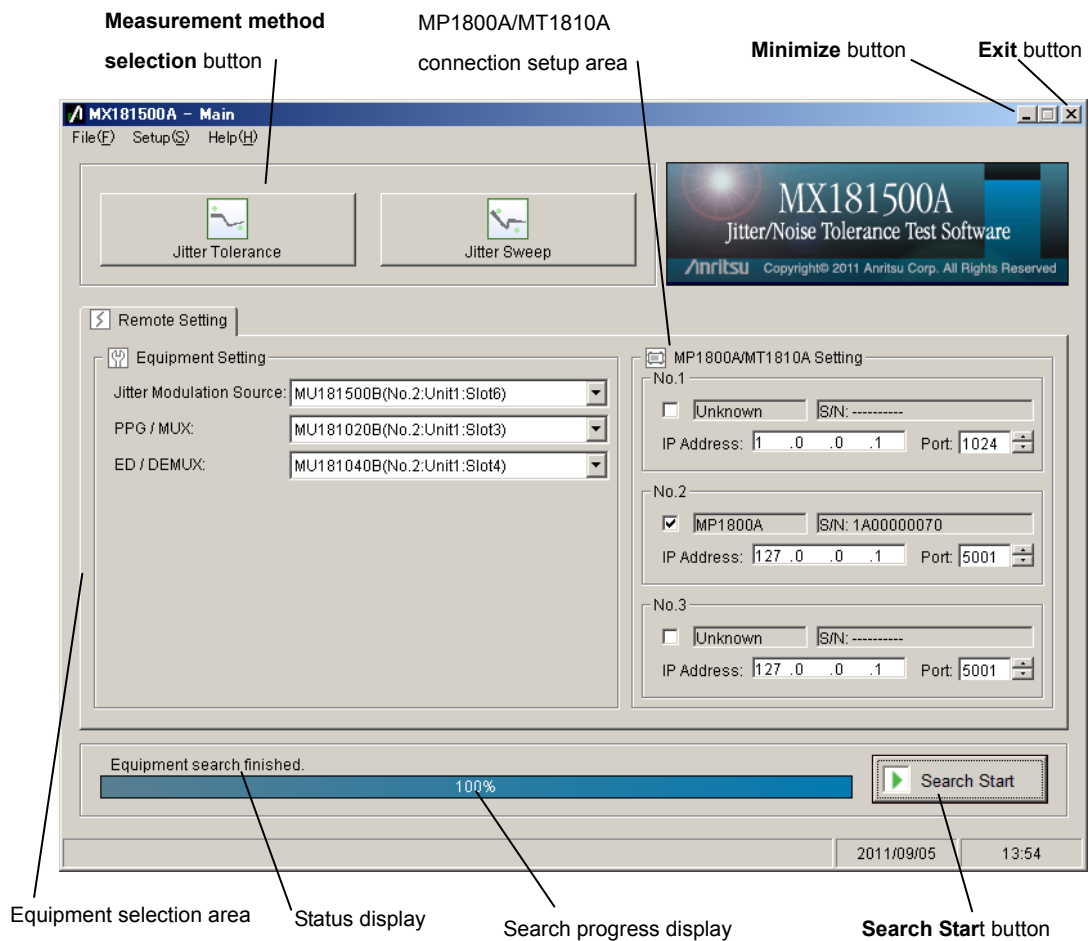
Figure 4.4-1   Main screen

After clicking the **Minimize** button while using MX181500A on MP1800A, you can revive the screen by following the procedure given below:

- Press the **Alt** + **Tab** key on the front panel of MP1800A.
- Press the **Alt** + **Tab** key of the connected keyboard.

4

Operation

Table 4.4-1   Main screen-Remote Setting

Item	Description
Measurement method selection button	Selects the measurement method. You cannot operate this button if no equipment is selected. The **Jitter Tolerance** button: The Jitter Tolerance screen appears. The **Jitter Sweep** button: The Jitter Sweep screen appears.
Equipment selection area	The list of detected equipment is displayed by equipment type as the result of equipment search. When MP1821A or MP1822A is connected to MP1800A that controls MX181500A, the detected equipment is displayed. Refer to Figure 4.4-3 for details.
MP1800A/ MT1810A Setting	When this is selected, the selected equipment will be searched with the press of the **Search Start** button. For MP1800A and MT1810A, up to three units can be selected. Sets the IP address and the TCP port number of MP1800A or MT1810A to be controlled. When connection is established, the model number and the serial number will be displayed. The available range for setting the TCP port number is 1024 to 65535. The default values are as follows: 　IP address: 127.0.0.1,Port number: 5001
Search Start button	Searches the equipment connected to the Ethernet. The indication on the button changes to **Search Abort** during search. Stops searching equipment if you click the **Search Abort** button.
Search progress display	Displays the progress of the equipment search.
Status display	Displays the status of the equipment search.
Minimize button	Minimizes the screen.
Exit button	Exits MX181500A.

If you have changed the equipment to be connected, execute Equipment Search once again.

Note:

Do not pull off the Ethernet cable connected to MP1800A/MT1810A while Equipment Search is going on, or else MX181500A cannot recognize the equipment correctly.
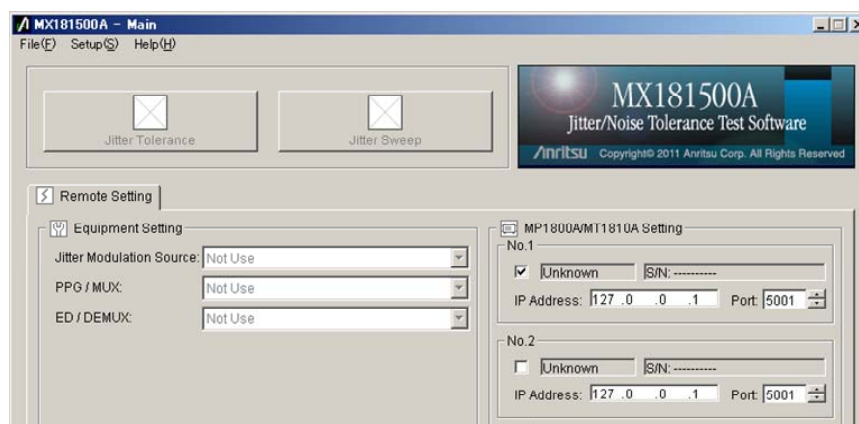
Figure 4.4-2   Main screen When No Equipment Is Selected

The screen appearance changes as follows by executing an equipment search when MP1821A or MP1822A is connected.
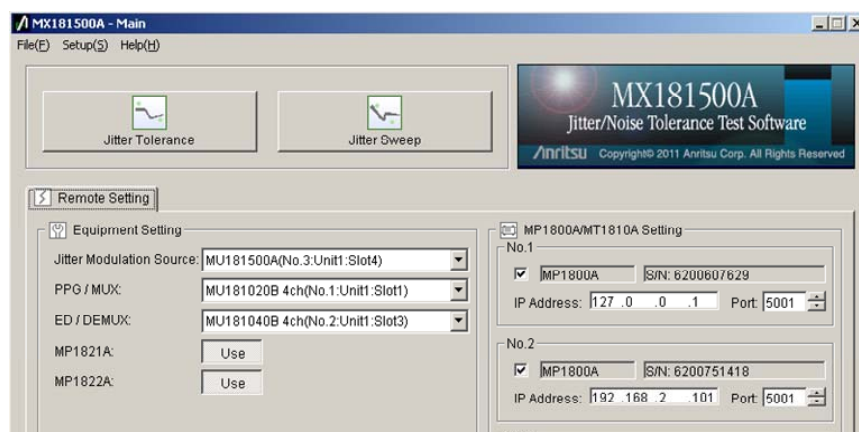
Figure 4.4-3   Main Screen When MP1821A or MP1822A Is Detected

Notes:

- Do not remove the USB cable that connects MP1800A with MP1821A or MP1822A when the equipment search is being executed or has completed. If removed, the equipment cannot be controlled correctly.

- If the equipment cannot be detected when MP1821A or MP1822A is connected, check the following items:

  - The MUX-PPG Link button or DEMUX-ED Link button is switched on.

  - The Clock Input Band Switch is set to "Half Rate Clock".

  Refer to *MP1821A 50G/56Gbit/s MUX Operation Manual* and *MP1822A 50G/56Gbit/s DEMUX Operation Manual* for details on how to operate MP1821A and MP1822A.

4

Operation

4.5 Measurement Condition Setup

4.5.1 Selecting the measurement method

Press the **Measurement method selection** button on the Main screen to select Jitter Tolerance or Jitter Sweep.

Jitter Tolerance

This method changes the modulation frequency of SJ to measure the jitter tolerance.
The jitter tolerance is measured by changing the jitter modulation amplitude to find the maximum modulation amplitude satisfying the bit error rate equal to or below the threshold value.
Pass or fail is judged for every modulation frequency by comparing the measured jitter tolerance with the mask data.

Jitter Sweep

The bit error rate is measured by changing the modulation frequency and modulation amplitude of SJ according to the list of frequencies and amplitudes.
Pass or fail is judged for every modulation frequency by comparing the measured bit error rate and the threshold value.

4.5.2 Screen configuration

Click the **Jitter Tolerance** button on the Main screen to let the Jitter Tolerance setup screen appear. The referents for each setup area are shown in the figure below.

Menu   4.5.3 Setting the jitter and pattern   4.5.7 Starting Measurement

4.5.4 Setting up the BER measurement method   4.5.6 Setting up the Mask data   4.5.5 Setting up the Jitter modulation frequency
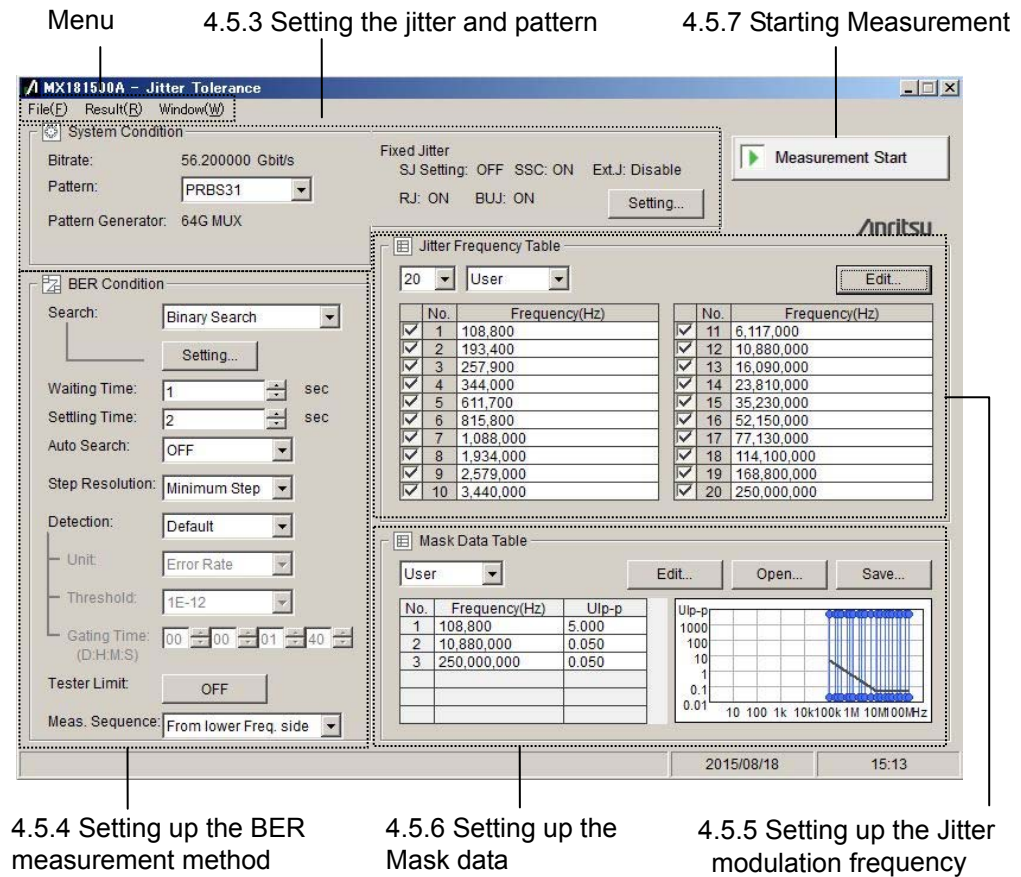
Figure 4.5.2-1   Jitter Tolerance setup screen

Click the **Jitter Sweep** button on the Main screen, to let the Jitter Sweep setup screen appear as shown below: The referents for setup areas are shown in the figure below.
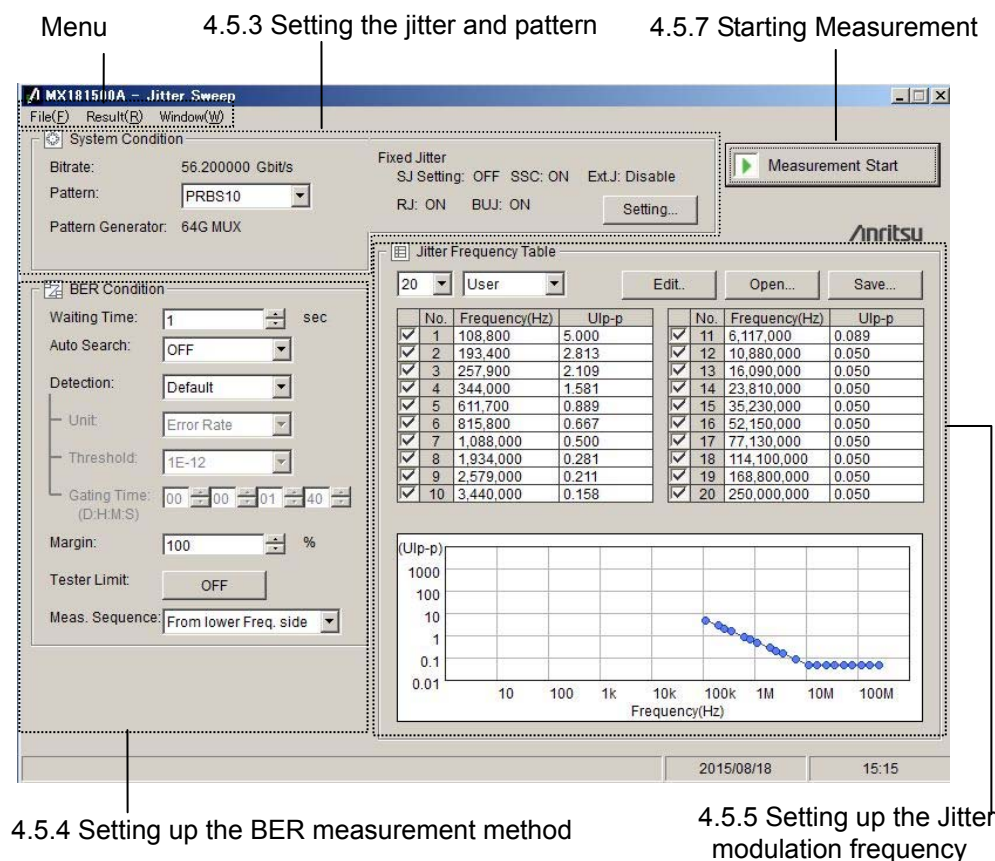
Figure 4.5.2-2   Jitter Sweep setup screen

The menu on the screen has the following items:

Table 4.5.2-1   Items on the menu

Menu	Description
File(F)	
Save(S)	Saves parameters of measurement conditions to file.
Load(L)	Reads out parameters of measurement conditions from file.
Initialize(I)	Initializes parameters.
Exit(X)	Exits MX181500A. Measurement results are not saved.
Result(R)	
Show(S)	Displays the Result screen.
Window(W)	
Maximize	Sets the setup screen to the maximum-size display.
Minimize	Sets the setup screen to the minimum-size display.

4.5.3 Setting the jitter and pattern

Set the sending pattern and jitter in System Condition.
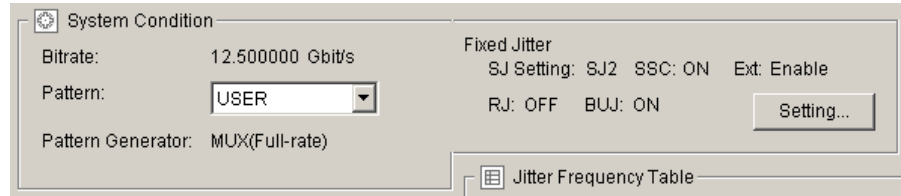
Figure 4.5.3-1   System Condition setup area

Table 4.5.3-1   System Condition setup items

Item	Description
Bit Rate	Displays the bit rate of MU181500B.
Pattern	Sets the test patterns of MU181020A/B, MU181040A/B, MU183020A, MU183021A, MU183040A/B and MU183041A/B. PRBS: Sets the number of steps for PRBS. User: When using a test pattern other than PRBS, use the one set in PPG/ED in advance.
Pattern Generator	Displays the output settings of MU181500B.
Fixed Jitter	Displays the state of jitter output from MU181500B.
Setting	Displays the jitter setup screen shown in Figure 4.5.3-2, and changes the setup status.

Note:

When you click the **Jitter Tolerance** button or the **Jitter Sweep** button, the value set in MU181500B is displayed in System Condition.
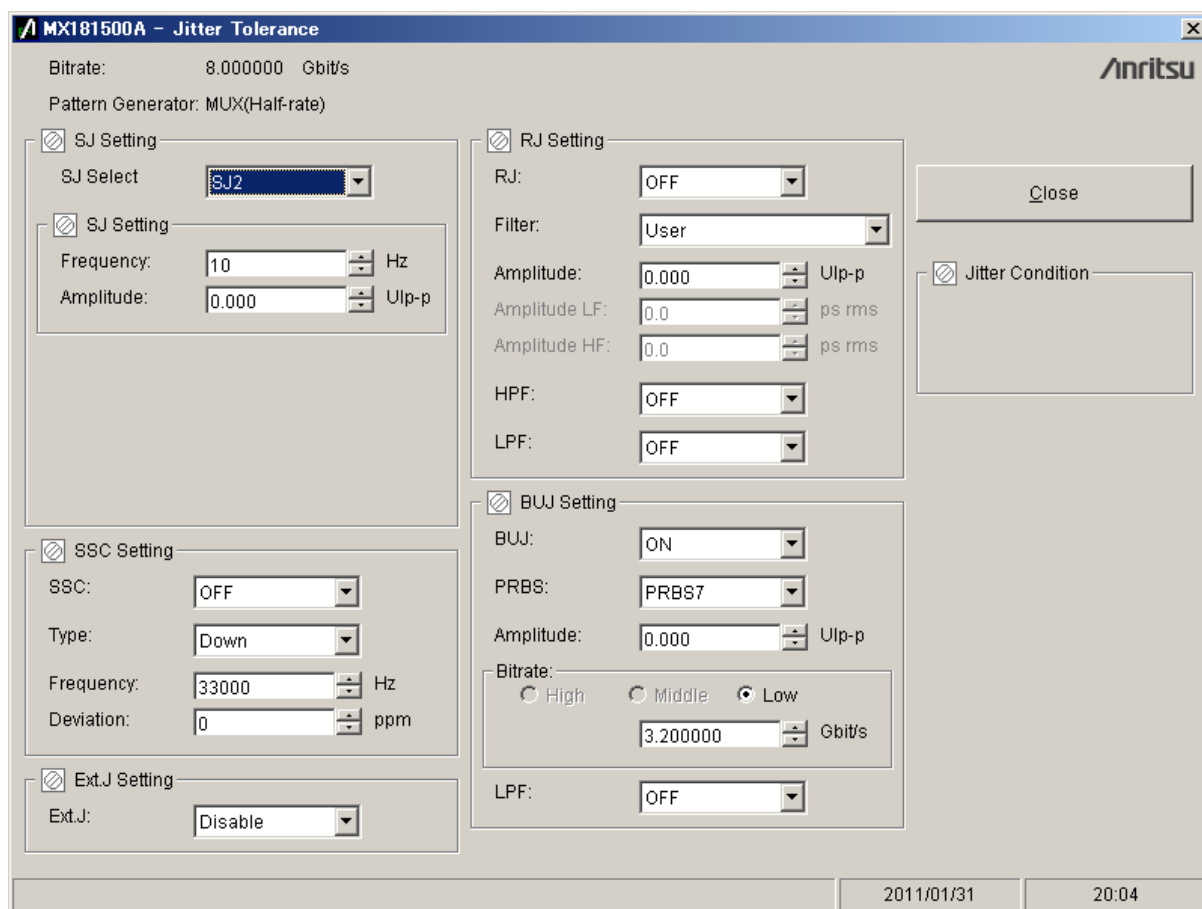
Figure 4.5.3-2   Jitter setup screen

On the jitter setup screen, set the type and parameters of the static-output jitter generated by MU181500B.

For the type and specifications of jitters generated by MU181500B, see *MU181500B Jitter Modulation Source Operation Manual*.

Table 4.5.3-2　Jitter setup items

Item		Description
SJ Setting		Sets parameters for SJ (Sinusoidal Jitter).
	SJ Select	Select which jitter is to add with fixed amplitude.
		SJ[1]: The amplitude of SJ is fixed; the amplitude of SJ2 is swept.
		SJ2[1]: The amplitude of SJ2 is fixed; the amplitude of SJ is swept.
		OFF: The amplitude of SJ is swept.
	SJ Setting	The parameter setting of SJ or SJ2 configured in SJ Select.
	Frequency	Jitter modulation frequency
	Amplitude	Jitter modulation amplitude
SSC Setting		Sets parameters for SSC (Spread Spectrum Clock).
	SSC	Sets On/Off of the SSC modulation output.
	Type	The direction in which the clock frequency is to be spectrum-spread
	Frequency	The frequency to modulate the clock frequency
	Deviation	Spread spectrum width
RJ Setting		Sets parameters for RJ (Random Jitter).
	RJ	Sets On/Off of the RJ modulation output.
	Filter	The filter that controls the modulation frequency and amplitude of random jitters
	Amplitude[2]	Jitter modulation amplitude
	Amplitude LF [3]	The jitter modulation amplitude of the lower modulation frequency
	Amplitude HF [3]	The jitter modulation amplitude of the higher modulation frequency
	HPF	The high-pass filter to limit lower frequency of the random jitter modulation
	LPF	The low-pass filter to limit upper frequency of the random jitter modulation

[1]: Selectable when MU181500B is synchronized with MU181000A/B-x01.

[2]: Selectable when the setting of Filter is User.

[3]: Selectable when the setting of Filter is PCIe.

Table 4.5.3-2   Jitter setup items (Cont'd)

Item		Description
BUJ Setting		Sets parameters for BUJ (Bounded Uncorrelated Jitter).
	BUJ	Sets On/Off of the BUJ modulation output.
	PRBS	The bit pattern of PRBS (Pseudo Random Bit Sequence)
	Amplitude	Jitter modulation amplitude
	Bit Rate	BUJ bit rate. High: 9.8 to 12.5 Gbit/s Middle: 4.9 to 6.25 Gbit/s Low: 0.1 to 3.2 Gbit/s
	LPF	The low-pass filter of the BUJ modulation frequency
Ext. J Setting		Ext. Sets parameters for J (External Jitter).
	Ext. J	Ext. Sets Enable/Disable of the J modulation output.
Jitter Condition		**Overload** will be indicated if the total amplitude of the jitters exceeds the specification of MU181500B.

4.5.4 Setting up the BER measurement method

When measuring Jitter Tolerance, set parameters for the test pattern, stable time, executing/not executing auto search, Pass/Fail judgment condition, error judgment unit, Pass/Fail judgment error threshold, and measurement time.

(a) Jitter Tolerance   (b) Jitter Sweep

Figure 4.5.4-1   BER Condition setup area

Table 4.5.4-1   BER Condition setup items

Item		Description
Search *1		The change direction and method for jitter modulation amplitude ☞ 4.1.1 Jitter Tolerance measurement method Binary Search: Changes the amplitude between Upper Value and Lower Value based on the binary search method. Downwards Linear, Downwards Log, Upwards Linear, Upwards Log 　Downwards: 　Executes the BER measurement by decreasing the amplitude from the maximum value or Upper Value. 　Upwards: Executes the BER measurement by increasing the amplitude from 0 or Lower Value. 　Linear: Changes the amplitude in a fixed step. 　Log: Changes the amplitude at a fixed ratio. Binary + Linear: Executes the Upwards Linear measurement after the binary search method.
	Setting	Displays the Search Setting screen given in Figure 4.5.4-2. Enter Upper Value, Lower Value, Step, and Ratio.
Waiting Time		The Waiting time after changing the jitter modulation frequency up to execution of the next processing. ☞ 4.1.3 Measurement time
Settling Time*1		The waiting time after changing the jitter modulation amplitude up to starting of the BER measurement.

*1:   Appears when Jitter Tolerance is selected.

If selecting a search method other than Binary Search, the setting

for Step Resolution will be disabled.

Table 4.5.4-1   BER Condition setup items (Cont'd)

Item	Description
Auto Search	Sets ON/OFF of MU181040A/B,MU182040A, MU182041A, MU183040A/B, MU183041A/B or MP1822A before starting measurement. Fine：Executes Auto Search (Fine) before starting measurement. Course　:Executes Auto Search (Course) before starting measurement OFF :Executes no Auto Search before starting measurement (default) In the following cases, you cannot operate Auto Search because it is unexecutable. • MU181040A/B-x01 is installed. • The target equipment is executing Auto Adjustment. • Auto Sync is set to Off. • Option x02 is added to MU181040A/B, but option x30 is not. • Option x30 or Option x31 is not added to MU182040A, MU182041A or MP1822A.
Step Resolution *2	The step resolution of searching the jitter tolerance point. Where the setting of Pattern Generator is MUX(Half-rate)

Where the setting of Pattern Generator is MUX(Half-rate)

		Jitter modulation frequency/Minimum resolution (UI)		
	Modulation frequency (Hz)	10-1M	1M-10M	10M-250M
Setting	Fine	0.2	0.02	0.002
	Normal	0.4	0.04	0.004
	Coarse	1	0.1	0.01
	Minimum Step	0.002	0.002	0.002

Where the setting of Pattern Generator is MUX(Full-rate), PPG

		Jitter modulation frequency/Minimum resolution (UI)		
	Modulation frequency (Hz)	10-1M	1M-10M	10M-250M
Setting	Fine	0.1	0.01	0.001
	Normal	0.3	0.03	0.003
	Coarse	1	0.1	0.01
	Minimum Step	0.001	0.001	0.001

*2:   Displayed when Jitter Tolerance is selected.

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Table 4.5.4-1   BER Condition setup items (Cont'd)

Item		Description
Detection		Sets conditions to be used for the Pass/Fail judgment.

		Default: Pass/Fail judgment is available in the following condition;
		    Unit = Error Count,
		    Threshold = two
		    Gating Time = one second (default).

		Error: Executes judgment if the bit error in the set Gating Time exceeds the value of Error Threshold.
	Unit	Sets whether to make the Pass/Fail judgment based on the error rate or the number of errors.
		Error Rate: Makes judgment based on the error rate (default).
		Error Count : Makes judgment based on the error bit count.
	Threshold	Sets the judgment threshold for the judgment method selected in Unit. Judges as Fail if the number of the bit errors is more than the judgment threshold value.
		Where Unit is Error Rate: $1E{-}8, 1E{-}9, 1E{-}10, 1E{-}11, 1E{-}12$ (default: $1E{-}12$)
		Where **Unit** is Error Count: 0 to 99999/Step 1 (default: 0)
	Gating Time	Specifies the measurement time up to the end of judgment.

Item	Range	Default
Day	0 to 99	0
Hour	0 to 23	0
Min	0 to 59	1
Sec	0 to 59	40

Item	Description
Margin *3	Sets the margin of the Pass/Fail judgment in the range of 0 to 100%.
	If you set the margin of 50%, the Pass/Fail judgment criteria will be 1.5 times the value of Threshold.
Tester Limit	Sets whether to enable or disable the Amplitude limit for SJ/SJ2 when performing the Tolerance/Sweep measurement. (This parameter is available only when 32G PPG, 56G MUX and 64G MUX are used.)
	ON: Sets the SJ Amplitude limit to the upper limit of the guaranteed operating range of the PPG to be used for measurement.
	OFF: Sets the SJ Amplitude limit to the maximum amplitude that the PPG can generate.
Meas.Sequence	Specifies the measurement sequence direction.
	From lower Freq.side : Measures from lower modulation frequency side
	From higher Freq.side : Measures from higher modulation frequency side

*3:   Displayed when Jitter Sweep is selected.

If the margin is set above the upper setting limit value,

measurement will be made with the upper setting limit value.

By clicking the **Setting** button, you can set parameters for the modulation amplitude for every range of the modulation frequency.
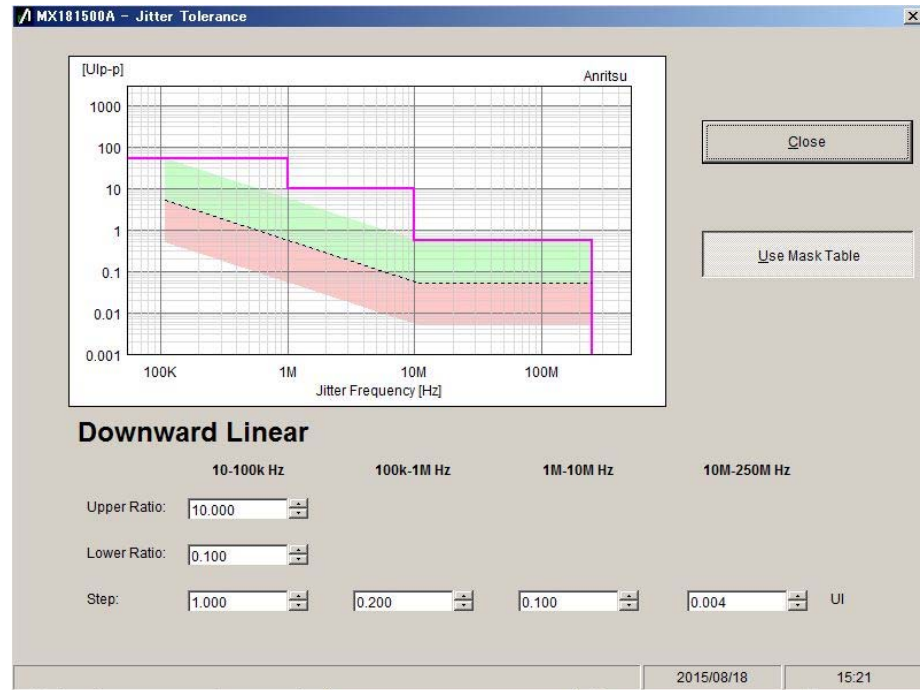
**Figure 4.5.4-2   Search Setting screen
(Downward Linear, Use Mask Table ON)**
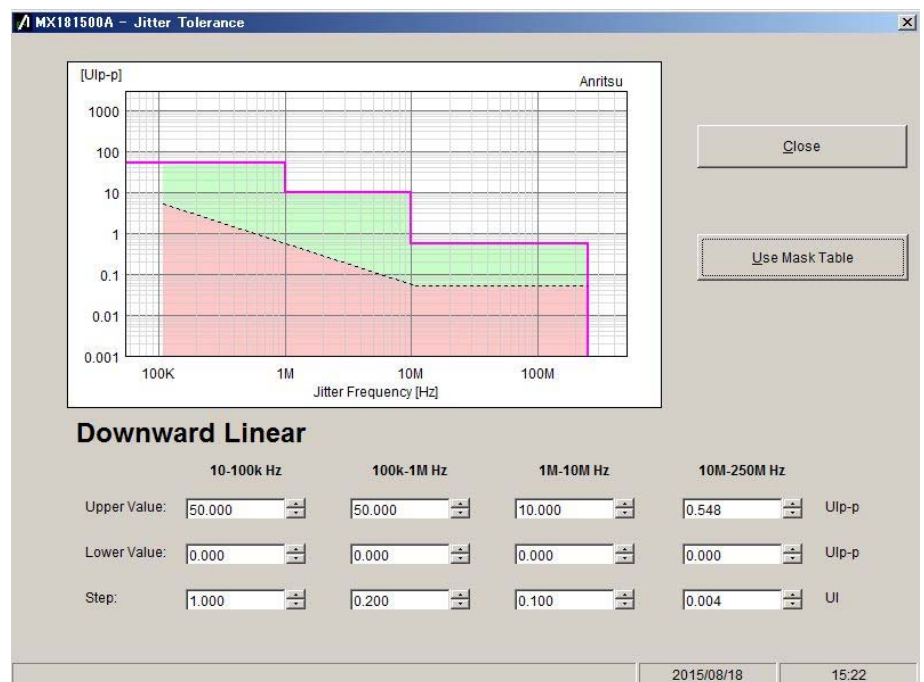
**Figure 4.5.4-3   Search Setting screen
(Downward Linear, Use Mask Table OFF)**

Table 4.5.4-2   Search Setting setup items

Item	Description
Use Mask Table	If set to On, jitter modulation amplitude varies depending on the ratio of the mask line specified on the Mask Data Table (Figure 4.5.6-1). If set to Off, jitter modulation amplitude ranges can be set for each frequency range.
Upper Ratio[1]	Upper limit ratio to the mask limit line for jitter modulation amplitude
Lower Ratio[1]	Lower limit ratio to the mask limit line for jitter modulation amplitude
Upper Value[2]	The upper measurement limit value of the jitter modulation amplitude
Lower Value[2]	The lower measurement limit value of the jitter modulation amplitude
Step[3]	The step to change the jitter modulation amplitude.
Ratio[4]	Ratio to change the jitter modulation amplitude

[1]:   Displayed when Use Mask Table is set to On.

[2]:   Displayed when Use Mask Table is set to Off.

[3]:   Displayed when Search is Downwards Linear or Upwards Linear.

[4]:   Displayed when Search is Downwards Log or Upwards Log.

4.5.5 Setting up the Jitter modulation frequency

Set the modulation frequency of SJ used in jitter tolerance measurement.
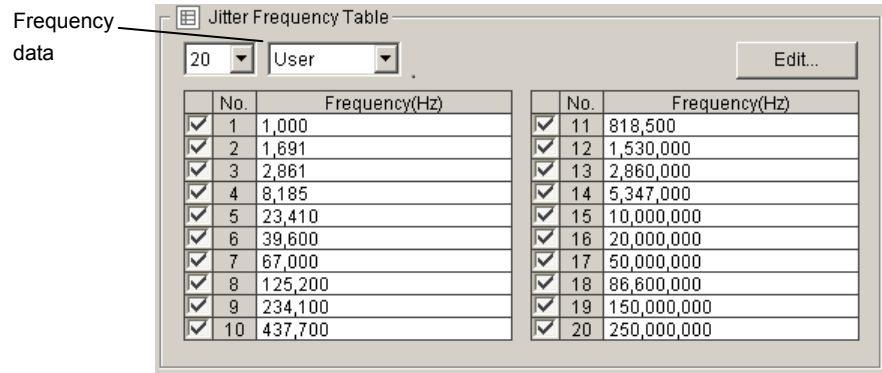
Figure 4.5.5-1　Jitter Frequency Table setup area (Jitter Tolerance)
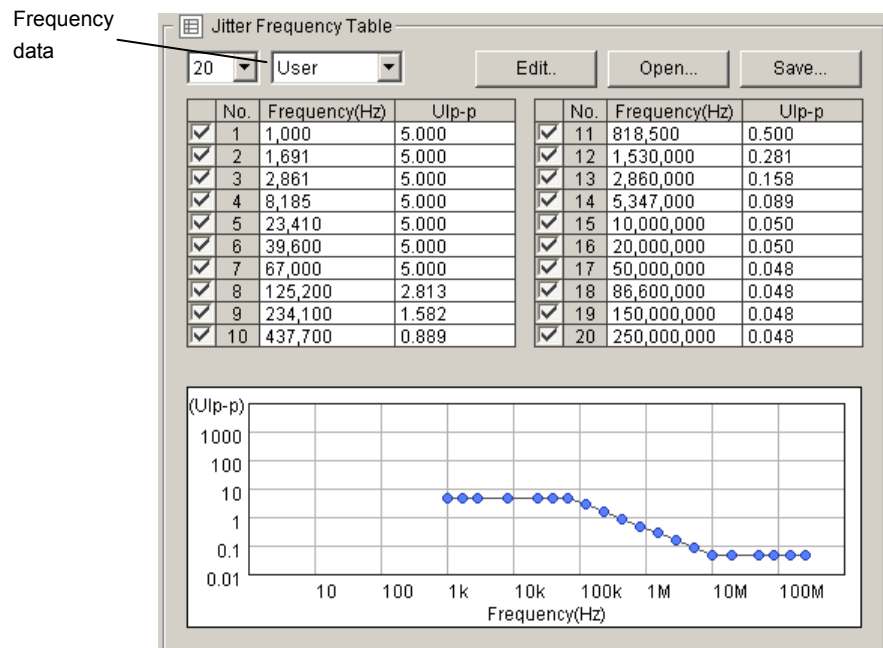
Figure 4.5.5-2　Jitter Frequency Table setup area (Jitter Sweep)

Table 4.5.5-1   Jitter Frequency Table setup items

Item	Description
The number of measurement points	Sets the number of measurement points to be displayed in the table. Select the upper limit of the number of measurement points from 20, 30, 40 and 50.
Table setup	Selects the measurement frequency data table to be used. User: The table in which you can edit measurement points (default). Mask Table: Uses the table of Mask Data Table.*1 Standard: Uses the table of the Standard data file.*2
Edit	This button is displayed when Table is set to User. Displays User Frequency Table shown on Figure 4.5.5-4 or Figure 4.5.5-5. The number of jitter modulation frequency points varies in the range of 20 to 50, depending on the number of measurement points specified.
Open	This button is displayed when Table is set to Standard or User. Displays the file selection screen.
Save	This button is displayed when Table is set to User. The table data edited by a user is saved to the user data file with the umsk extension.
Graph	If Jitter Sweep is selected, the graph of frequency and amplitude will be displayed.

*1: Displayed when Jitter Tolerance is selected.

*2: Displayed when Jitter Sweep is selected.
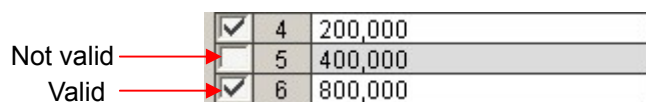
Figure 4.5.5-3   Valid/Not valid check box

The left-end column provides check boxes as shown in the figure above. The frequency currently being checked is used for measurement.

Jitter modulation frequency table
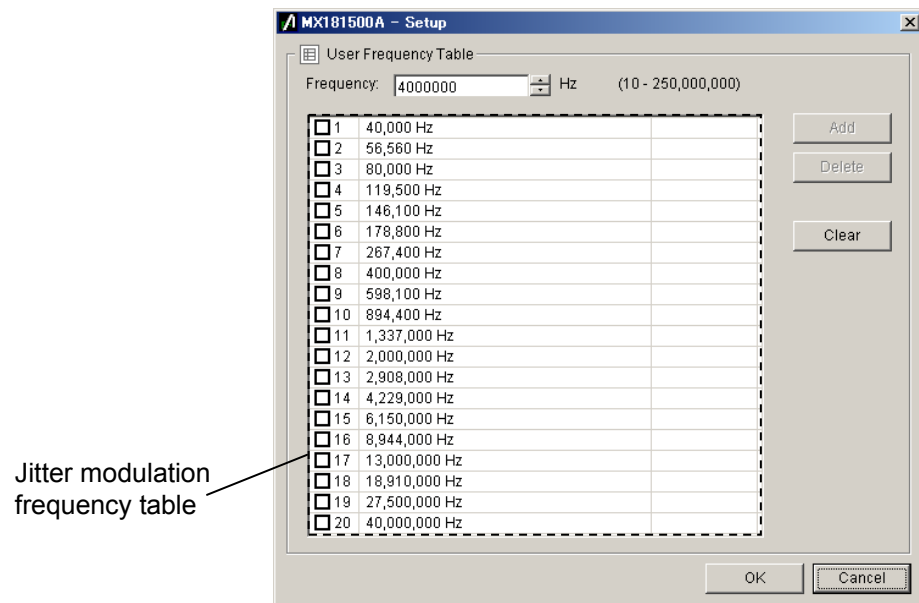
Figure 4.5.5-4 User Frequency Table screen (Jitter Tolerance)

Jitter modulation frequency table
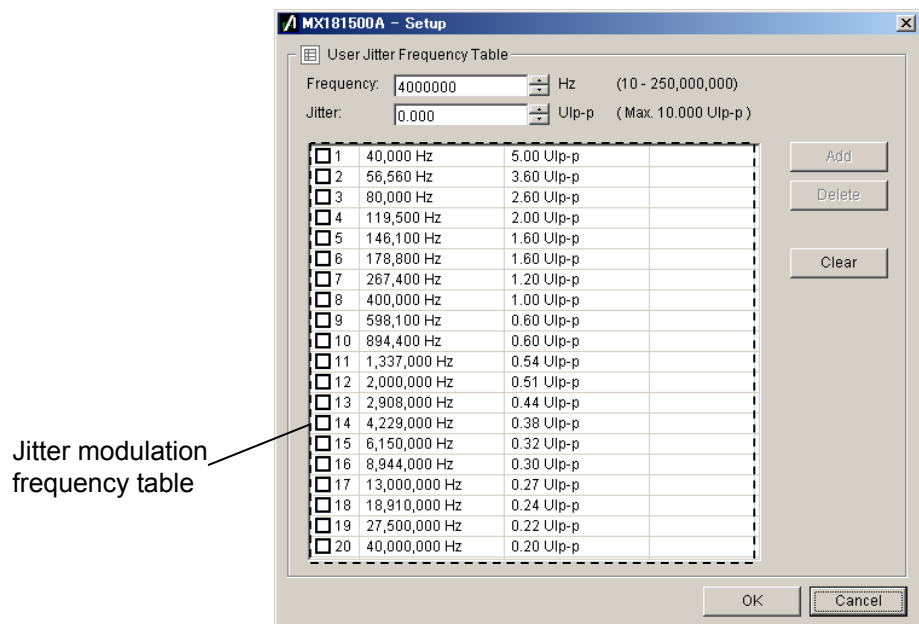
Figure 4.5.5-5 User Frequency Table screen (Jitter Sweep)

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Table 4.5.5-2   User Frequency Table setup items

Item	Description
Frequency	Sets the jitter modulation frequency. The setting range is equal to the setting range of the modulation frequency of MU181500B. 	Setting range [Hz]	Setting Resolution [Hz]	 |---|---| | 10 to 10 000 | 1 | | 10 010 to 100 000 | 10 | | 100 100 to 1 000 000 | 100 | | 1 001 000 to 10 000 000 | 1 000 | | 10 010 000 to 100 000 000 | 10 000 | | 100 100 000 to 250 000 000 | 100 000 |
Jitter[*1]	Sets the jitter modulation amplitude. The setting range is equal to the setting range of the amplitude of MU181500B. | Frequency [Hz]	Setting range [Ulp-p]	Setting resolution [Ulp-p] | |---|---|---| | 10 to 1 000 000 | 0 to 50 | 0.002 | | 1 001 000 to 10 000 000 | 0 to 10 | 0.002 | | 10 010 000 to 250 000 000 | 0 to 0.55 | 0.002 | When interacting with 32G PPG[*2] | Frequency [Hz]	Setting range [Ulp-p]	Setting resolution [Ulp-p] | |---|---|---| | 10 to 100 000 | 0 to 2000 | 0.002 | | 100 100 to 1 000 000 | 0 to 200 | 0.002 | | 1 001 000 to 10 000 000 | 0 to 16 | 0.002 | | 10 010 000 to 250 000 000 | 0 to 1 | 0.002 |
Add	Adds the values entered in Frequency and Jitter to the jitter modulation frequency table.
Delete	Deletes the frequency with a check entered in its check box in the jitter modulation frequency table.
Clear	Deletes all jitter modulation frequency data.
OK	Enables the settings and closes the screen.
Cancel	Disables the settings and closes the screen.

*1: Displayed when Jitter Sweep is selected.

*2: The range will be extended in Version 2.04.00 or any later version of MX181500A. The version of MX180000A used simultaneously must be 7.09.00 or later.

4.5.6 Setting up the Mask data

Mask data is the amplitude value with which the Pass/Fail judgment is made on the Jitter Tolerance measurement value. If the jitter amplitude measurement value is smaller than the value of the mask data, the judgment result will be Fail.
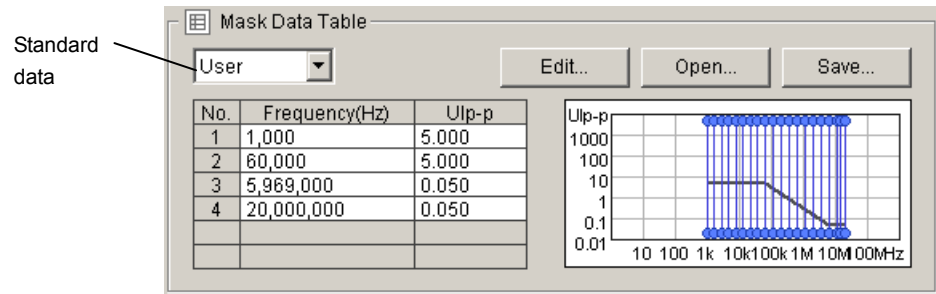
Figure 4.5.6-1   Mask Data Table setup area

Table 4.5.6-1   Mask Data Table setup items

Item	Description
Table setup	Selects the standard to be used. User: A table in which you can edit measurement points (default) Standard: The table of measurement points specified by specific standards. You cannot edit the frequencies in the table.
Edit	This button is displayed when Standard is set to User. Displays the User Mask Table shown on Figure 4.5.6-2.
Open	Displays the screen for selecting a mask file.
Save	The table data edited by a user is saved to the user data file with the umsk extension.
Mask Data Table	Displays the amplitude standard value for each jitter frequency.
Mask Data Graph	Displays the amplitude standard value in black solid line. Displays the frequency of Jitter Frequency Table in blue line.

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Jitter modulation frequency table
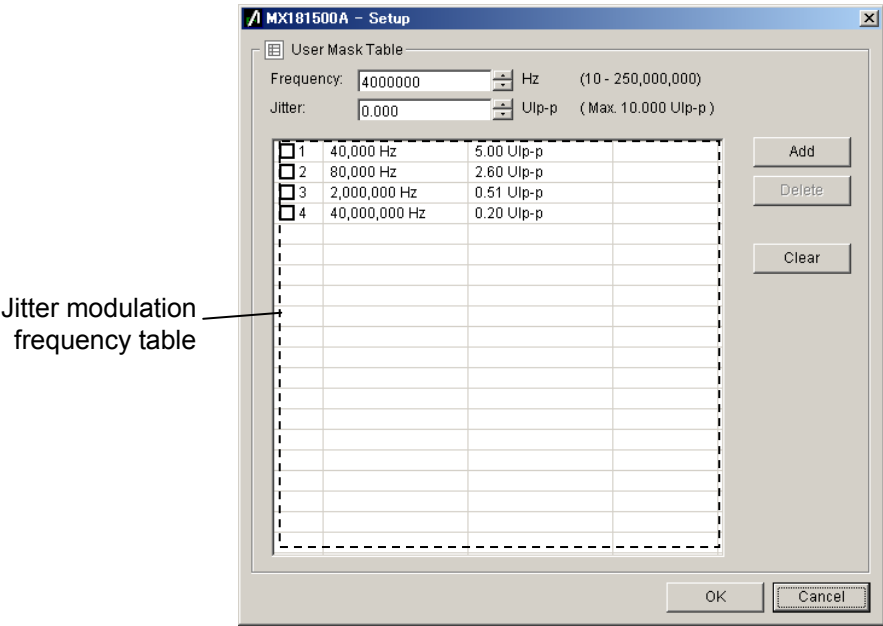
Figure 4.5.6-2   User Mask Data Setting screen

Table 4.5.6-2   User Mask Data Setting setup items

Item	Description
Frequency	Sets the jitter modulation frequency. The setting range is equal to the setting range of the modulation frequency of MU181500B. | Setting range [Hz]	Setting resolution [Hz] | |---|---| | 10 to 10 000 | 1 | | 10 010 to 100 000 | 10 | | 100 100 to 1 000 000 | 100 | | 1 001 000 to 10 000 000 | 1 000 | | 10 010 000 to 100 000 000 | 10 000 | | 100 100 000 to 250 000 000 | 100 000 |

Table 4.5.6-2   User Mask Data Setting setup items (Cont'd)

Item	Description
Jitter	Sets the jitter modulation amplitude. The setting range is equal to the setting range of the amplitude of MU181500B. 	Frequency [Hz]	Setting range [Ulp-p]	Setting resolution [Ulp-p]
---	---	---
10 to 1 000 000	0 to 50	0.002
1 001 000 to 10 000 000	0 to 10	0.002
10 010 000 to 250 000 000	0 to 0.55	0.002 | When interacting with 32G PPG* | Frequency [Hz]	Setting range [Ulp-p]	Setting resolution [Ulp-p]
---	---	---
10 to 100 000	0 to 2000	0.002
100 100 to 1 000 000	0 to 200	0.002
1 001 000 to 10 000 000	0 to 16	0.002
10 010 000 to 250 000 000	0 to 1	0.002	
Add	Adds the values entered in Frequency and Jitter to the jitter modulation frequency table.
Delete	Deletes the data with the check entered in its check box in the jitter modulation frequency table.
Clear	Deletes all data registered in the table.
OK	Enables the settings and closes the screen.
Cancel	Disables the settings and closes the screen.

*:   The range will be extended in Version 2.04.00 or any later version of MX181500A. The version of MX180000A used simultaneously must be 7.09.00 or later.

4.5.7 Starting Measurement

Click the **Measurement Start** button to start measurement.
The Result screen appears and Figure 4.5.2-1 Jitter Tolerance screen, or Figure 4.5.2-2 Jitter Sweep screen will be minimized at the right bottom of the screen.

During measurement, the indication on the button switches to **Measurement Stop**. Upon completion of measurement, the indication switches back to **Measurement Start**.
If you click **Measurement Stop**, measurement will stop.

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4.6 Measurement Result Display

Display the Result screen by either one of the following operations:

- Click the **Measurement Start** button.
- After clicking **Result** and then **Show** in the Menu, click the **Result** tab.

4.6.1 Jitter Tolerance measurement result

Current measurement point display   Measurement parameter display

Measurement result graph

Measurement progress bar   Measurement result table   Measurement status
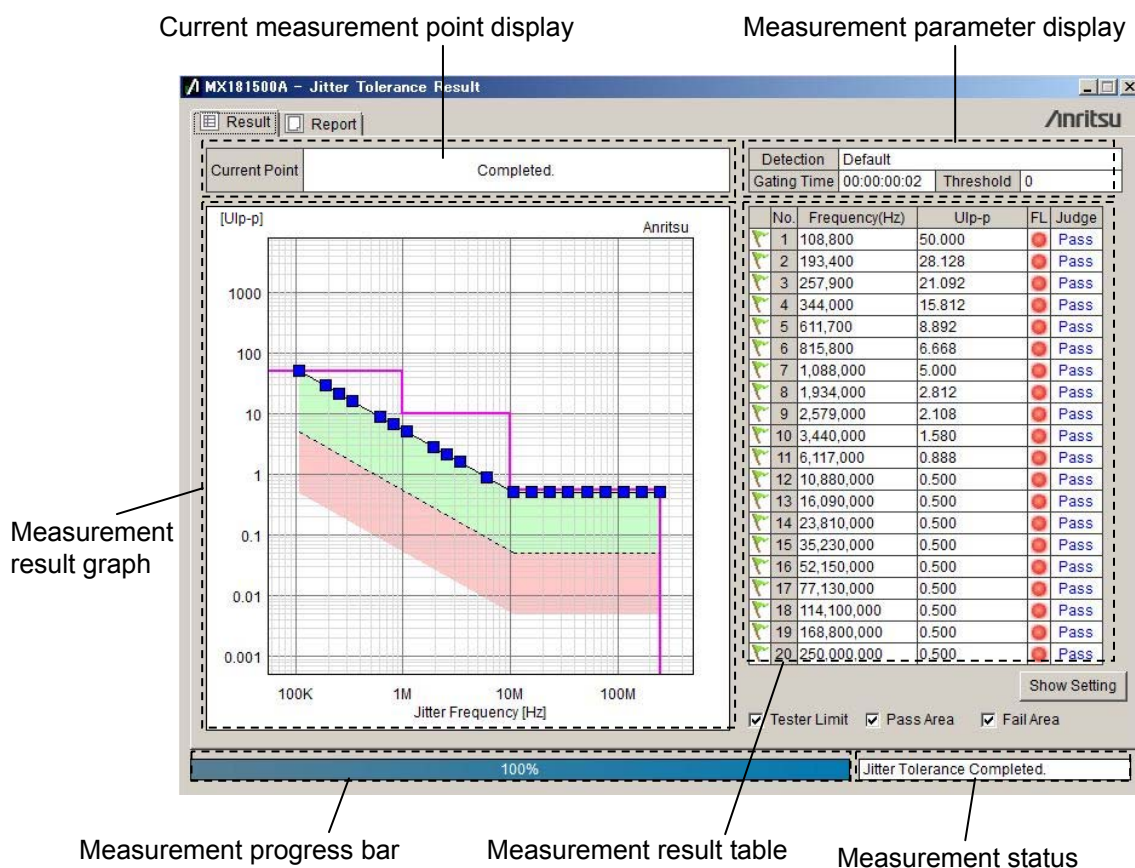
Figure 4.6.1-1   Jitter Tolerance Result screen

Table 4.6.1-1   Jitter Tolerance Result items

Item	Description
Current measurement point display	Displays the current jitter modulation frequency and modulation amplitude. Jf: Shows the jitter modulation frequency. Tx_Jitter: Shows the jitter modulation amplitude. Displays "Completed." upon completion of measurement.
Measurement parameter display	Shows the following settings on the setup screen: BER Condition: Detection, Gating Time, Threshold

Table 4.6.1-1   Jitter Tolerance Result items (Cont'd)

Item		Description
Measurement result graph		Plots the measurement points on a graph. The shape and color of each plot point indicate the results as shown below: ● ：The judgment result indicates Pass. ✖ ：The judgment result indicates Fail. ■ ：The upper generation limit point of the amount of jitter from the MU181500B jitter signal source 　Indicates that the jitter tolerance could not be driven (Overflow). ✚ ：The lower generation limit point of the amount of jitter from the MU181500B jitter signal source 　Indicates that the jitter tolerance could not be driven (Underflow).
Measurement result table		The following Jitter Tolerance measurement result is displayed for each measurement point.
	Flag	⚑: Pass ⚑: Fail ⚑: Unmeasured ▶: Measurement in progress
	No.	Measurement point number
	Frequency (Hz)	Jitter modulation frequency
	UIpp	The amplitude of SJ added by the MU181500B jitter signal source An arrow appears for the modulation frequency under measurement.
	FL (Flow)	The red light turns on when Overflow or Underflow occurs.
	Judge	Pass: Passed, Fail: Failed Judges as Fail if the jitter tolerance point is lower than the standard line set in 4.5.6 "Setting up the Mask data". If the modulation frequency is beyond the frequency range set in Mask Data Table, the modulation frequency standard in Mask Data Table nearest to the modulation frequency is regarded as the judgment result criterion.
Measurement progress bar		Displays the progress rate of measurement in %.
Measurement status		Displays the current measurement status.
Tester Limit		If the item is checked, the jitter generation limit of MU181500B is displayed in the measurement result graph display area.
Pass Area		If the item is checked, the area for which the judgment result is Pass is displayed in a measurement result graph against the green background.
Fail Area		If the item is checked, the area for which the judgment result is Fail is displayed in a measurement result graph against the red background.

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4.6.2 Jitter Sweep measurement result

Current measurement point display   Measurement parameter display

Measurement result graph

Measurement progress bar   Measurement result table   Measurement status
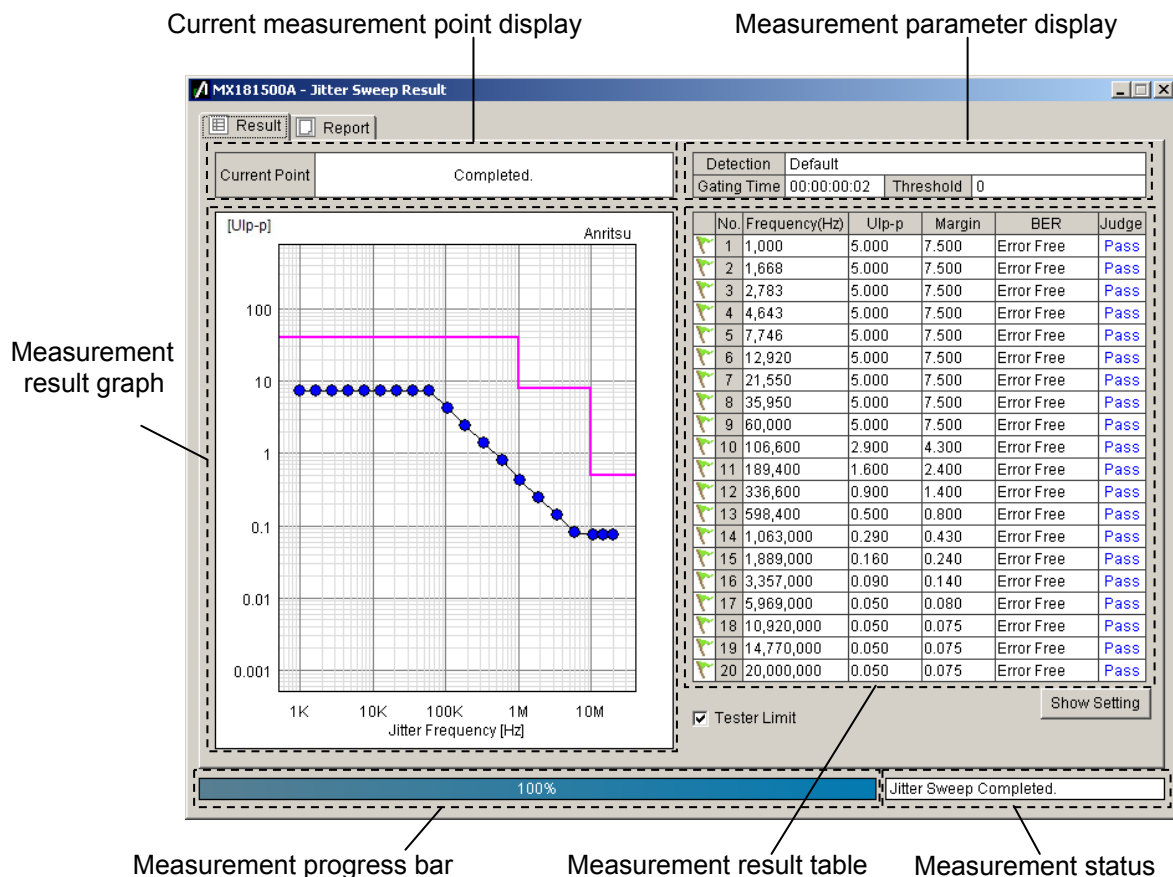
Figure 4.6.2-1 Jitter Sweep Result screen

Table 4.6.2-1 Jitter Sweep Result item

Item	Explanation
Current measurement point display	Displays the current jitter modulation frequency and modulation amplitude. Jf: Shows the jitter modulation frequency. Tx_Jitter: Shows the jitter modulation amplitude. Displays "Completed." upon completion of measurement.
Measurement parameter display	Displays the following settings on the setup screen: BER Condition: Detection, Gating Time, Threshold, Margin
Measurement result graph	Plots the measurement points on a graph. The shape and color of the plot points show the results as shown below: ● : Judgment result is Pass ✖ : Judgment result is Fail

Table 4.6.2-1　Jitter Sweep Result item (Cont'd)

Item		Description
Measurement result table		The following Jitter Tolerance measurement result is displayed for every measurement point:
	Flag	: Pass : Fail : Unmeasured : Measurement in progress
	No.	Measurement point number
	Frequency (Hz)	Jitter modulation frequency
	UIpp	The amplitude of SJ added by the MU181500B jitter signal source An arrow appears for the modulation frequency under measurement.
	Margin	Jitter amplitude with margin added. Margin = Uipp × (1 + M/100) M: Figure 4.5.4-1　Margin setting value for BER Condition
	BER	Bit Error Rate Displays "Error Free" when no error occurs.
	Judge	Pass: When the number of errors or the error rate is equal to or below the judgment value. Fail: When the number of errors or the error rate exceeds the judgment value.
Measurement progress bar		Displays the progress rate of measurement in %.
Measurement status		Displays the current measurement status.

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4.6.3 Saving the graph and setting up the scale

Right-click in the measurement result graph display area on the Result screen, a submenu will appear.

You can copy and save the graph, or change the graph display from the submenu.
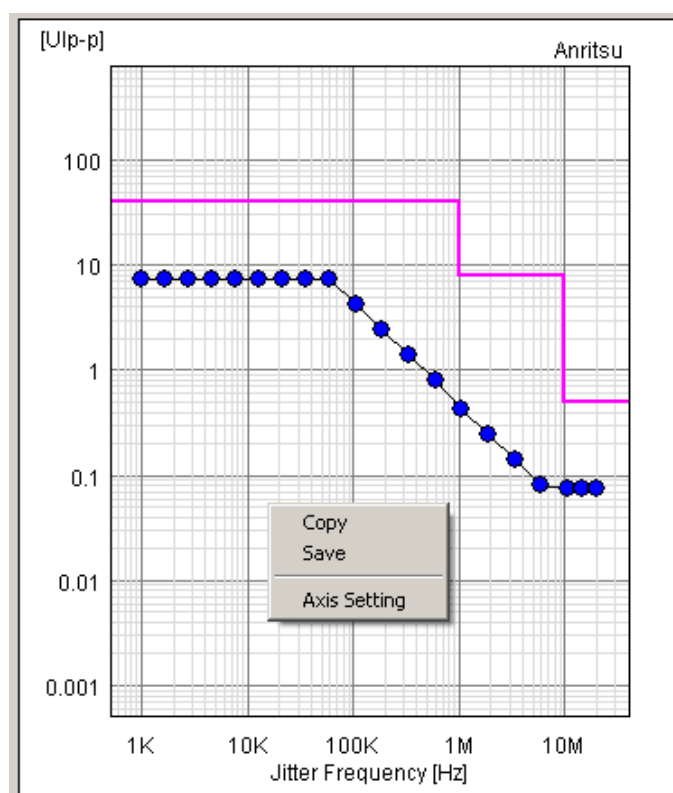
Figure 4.6.3-1   Submenu in the measurement result graph display area (Jitter Sweep)

Table 4.6.3-1   Submenu in the measurement result graph display

Item	Description
Copy	Copies the graph display area to the clip board.
Save	Saves the graph display area in the file specified in the bit map format.
Axis Setting	Sets the X-axis and Y-axis scales of the graph display.

Note:

The submenu of the graph display will not appear if you stop the process during measurement or by clicking **Measurement Stop**.

When you execute Axis Setting, the following screen will appear:
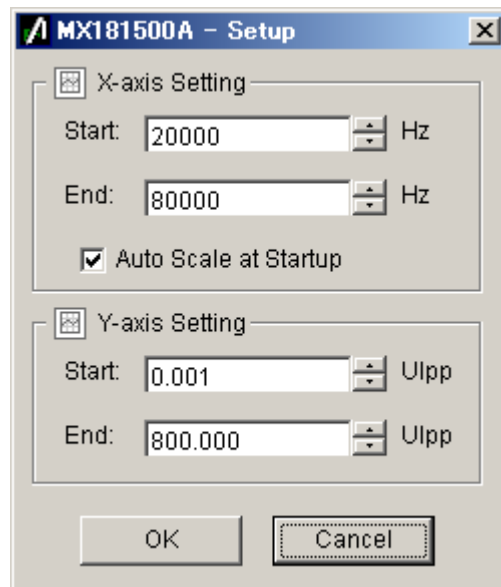
Figure 4.6.3-2   Graph display setup screen

Table 4.6.3-2   Graph display setup items

Item		Description
X-axis Setting		Sets the X axis of the graph.
	Start	Frequency at the left end of the graph
	End	Frequency at the right end of the graph
	Auto Scale at Startup	Automatically adjusts the display range of the X axis at the start of measurement. If the measurement point is 1, the memory of the X axis may not sometimes be displayed. In such a case, enter the values in Start and End.
Y-axis Setting		Sets the Y axis of the graph.
	Start	The amplitude at the bottom end of the graph
	End	The amplitude at the upper end of the graph

4.7 File Operation and Printing

You can execute **Print** and **Save** of the measurement result data on the **Report** tab screen on the Result screen.

1. Click **Result** in the Menu and then click **Show**. The Result screen appears.

2. Click the **Report** tab.

3. Select the data to be saved or printed in Style.

4. Click **Make HTML** to print/save the data in the HTML format. The print image will appear.

5. Click **Make CSV** to print/save the data in the CSV format. The print image will appear.

6. Click **Print** to print the image currently displayed. Click **Save** to save the displayed image in the file.

Note:

     If you click the **Measurement Stop** button during measurement, you cannot operate the Style list box, **Make HTML** button, and **Make CSV** button, etc.
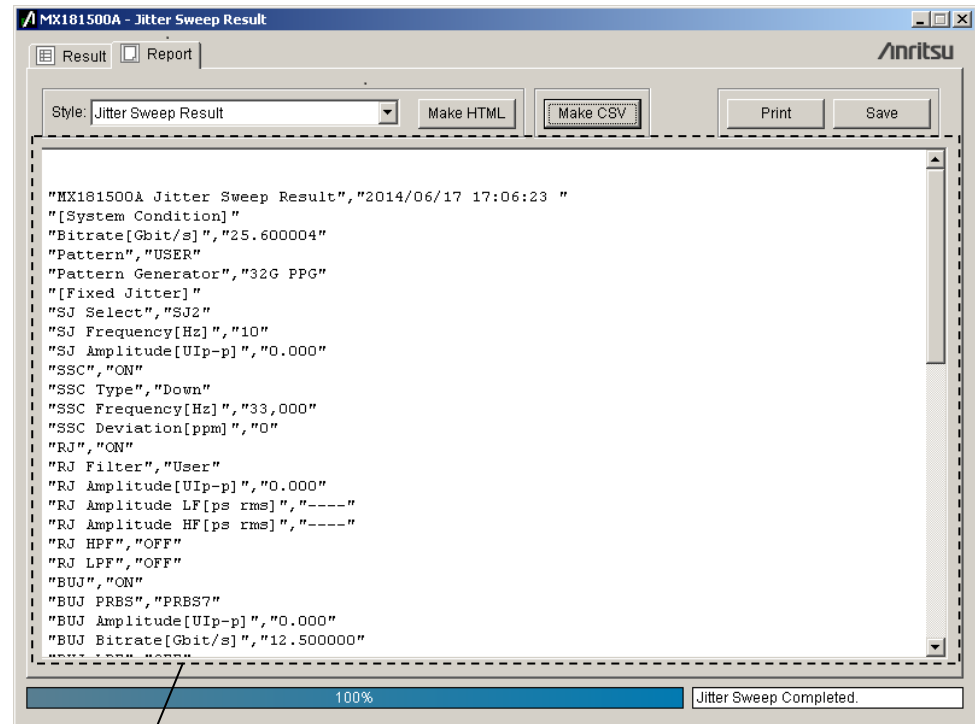
Report display area

Figure 4.7-1 Result screen-Report (Make CSV)
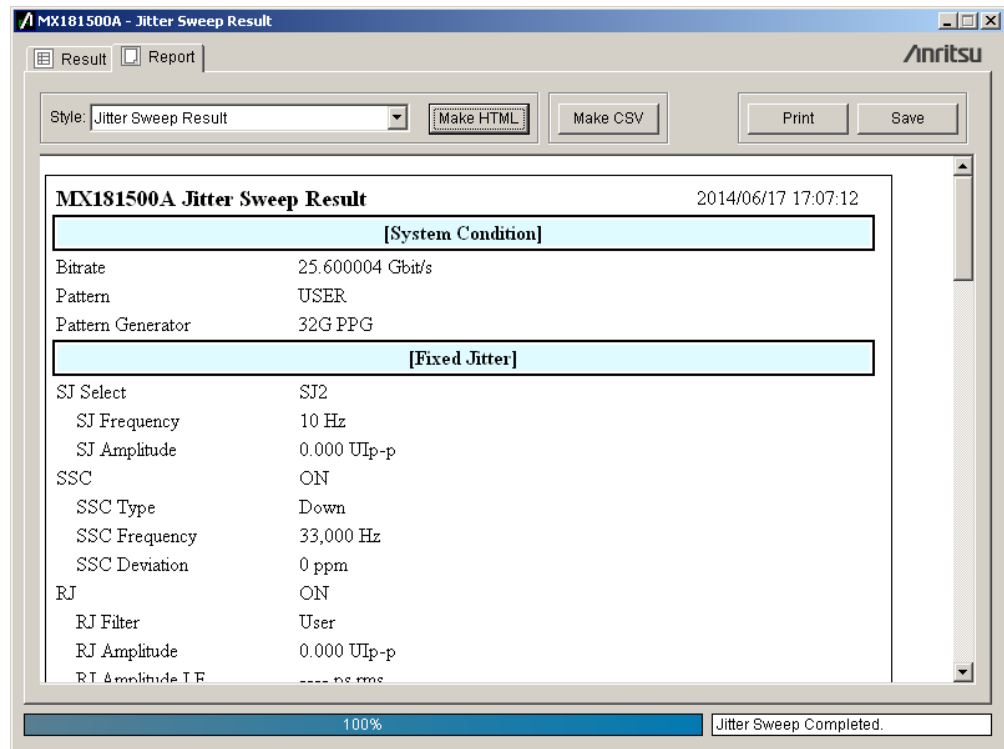
Figure 4.7-2 Result screen-Report (Make HTML)

Table 4.7-1   Items under the Report tab

Item	Description
Style	Selects the measurement result to be printed/saved. Jitter Tolerance Result Jitter Sweep Result
Make HTML	Displays the HTML-output image of the result data in the report display area.
Make CSV	Displays the CSV-format image of the result data in the report display area.
Print	Prints the content of the report display area.
Save	Displays the file save screen. Saves the content displayed in the report display area into the specified folder.
Report display area	Displays the print output image or the data to be saved.

When you saved the data, the following files are created:
(1)   HTML data

- Specified file name.htm
- conf.css
- IMG folder: A bmp file of the waveform and the graph will be created.
  The name of the file will be created in the specified file name xx.bmp. xx will be replaced by a number.
  If you double-click the htm file, you can display the saved result on a Web browser such as the Internet Explorer.
  Required file size to save HTML may sometimes be up to about 20MB. Verify the amount of free space on the hard disk before executing Save.

(2)   CSV data

- Specified file name.csv

Chapter 5 Remote Control

This chapter describes the remote control method and remote commands of MX181500A.

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Remote Control

5.1 Setting Interface for Remote Control

This section describes the remote interface setting method for MX181500A.

1. Click the Remote(<u>R</u>) from Setup(<u>S</u>) menu on the MX181500A main screen.
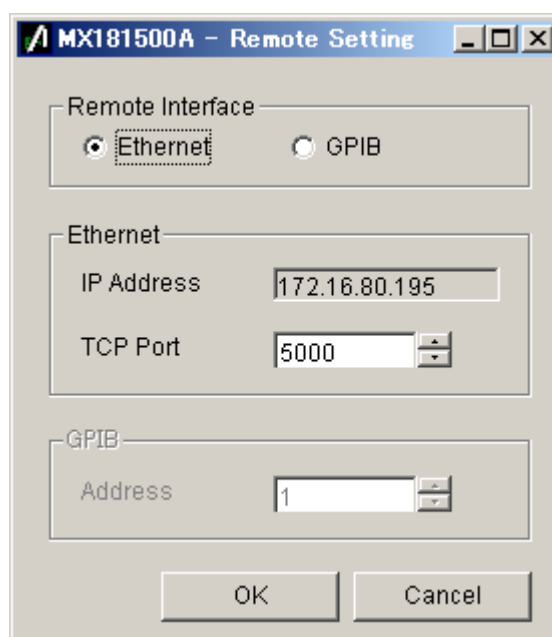
Figure 5.1-1   Remote Setting Screen

2. Select either Ethernet or GPIB of Remote Interface.

3. When Ethernet of Remote Interface is selected

   The IP address setting of the MP1800A or PC controller with the MX181500A installed is displayed and TCP Port setting is enabled. Set the number which does not overlap with the TCP Port setting in MP1800A or PC controller of the installation destination.

   TCP Port setting initial value: 5000

   TCP Port setting range: 1024 to 5001

   The IP address cannot be changed on the Remote Setting screen. Change the IP address on the Setup Utility of the MP1800A or on the network setting of the PC controller.

4. When GPIB of Remote Interface is selected

   Set the GPIB address within 1 to 30. The initial value is 1.

Note:

When the Remote Interface setting has been changed, click **Exit** from File of the menu of the MX181500A main screen to end MX181500A once.

When MX181500A is rebooted, the Remote Interface setting is reflected.

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Remote Control

5.2 Remote Control Procedure

This section describes the procedure and usage example to remotely control MX181500A. The case where three units of MP1800A are controlled by a PC for remote control via Ethernet is explained as an example. Figure 5.2-1 shows the IP address and port number setting. The module configuration of the MP1800A is same as the one in Figure 3.5-1 and 3.5-2.

When controlling three MP1800A units via Ethernet:

There are two following methods when MX181500A is remotely controlled via Ethernet:

- Controlling MX181500A installed in the PC for the remote control
- Controlling MX181500A installed in the MP1800A

Remote control PC installing MX181500A

MP1800A

IP Address:192.168.2.100
Port: 5001

Port: 5000 (MX181500A)

MU181000A/B
MU181500B

Ethernet

IP Address:192.168.2.101
Port: 5001

MU181020B×4
MU182021A

IP Address:192.168.2.102
Port: 5001

MU181040B×4
MU182041A

MX181500A Equipment List

Equipment Setting

Jitter Modulation Source: MU181500B(No.1:Unit1:Slot6)

PPG / MUX: MU182021A(No.2:Unit2:Slot5)

ED / DEMUX: MU182041A(No.3:Unit3:Slot5)

MP1800A/MT1810A Setting

No.1
☑ MP1800A   S/N: 1A00000070
IP Address: 192 .168 .2 .100   Port: 5001

No.2
☑ MP1800A   S/N: 1A00000070
IP Address: 192 .168 .2 .101   Port: 5001

No.3
☑ MP1800A   S/N: 1A00000070
IP Address: 192 .168 .2 .102   Port: 5001

Figure 5.2-1   Remote Control System Configuration (Ethernet Control 1)

5
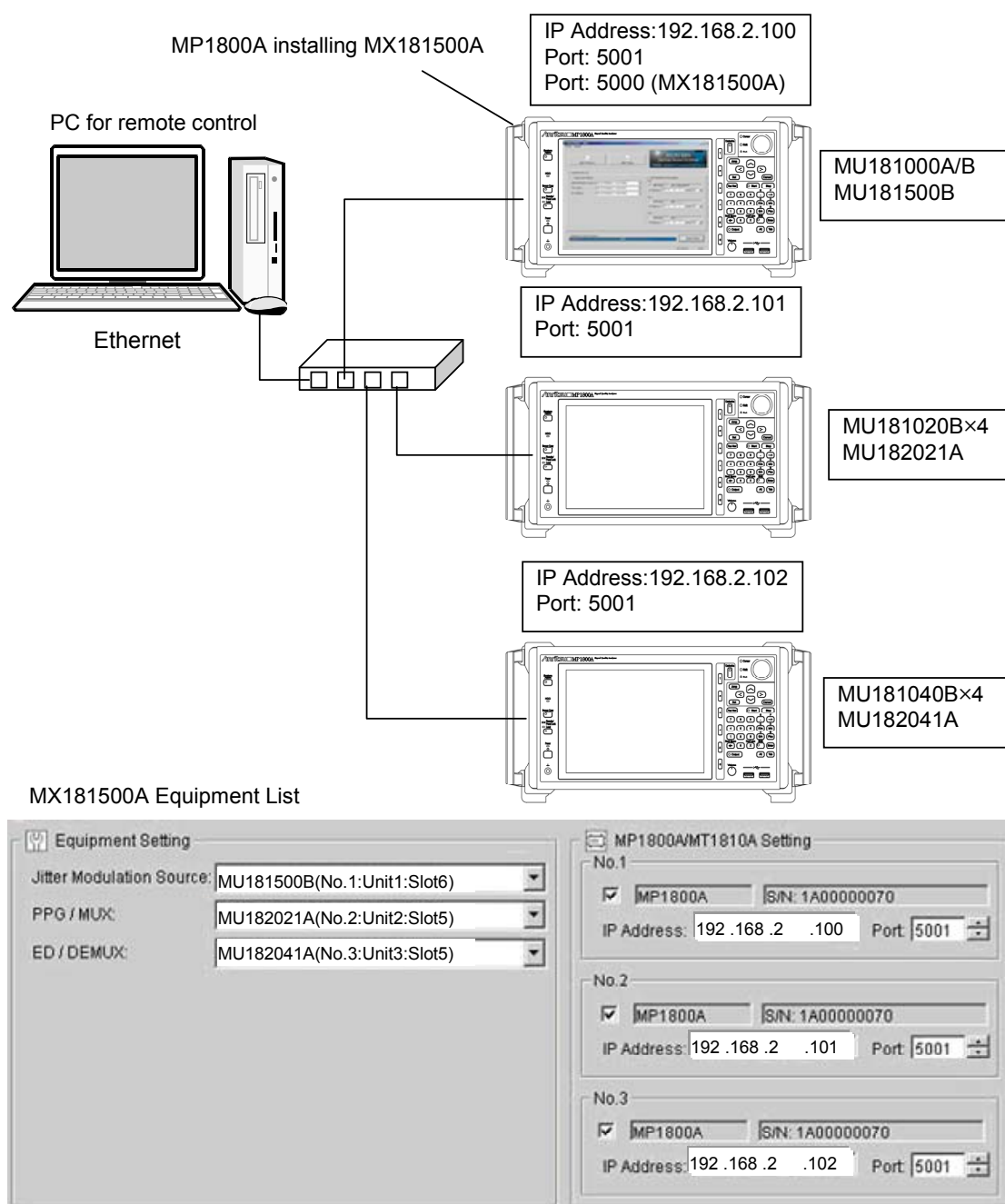
Remote Control

Figure 5.2-2   Remote Control System Configuration (Ethernet Control 2)

In the system configuration as shown in Figure 5.2-1, the IP address for transmitting MX181500A to the remote control software is "127.0.0.1" and the port number is "5000".

In the system configuration as shown in Figure 5.2-2, the IP address for transmitting MX181500A to the remote control software is "192.168.2.100" and the port number is "5000".

1. Connect the MP1800A and the remote control PC with Ethernet.

2. Start MX181500A.

3. Set the remote interface port number of MX181500A to 5000. Refer to Section 5.1 "Setting Interface for Remote Control".

4. Send the following command to search the MP1800A in the controller.

   ```
   :SYSTem:EQUipment:SEARch:ENABle 1,1
   :SYSTem:EQUipment:SEARch:ENABle 1,2
   :SYSTem:EQUipment:SEARch:ENABle 1,3
   :SYSTem:EQUipment:SEARch:STARt
   ```

5. Check the end of the controller search.

   ```
   :SYSTem:EQUipment:SEARch:STATe?
   ```

6. Check the unit numbers of detected equipment.

   ```
   :SYSTem:EQUipment:SETTing? JITTer
   :SYSTem:EQUipment:SETTing? PPG
   :SYSTem:EQUipment:SETTing? ED
   ```

7. Set the MX180000A remote command control target to Slot 6 of No.1 unit and set the MU181500B frequency to 10 312 500 kHz.

   ```
   :MFRame:ID 1
   :MODule:ID 6
   :OUTPut:CLOCk:FREQuency 10312500
   :SOURce:OUTPut:DATA:SELect HALFrate
   ```

8. Set the MX180000A remote command control target to Slot 5 of No.2 unit and set the MU182021A output voltage to 1 V.

   ```
   :MFRame:ID 2
   :MODule:ID 5
   :MUX:DATA:AMPLitude DATA,1.000
   :MUX:DATA:AMPLitude XDAT,1.000
   :MUX:DATA:OUTPut ON
   ```

9. Set the MX180000A remote command control target to Slot 5 of No.3 unit and set the MU182041A Input Condition to Differential 100 Ω and the threshold voltage to 0 V.

   ```
   :MFRame:ID 3
   :MODule:ID 5
   :DEMux:DATA:INTerface DIF100
   :DEMux:DATA:DIFFerential:THReshold 0
   ```

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Remote Control

10. Display the Tolerance measurement screen.

When the Tolerance measurement screen or Sweep measurement screen is displayed, the MP1800A of No.1 to 3 cannot be controlled with the MX180000A remote command.

    :SYSTem:MEASure:SELect TOL

11. Set the measurement conditions for the Tolerance measurement.
    :SENSe:MEASure:SYSCond:PATTern PRBS11
    :SENSe:MEASure:BERCond:STIMe 1
    :SENSe:MEASure:BERCond:WTIMe 5
    :SENSe:MEASure:BERCond:SEARch BIN
    :SENSe:MEASure:BERCond:DETection DEF
    :SENSe:MEASure:BERCond:RESolution FINE
    :SENSe:MEASure:TABLedata:OPEN "C:\Program
    Files\Anritsu\MX181500A\Mask\Fibre
    Channel_4.25G_CRPAT.mask"

12. Start the Tolerance measurement.
    :SENSe:MEASure:JITTer:STARt

13. Only the measurement stop and measurement status acquisition can be controlled remotely during Tolerance or Sweep measurement.
    :SENSe:MEASure:JITTer:STOP
    :SENSe:MEASure:JITTer:STATe?

14. Acquire the measurement result after the Tolerance/Sweep measurement is finished.
    :CALCulate:RESult:DATA? ALL

15. When settings of each MP1800A of No.1 to 3 are to be changed, end the Tolerance/Sweep measurement and return to the main screen.
    :SYSTem:MEASure:SELect OFF

When controlling three MP1800A units via GPIB:

MP1800A installing MX181500A

PC for remote control

GPIB

IP Address:192.168.2.100
Port: 5001
GPIB Adress: 1

MU181000A/B
MU181500B

Ethernet

IP Address:192.168.2.101
Port: 5001

MU181020B×4
MU182021A

IP Address:192.168.2.102
Port: 5001

MU181040B×4
MU182041A

MX181500Aの Equipment List

Equipment Setting

Jitter Modulation Source: MU181500B(No.1:Unit1:Slot6)

PPG / MUX: MU182021A(No.2:Unit2:Slot5)

ED / DEMUX: MU182041A(No.3:Unit3:Slot5)

MP1800A/MT1810A Setting

No.1
☑ MP1800A   S/N: 1A00000070
IP Address: 192 .168 .2   .100   Port: 5001

No.2
☑ MP1800A   S/N: 1A00000070
IP Address: 192 .168 .2   .101   Port: 5001

No.3
☑ MP1800A   S/N: 1A00000070
IP Address: 192 .168 .2   .102   Port: 5001

Figure 5.2-3   System Configuration of Remote Control (GPIB Control)

1. Connect the MP1800A installing MX181500A and the remote control PC with GPIB.

2. Connect three MP1800A units with Ethernet.

3. Start MX181500A.

4. Set the GPIB address of MX181500A. Refer to Section 5.1 "Setting Interface for Remote Control".

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Remote Control

5.   Control steps 4 or later for "when controlling three MP1800A via Ethernet".

Restrictions/Precautions

- Select Ethernet for the Setup Utility remote setting of the MP1800A regardless of whether the connection setting of the remote control PC and MX181500A is Ethernet or GPIB.
- When the connection of the remote control PC and MP1800A is Ethernet, the MP1800A can be directly controlled remotely with specification of IP address and Port of No.1 to 3 MP1800A.
- When the MX181500A Tolerance/Sweep measurement screen is being activated, the MP1800A cannot be controlled remotely with the :MFRame:ID. Also, the MP1800A cannot be controlled directly via Ethernet.
- Commands other than the measurement stop and measurement status query are not processed during the MX181500A Tolerance/Sweep measurement. However, reading each setting with query commands is enabled.

5.3　Command Description Method

This chapter explains the notations used in the message syntax.

Table 5.3-1　Notation used in Command Syntax

Symbol	Usage
<>	Parameters enclosed in < > are character strings input to the program.
[]	Messages or parameters enclosed in square brackets can be omitted.
|	Choose one from multiple choices. A|B|C|D means choose from A, B, C, and D.
{}	Groups choice in braces. A|B({C|D}) means choose one of A,B(C),and B(D).
< CHARACTER DATA >	Short alphabet or alphanumeric
< DECIMAL NUMERIC DATA >	Decimal numeric value Example: –1.00,256000,1.3E–1
<NR1 NUMERIC DATA>	Decimal integer value Example: –100,12500000
<NR2 NUMERIC DATA>	Decimal fraction Example: –0.02 2.35
< STRING DATA >	Alphanumeric data Double or single quotes are required before and after the data.
< BOOLEAN DATA >	Data indicating logical true or false

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The following shows the description example of command.

■Example of program command

Program command   Parameter type name   Parameter type

:DISPlay:MEASure:CHANge \<type\>

Parameter	\<type\>=\<CHARACTER PROGRAM DATA\>
	SETTing Setting screen
	RESult Result screen
	REPort Report screen
Function	Switches the display screen for Tolerance/Sweep measurement.
	Result cannot be specified for measurement not executed.
Example	Displays the Result screen for Tolerance measurement.
	\> :DISPlay:MEASure:CHANge RES

Parameter contents   Command example

■Example of query command

Program command   Parameter type name   Parameter type

:SENSe:MEASure:SYSCond:SJSelect?

Response	\<type\>=\<CHARACTER RESPONSE DATA\>
	OFF,SJ,SJ2
Function	Queries the sine wave jitter setting fixed and added for Tolerance/Sweep measurement.
Example	\> :SENSe:MEASure:SYSCond:SJSelect?
	\< SJ2

Command example, response example

The \< and \> in the example indicate the response and the program message respectively.

Notes:

- Any commands for MX181500A are sequential commands.

- If commands have restrictions, other settings may be affected. For the setting items to be affected and conditions to be restricted, refer to *MX180000A Signal Quality Analyzer Control Software Operation Manual* and operation manual for each module.

- When the parameters of program command and query command are same, the parameter of query command may be omitted.

5.4 IEEE488.2 Common Commands

MX181500A supports the following IEEE188.2 common commands.

Table 5.4-1   IEEE488.2 Common Commands List

Mnemonic	Command's full spell
*CLS	Clear Status Command
*IDN?	Identification Query

*CLS   Clear Status Command

Parameter	None
Function	Clears any event register and queue excluding output queues and their MAV summary messages for MX181500A.
Example	>*CLS

*IDN?   Identification Query

Parameter	None
Response	<Manufacturer>, <Model>, <Serial No.>
	<Manufacturer>, <Model>=<CHARACTER RESPONSE DATA>
	ANRITSU
	MX181500A
	<Serial No.>=<NR1 NUMERIC RESPONSE DATA>
	0000000000
	The serial No. of MX181500A is always "0000000000".
	Main frame Serial number
Function	Reports manufacture name, model, etc.
	When the MX181500A is queried, send :MFRame:ID 0 in advance.
Example	> :MFRame:ID 0
	> *IDN?
	< ANRITSU,MX181500A,0000000000

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5.5 MX181500A Command List (Tree)

The command list of MX181500A is displayed in tree.

Table 5.5-1   MX181500A Command Tree

No.	Command Header 1	Command Header 2	Command Header 3	Command Header 4	Command/ Query	Remarks
1	:CALCulate	:RESult	:DATA		Q	
2			:STATus		Q	
3	:DISPlay	:MEASure	:CHANge		C	
4		:RESult	:GRAPh		C	
5	:MFRame	:ID			C/Q	
6	:SENSe	:MEASure	:BERCond	:ASEarch	C/Q	
7				:DETection	C/Q	
8				:GTIMe	C/Q	
9				:MARGin	C/Q	
10				:RESolution	C/Q	
11				:SEARch	C/Q	
12				:SSETing	C/Q	
13				:STIMe	C/Q	
14				:THReshold	C/Q	
15				:TLIMit	C/Q	
16				:UNIT	C/Q	
17				:WTIMe	C/Q	
18				:USEMask	C/Q	
19				:RATiosetting	C/Q	
20				:SEQuence	C/Q	
21			:JITTer	:STARt	C	
22				:STATe	Q	
23				:STOP	C	
24			:SYSCond	:BITRate	Q	
25				:PATTern	Q	
26				:PGENerator	Q	
27				:SJSelect	C/Q	
28				:FJITter	Q	
29			:TABLedata	:OPEN	C	
30				:SELect	Q	

Table 5.5-1   MX181500A Command Tree (Cont'd)

No.	Command Header 1	Command Header 2	Command Header 3	Command Header 4	Command/ Query	Remarks
31	:SYSTem	:DEMux	:SETTing		C/Q	
32		:ERRor			Q	
33		:EQUipment	:SEARch	:ABORt	C	
34				:ENABle	C/Q	
35				:SETTing	C/Q	
36				:STARt	C	
37				:STATe	Q	
38			:SETTing		C/Q	
39				:MODule	Q	
40		:MEASure	:INITialize		C	
41			:SELect		C/Q	
42		:MMEMory	:RESult	:PRINt	C	
43				:STORe	C	
44			:SETTing	:RECall	C	
45				:STORe	C	
46		:MUX	:SETTing		C/Q	
47		:TERMination			C/Q	

5

5.6 Common Command

This section explains the commands for the common setting and function of MX181500A.

Table 5.6-1 Common Command

Setting Item	Command
Queries error message	:SYSTem:ERRor?
Specifies the MP1800A remotely controlled	:MFRame:ID
	:MFRame:ID?
Sets terminator	:SYSTem:TERMination
	:SYSTem:TERMination?

:SYSTem:ERRor?

Parameter	None
Response	<error/event_number>,"<error/event_description>"
	<error/event_number>=<NR1 NUMERIC RESPONSE DATA>
	−32768 to 32767
	The value of zero indicates no error or no event occurrence.
	Others return standard errors reserved by SCPI or equipment-specific errors.
	<error/event_description>=<STRING RESPONSE DATA>
	Error messages corresponding to each <error/event_number>. The maximum length of this character string is 255 characters.
Function	Queries error messages that exist in errors or event queues.
Example	> :SYSTem:ERRor?
	< 0, "No error"

:MFRame:ID <numeric>

Parameter	<number>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 3 MP1800A No.1 to 3
	0 Specifies the MX181500A.
Function	When the MX181500A is running, the MP1800A with the number specified with this command can be controlled with the commands described in *MX180000A Signal Quality Analyzer Control Software Remote Control Operation Manual*.
	Use this command after the equipment search is finished and a model name is displayed on the MP1800A/MT1810A Setting of the main screen. When the command below is to be sent to MX181500A, specify the parameter with 0.
	· *IDN?
Example	To specify the MP1800A No.3.
	> :MFRame:ID 3

:MFRame:ID?

Parameter	<number>=<DECIMAL NUMERIC RESPONSE DATA>
	0 to 3
Function	Queries the number of MP1800A to be controlled with the commands described in "MX180000A Signal Quality Analyzer Control Software Remote Control Operation Manual".
Example	> :MFRame:ID?
	< 3

:SYSTem:TERMination <numeric>

Parameter	<numeric>=<DECIMAL NUMERIC PROGRAM DATA>
	0 LF + EOI
	1 CR + LF + EOI
Function	Sets terminator type of response data.
Example	To set terminator type to LF + EOI
	> :SYSTem:TERMination 0

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:SYSTem:TERMination?

Response	\<numeric\>=\<NR1 NUMERIC RESPONSE DATA\>
	0 LF + EOI
	1 CR + LF + EOI
Function	Queries terminator of response data
Example	> :SYSTem:TERMination?
	< 0

5.7 Setting Measurement System
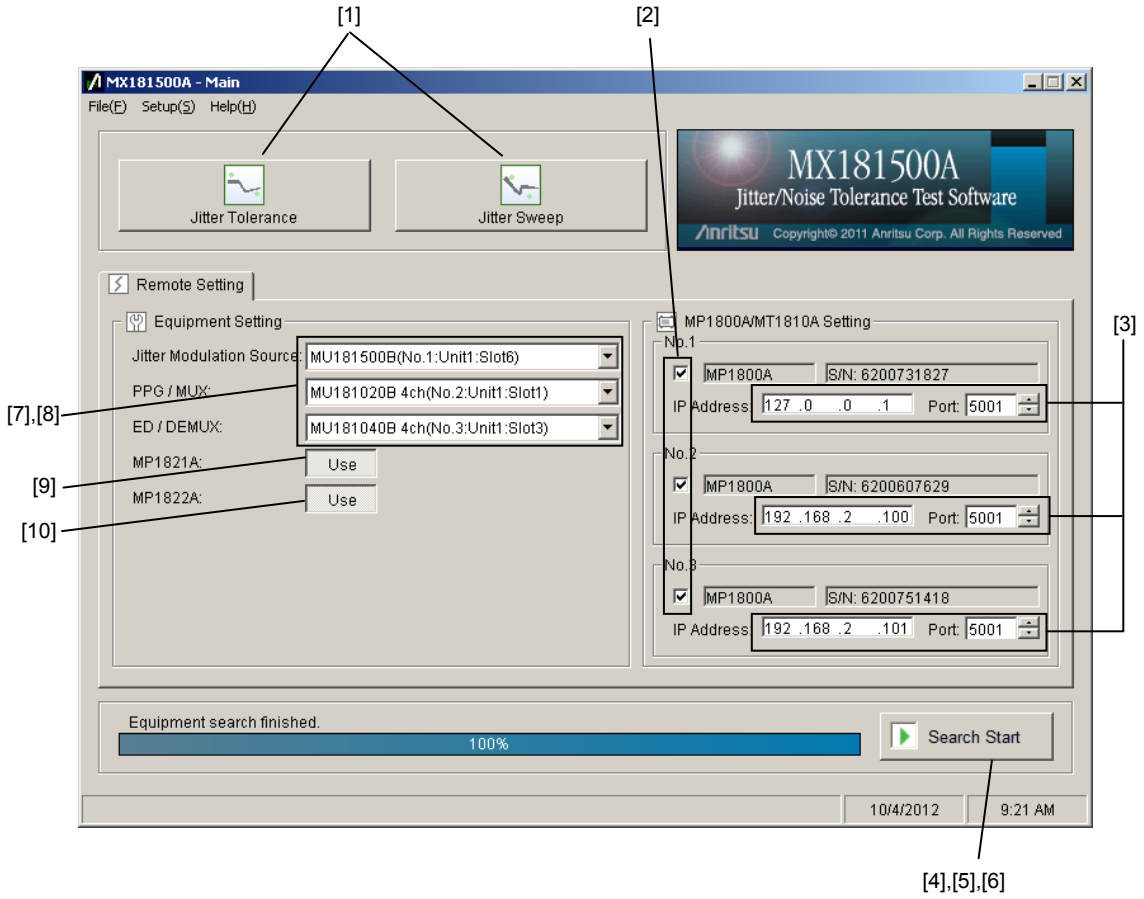
Figure 5.7-1 Main Window

Table 5.7-1   Setting Commands of Main Window

No.	Setting Item	Command
[1]	Tolerance/Sweep Startup Button	:SYSTem:MEASure:SELect
		:SYSTem:MEASure:SELect?
[2]	MP1800A/MT1810A Setting Check Box	:SYSTem:EQUipment:SEARch:ENABle
		:SYSTem:EQUipment:SEARch:ENABle?
[3]	MP1800A/MT1810A Setting IP Address,Port	:SYSTem:EQUipment:SEARch:SETTing
		:SYSTem:EQUipment:SEARch:SETTing?
[4]	Search Start	:SYSTem:EQUipment:SEARch:STARt
[5]	Search Abort	:SYSTem:EQUipment:SEARch:ABORt
[6]	Search State	:SYSTem:EQUipment:SEARch:STATe?
[7]	Equipment Setting	:SYSTem:EQUipment:SETTing
		:SYSTem:EQUipment:SETTing
[8]	Equipment Setting Query	:SYSTem:EQUipment:SETTing:MODule?
[9]	MUX Select	:SYSTem:MUX:SETTing
		:SYSTem:MUX:SETTing?
[10]	DEMUX Select	:SYSTem:DEMux:SETTing
		:SYSTem:DEMux:SETTing?

:SYSTem:MEASure:SELect <item>

Parameter	<item>=<CHARACTER PROGRAM DATA>
	TOLerance Starts the Tolerance measurement screen.
	SWEep Starts the Sweep measurement screen.
	OFF Returns to the main screen.
Function	Starts the Tolerance measurement window.
Example	To start the Tolerance measurement window.
	> :SYSTem:MEASure:SELect TOLerance

:SYSTem:MEASure:SELect?

Parameter	< item>=< CHARACTER RESPONSE DATA>
	TOL,SWE,OFF
Function	Queries the running status of the measurement screen.
Example	> :SYSTem:MEASure:SELect?
	< TOL

:SYSTem:EQUipment:SEARch:ENABle <boolean>[,<number>]

Parameter	<boolean>=<BOOLEAN PROGRAM DATA>
	ON or 1 Search ON
	OFF or 0 Search OFF
	<number>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 3 No.1 to 3
	Note:
	When <number> is omitted, No.1 is set.
Function	Selects the search target equipment (MP1800A/MT1810A main unit).
Example	To set No.2 as the search target.
	> :SYSTem:EQUipment:SEARch:ENABle 1,2

:SYSTem:EQUipment:SEARch:ENABle? [<number>]

Parameter	<number>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 3 No.1 to 3
	Note:
	When <number> is omitted, No.1 is queried.
Response	<boolean>=< NR1 NUMERIC RESPONSE DATA>
	1 Search ON
	0 Search OFF
Function	Queries the ON/OFF setting of the search target.
Example	To query the search setting of No.2.
	> :SYSTem:EQUipment:SEARch:ENABle? 2

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:SYSTem:EQUipment:SEARch:SETTing
<address>,<port>[,<number>]

Parameter	<address>=< STRING PROGRAM DATA>
	Enter the IP address with "223.255.255.254" format.
	1st: 1 to 223, 2nd to 3rd: 0 to 255, 4th: 0 to 254
	<port>=< DECIMAL NUMERIC PROGRAM DATA>
	1024 to 5001 1024 to 5001 / 1 Step
	<number>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 3 No.1 to 3
	Note:
	When <number> is omitted, No.1 is queried.
Function	Sets the IP address and port with specification of the controller No.
Example	To set the IP address and port of the No.2 MP1800A.
	> :SYSTem:EQUipment:SEARch:SETTing "192.168.2.150",5001,2

:SYSTem:EQUipment:SEARch:SETTing? [<number>]

Parameter	<number>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 3 No.1 to 3
	Note:
	When <number> is omitted, No.1 is queried.
Response	<model>,<serial>,<address>,<port>
	<model>=<CHARACTER RESPONSE DATA>
	MP1800A or MT1810A
	<serial>=<NR1 NUMERIC RESPONSE DATA>
	XXXXXXXXXX Serial number of 10-digit integers of MP1800A/MT1810A
	<address>=<STRING RESPONSE DATA>
	Output with "223.255.255.254" format.
	<port>=< NR1 NUMERIC RESPONSE DATA >
	1024 to 5001
Function	Queries the IP address and port with specification of the controller No.
Example	To query the IP address and port of the No.2 MP1800A.
	> :SYSTem:EQUipment:SEARch:SETTing? 2
	< MP1800A,6200123456,"192.168.2.150",5001
	When the equipment scan result does not exist, the model name and serial number are displayed with ------.
	< ----,----------,"192.168.2.150",5001

:SYSTem:EQUipment:SEARch:STARt

Parameter	None
Function	Starts the search for MP1800A/MT1810A of the controller.
Example	> :SYSTem:EQUipment:SEARch:STARt

:SYSTem:EQUipment:SEARch:ABORt

Parameter	None
Function	Aborts the controller search.
Example	> :SYSTem:EQUipment:SEARch:ABORt

:SYSTem:EQUipment:SEARch:STATe?

Response	1	Equipment search being executed
	0	Equipment search stopped
	−1	Equipment search failed
Function	Queries the status of the controller search.	
Example	> :SYSTem:EQUipment:SEARch:STATe?	
	< 1	

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Remote Control

:SYSTem:EQUipment:SETTing

<type>,<number>,<unit>,<slot>[,<data_if>]

Parameter	<type>=<CHARACTER PROGRAM DATA>
	JITTer Jitter Modulation Source
	PPG PPG/MUX
	ED ED/DEMUX
	<number>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 3 MP1800A/MT1810A No.1 to 3
	<unit>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 4 Unit 1 to 4
	0 MP1861A or MP1862A
	<slot>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 6 Slot 1 to 6
	7 to 10 MP1861A USB No. 7 to 10
	11 to 14 MP1862A USB No. 11 to 14
	[<data_if>]=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 4 Data 1 to 4

> ***Note:***
>
> <data_if> can be set when the module installed in slot is bellow:
> MU183020A, MU183021A, MU183040A/B, MU183041A/B
>
> Data 1 is specified when omitted.
>
> If <data_if> is set to other modules, the parameter error occurs.

Function	Selects the equipment to be used for the measurement.
Example	To assign MP1800A/MT1810A No.1, Unit 1, and Slot 4 to Jitter Modulation Source.

    `> :SYSTem:EQUipment:SETTing JITTer,1,1,4`

To assign MP1800A/MT1810A No.1, Unit 1, Slot 4, and Data 2 to PPG/MUX.

    `> :SYSTem:EQUipment:SETTing PPG,1,1,4,2`

To assign MP1800A/MT1810A No.1 and MP1861A USB7 to PPG/MUX.

    `> :SYSTem:EQUipment:SETTing PPG,1,0,7`

:SYSTem:EQUipment:SETTing? <type>

Parameter	<type>=<CHARACTER PROGRAM DATA>
	JITTer Jitter Modulation Source
	PPG PPG/MUX
	ED ED/DEMUX
Response	<number>=<DECIMAL NUMERIC RESPONSE DATA>
	1 to 3 MP1800A/MT1810A No.1 to 3
	0 None
	<unit>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 4 Unit 1 to 4
	0 None or when MP1861A or MP1862A is selected
	<slot>=<DECIMAL NUMERIC RESPONSE DATA>
	1 to 6 Slot 1 to 6
	0 None
	1 7 to 10 MP1861A USB No. 7 to 10
	2 11 to 14 MP1862A USB No. 11 to 14
	[<data_if>]=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 4 Data 1 to 4

> **Note:**
>
> <data_if> returns when the module installed in slot is bellow:
> MU183020A, MU183021A, MU183040A/B, MU183041A/B

Function	Queries the equipment used for the measurement.
Example	To query the equipment used for the jitter modulation source.
	> :SYSTem:EQUipment:SETTing? JITTer
	< 1,1,4
	When equipment is not assigned, the response of (None) is as follows:
	< 0,0,0
	When USB No.11 of MP1862A is selected, the response is as follows:
	< 1,0,11

:SYSTem:EQUipment:SETTing:MODule? <type>

Parameter	<type>=<CHARACTER PROGRAM DATA>
	JITTer Jitter Modulation Source
	PPG PPG/MUX
	ED ED/DEMUX
Response	<string>=<STRING RESPONSE DATA>
	"<number>,<unit>,<slot>,[<data_if>]" (Up to 12)
	<number>=<DECIMAL NUMERIC RESPONSE DATA>
	1 to 3 MP1800A/MT1810A No.1 to 3
	0 None
	<unit>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 4 Unit 1 to 4
	0 None or when MP1861A or MP1862A is selected
	<slot>=<DECIMAL NUMERIC RESPONSE DATA>
	1 to 6 Slot 1 to 6
	0 None
	1 7 to 10 MP1861A USB No. 7 to 10
	2 11 to 14 MP1862A USB No. 11 to 14
	[<data_if>]=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 4 Data 1 to 4

> **Note:**
>
> <data_if> returns when the module installed in slot is bellow:
> MU183020A, MU183021A, MU183040A/B, MU183041A/B

Function	Queries the equipment candidate to be used for the measurement. Selectable main unit No., Unit, and Slot are selected from the already searched equipment units.
Example	To query the equipment candidate for the jitter modulation source.

```
> :SYSTem:EQUipment:SETTing:MODule? JITTer
< "1,1,4","2,1,4","3,1,4"
```

When the equipment candidate does not exist, the response is as follows:

```
< 0,0,0
```

When the equipment candidate is MU183020A-x22/x23 the response is as follows:

```
< "1,1,3,1","1,1,3,2"
```

When USB No.7 and 8 of MP1861A are candidates for PPG, the response is as follows:

```
< "1,0,7","1,0,8"
```

:SYSTem:MUX:SETTing \<select>

Parameter	\<select>=\<DECIMAL NUMERIC PROGRAM DATA>
	1 Use MP1821A
	0 Not use MP1821A
Function	Selects whether to use MP1821A 50G/56G MUX as the measuring instrument.
Example	To set to use MP1821A:
	`> :SYSTem:MUX:SETTing 1`

:SYSTem:MUX:SETTing?

Response	\<select>=\< NR1 NUMERIC RESPONSE DATA>
	1, 0
Function	Queries whether it is set to use MP1821A 50G/56G MUX as the measuring instrument.
Example	`> :SYSTem:MUX:SETTing?`
	`< 1`

:SYSTem:DEMux:SETTing \<select>

Parameter	\<select>=\< DECIMAL NUMERIC PROGRAM DATA>
	1 Use MP1822A
	0 Not use MP1822A
Function	Selects whether to use MP1822A 50G/56G DEMUX as the measuring instrument.
Example	To set to use MP1822A:
	`> :SYSTem:DEMux:SETTing 1`

:SYSTem:DEMux:SETTing?

Response	\< select >=\< NR1 NUMERIC RESPONSE DATA>
	1, 0
Function	Queries whether it is set to use MP1822A as the measuring instrument.
Example	`> :SYSTem:DEMux:SETTing?`
	`< 1`

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5.8 Setting Measurement Conditions

5.8.1 Setting Tolerance/Sweep common measurement conditions
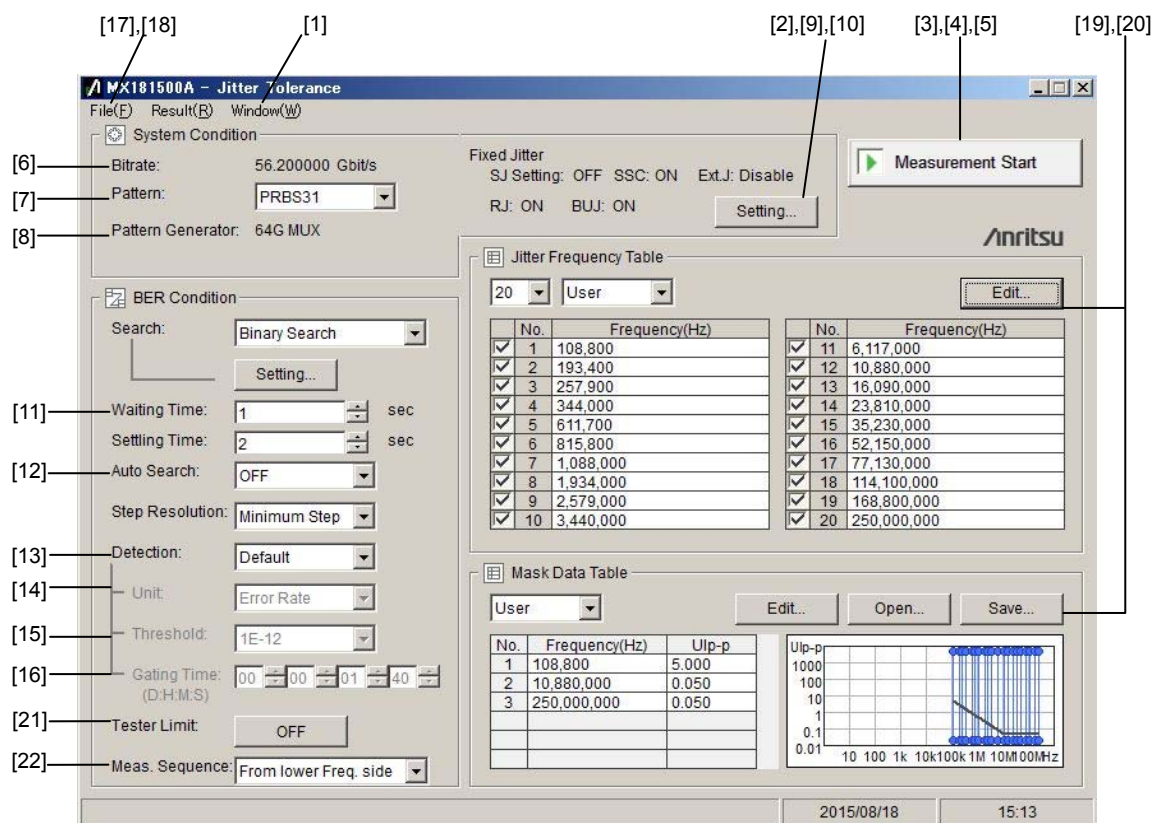
Figure 5.8.1-1 Tolerance Window

Table 5.8.1-1   Measurement Condition Setting Commands

No.	Setting Item	Command
[1]	Initialize	:SYSTem:MEASure:INITialize
[2]	Switch Display	:DISPlay:MEASure:CHANge
[3]	Measurement Start	SENSe:MEASure:JITTer:STARt
[4]	Measurement Stop	:SENSe:MEASure: JITTer:STOP
[5]	Measurement State	:SENSe:MEASure: JITTer:STATe?
[6]	Bitrate	:SENSe:MEASure:SYSCond:BITRate?
[7]	Pattern	:SENSe:MEASure:SYSCond:PATTern
		:SENSe:MEASure:SYSCond:PATTern?
[8]	Pattern Generator	:SENSe:MEASure:SYSCond:PGENerator?
[9]	Fixed Jitter SJ/SJ2 Select	:SENSe:MEASure:SYSCond:SJSelect
		:SENSe:MEASure:SYSCond:SJSelect?
[10]	Fixed Jitter ON/OFF setting	:SENSe:MEASure:SYSCond:FJITer?
[11]	Waiting Time	:SENSe:MEASure:BERCond:WTIMe
		:SENSe:MEASure:BERCond:WTIMe?
[12]	Auto Search	:SENSe:MEASure:BERCond:ASEarch
		:SENSe:MEASure:BERCond:ASEarch?
[13]	Detection	:SENSe:MEASure:BERCond:DETection
		:SENSe:MEASure:BERCond:DETection?
[14]	Unit	:SENSe:MEASure:BERCond:UNIT
		:SENSe:MEASure:BERCond:UNIT?
[15]	Threshold	:SENSe:MEASure:BERCond:THReshold
		:SENSe:MEASure:BERCond:THReshold?
[16]	Gating Time	:SENSe:MEASure:BERCond:GTIMe
		:SENSe:MEASure:BERCond:GTIMe?
[17]	Setting file save	:SYSTem:MMEMory:SETTing:STORe
[18]	Setting file load	:SYSTem:MMEMory:SETTing:RECall
[19]	Table Data Open	:SENSe:MEASure:TABLedata:OPEN
[20]	Table Data Select	:SENSe:MEASure:TABLedata:SELect?
[21]	Tester Limit	:SENSe:MEASure:BERCond:TLIMit
		:SENSe:MEASure:BERCond:TLIMit?
[22]	Meas.Sequence	:SENSe:MEASure:BERCond:SEQuence
		:SENSe:MEASure:BERCond:SEQuence?

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:SYSTem:MEASure:INITialize

Parameter	None
Function	Initializes the setting conditions for the Tolerance measurement or Sweep measurement.
Example	> :SYSTem:MEASure:INITialize

:DISPlay:MEASure:CHANge \<type\>

Parameter	\<type\>=\<CHARACTER PROGRAM DATA\>	
	SETTing	Setting window
	RESult	Result window
	REPort	Report window
Function	Switches the display screen for the Tolerance/Sweep measurement.	
	While the measurement is not being executed, Result cannot be specified.	
Example	To display the Result screen for the Tolerance measurement.	
	> :DISPlay:MEASure:CHANge RES	

:SENSe:MEASure:JITTer:STARt

Parameter	None
Function	Starts the tolerance/sweep measurement.
Example	> :SENSe:MEASure:JITTer:STARt

:SENSe:MEASure:JITTer:STOP

Parameter	None
Function	Stops the tolerance/sweep measurement.
Example	> :SENSe:MEASure:JITTer:STOP

:SENSe:MEASure:JITTer:STATe?

Response	1	Measurement being executed
	0	Measurement stopped
Function	Queries the state of the Tolerance/Sweep measurement.	
Example	> :SENSe:MEASure:JITTer:STATe?	
	< 1	

:SENSe:MEASure:SYSCond:BITRate?

Response	\<numeric\>=\<NR2 NUMERIC RESPONSE DATA\>
	0.100000 to 66.000000 0.100000 to 66.000000 Gbit/s
Function	Queries the Bitrate monitor value of the Tolerance/Sweep measurement.
Example	> :SENSe:MEASure:SYSCond:BITRate?
	< 28.000000

:SENSe:MEASure:SYSCond:PATTern \<type\>

Parameter	\<type\>=\<CHARACTER PROGRAM DATA\>
	USER,PRBS7,PRBS9,PRBS10,PRBS11,PRBS15,PRBS20,PRBS23,PRBS31
Function	To set the tolerance/sweep measurement pattern (PRBS setting or User).
Example	To set the pattern to "User".
	> :SENSe:MEASure:SYSCond:PATTern USER

:SENSe:MEASure:SYSCond:PATTern?

Response	\<type\>=\<CHARACTER RESPONSE DATA\>
	USER,PRBS7,PRBS9,PRBS10,PRBS11,PRBS15,PRBS20,PRBS23,PRBS31
Function	To query the tolerance/sweep measurement pattern (PRBS setting or User).
Example	> :SENSe:MEASure:SYSCond:PATTern?
	< USER

:SENSe:MEASure:SYSCond:PGENerator?

Response	\<type\>=\<CHARACTER RESPONSE DATA\>	
	MFUL	MUX Full rate
	PFUL	PPG Full rate
	MHAL	MUX Half rate
	PPG32	32G PPG
	MQUA	MUX Quarter rate
	MUX64	64G MUX
Function	To query the pattern generator setting of the tolerance/sweep measurement.	
Example	> :SENSe:MEASure:SYSCond:PGENerator?	
	< MHAL	

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:SENSe:MEASure:SYSCond:SJSelect \<type>

Parameter	\<type>=\<CHARACTER PROGRAM DATA>
	OFF No SJ added as a fixed value
	SJ SJ added as a fixed value
	SJ2 SJ2 added as a fixed value
Function	Sets the sine wave jitter added as a fixed value for the Tolerance/Sweep measurement.
Example	To set SJ2 to add a fixed value.
	> :SENSe:MEASure:SYSCond:SJSelect SJ2

:SENSe:MEASure:SYSCond:SJSelect?

Response	\<type>=\<CHARACTER RESPONSE DATA>
	OFF,SJ,SJ2
Function	Queries the sine wave jitter setting added as a fixed value for the Tolerance/Sweep measurement.
Example	> :SENSe:MEASure:SYSCond:SJSelect?
	< SJ2

:SENSe:MEASure:SYSCond:FJITer? \<type>

Parameter	\<type>=\<CHARACTER PROGRAM DATA>
	SJ SJ/SJ2 On/Off setting
	SSC SSC On/Off setting
	RJ RJ On/Off setting
	BUJ BUJ On/Off setting
	EXT Ext.J Enable/Disable setting
Response	\<boolean>=\< NUMERIC RESPONSE DATA>
	1 ON
	0 OFF
	When SJ is specified for the parameter, if SJ Select on the screen is SJ or SJ2, the response will be 1 (ON).
Function	Queries the ON/OFF setting of various jitters added as a fixed value for the Tolerance/Sweep measurement.
Example	To query the BUJ ON/OFF setting.
	> :SENSe:MEASure:SYSCond:FJITer? BUJ
	< 1

:SENSe:MEASure:BERCond:WTIMe <numeric>

Parameter	<numeric>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 99 1 to 99 s / 1s step
Function	Sets the Waiting Time for the Tolerance measurement.
Example	To set the Waiting Time to 5 sec.
	> :SENSe:MEASure:BERCond:WTIMe 5

:SENSe:MEASure:BERCond:WTIMe?

Parameter	None
Response	<numeric>=<NR2 NUMERIC RESPONSE DATA>
	1 to 99 1 to 99 s
Function	Queries the Waiting Time of the Tolerance/Sweep measurement.
Example	> :SENSe:MEASure:BERCond:WTIMe?
	< 5

:SENSe:MEASure:BERCond:ASEarch <type>

Parameter	<type>=<CHARACTER PROGRAM DATA>
	OFF Auto Search setting Off
	FINE Auto Search setting On (Fine mode)
	COARse Auto Search setting On (Coarse mode)
Function	Sets Auto Search On/Off of the tolerance/sweep measurement.
Example	To set Auto Search to On (Fine mode).
	> :SENSe:MEASure:BERCond:ASEarch FINE

:SENSe:MEASure:BERCond:ASEarch?

Response	<type>=<CHARACTER RESPONSE DATA>
	OFF,FINE,COAR
Function	Queries the Auto Search On/Off of the tolerance/sweep measurement.
Example	> :SENSe:MEASure:BERCond:ASEarch?
	< FINE

:SENSe:MEASure:BERCond:DETection <type>

Parameter	<type>=<CHARACTER PROGRAM DATA>
	DEFault Default mode
	ERRor Error mode
Function	Sets the conditions of Pass/Fail judgment.
Example	To set the conditions of Pass/Fail judgment to Default mode
	> :SENSe:MEASure:BERCond:DETection DEFault

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:SENSe:MEASure:BERCond:DETection?

Response	\<type>=\<CHARACTER RESPONSE DATA>
	DEF,ERR
Function	Queries the conditions of Pass/Fail judgment.
Example	> :SENSe:MEASure:BERCond:DETection?
	< DEF

:SENSe:MEASure:BERCond:UNIT \<type>

Parameter	\<type>=\<CHARACTER PROGRAM DATA>	
	RATE	Error rate
	COUNt	Error count
Function	Sets either the error rate or error count for the Pass/Fail judgment.	
Example	To set the error rate for the Pass/Fail judgment.	
	> :SENSe:MEASure:BERCond:UNIT RATE	

:SENSe:MEASure:BERCond:UNIT?

Response	\<type>=\<CHARACTER RESPONSE DATA>
	RATE,COUN
Function	Queries the setting of the Pass/Fail judgement
Example	> :SENSe:MEASure:BERCond:UNIT?
	< RATE

:SENSe:MEASure:BERCond:THReshold \<value>

Parameter	\<value>=\<DECIMAL NUMERIC PROGRAM DATA>	
	When Unit is set to Error Rate:	
	8 to 12	Error Rate 1E-8 to 1E-12
	When Unit is set to Error Count:	
	0 to 99999	Number of Error Count 0 to 99999 / 1Step
Function	Sets the evaluation threshold value.	
Example	To set the evaluation threshold value of error rate to 1E-9	
	> :SENSe:MEASure:BERCond:THReshold 9	

:SENSe:MEASure:BERCond:THReshold?

Response	\<numeric\>=\<NR1 NUMERIC RESPONSE DATA\>
	When Unit is set to Error Rate:
	8 to 12 Error Rate 1E-8 to 1E-12
	When Unit is set to Error Count:
	0 to 99999 Number of Error Count 0 to 99999
Function	Queries the evaluation threshold value of error rate
Example	> :SENSe:MEASure:BERCond:THReshold?
	< 9

:SENSe:MEASure:BERCond:GTIMe \<time\>

Parameter	\<time\>=\<DECIMAL NUMERIC PROGRAM DATA\>
	\<time\> =\<day\>,\<hour\>,\<min\>,\<sec\>
	0 to 99 0 to 99 /day
	0 to 23 0 to 23 /hour
	0 to 59 0 to 59 /min
	0 to 59 0 to 59 /sec
Function	Sets the Gating Time.
Example	To set the Gating Time to 1 and half minutes.
	> :SENSe:MEASure:BERCond:GTIMe 0,0,1,30

:SENSe:MEASure:BERCond:GTIMe?

Response	\<numeric\>=\<NR1 NUMERIC RESPONSE DATA\>
	\<time\> =\<day\>,\<hour\>,\<min\>,\<sec\>
	0 to 99 0 to 99 /day
	0 to 23 0 to 23 /hour
	0 to 59 0 to 59 /min
	0 to 59 0 to 59 /sec
Function	Queries the Gating Time.
Example	> :SENSe:MEASure:BERCond:GTIMe?
	< 0,0,1,30

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:SYSTem:MMEMory:SETTing:STORe <file_name>

Parameter	<file_name>=<STRING PROGRAM DATA>
	"<drv>:\<dir1>\<dir2>\<file>"
	<drv>=C,D,E,F Drive name
	<dir>=xxxxxxxx Directory name
	<file>=xxxxxxxxx File name
Function	Stores the setting conditions for the Tolerance/Sweep measurement.
Example	> :SYSTem:MMEMory:SETTing:STORe
	"D:\test_folder\test_setting"

:SYSTem:MMEMory:SETTing:RECall <file_name>

Parameter	<file_name>=<STRING PROGRAM DATA>
	"<drv>:\<dir1>\<dir2>\<file>"
	<drv>=C,D,E,F Drive name
	<dir>=xxxxxxxx Directory name
	<file>=xxxxxxxxx File name
Function	Queries the setting conditions for the Tolerance/Sweep measurement.
Example	> :SYSTem:MMEMory:SETTing:RECall
	"D:\test_folder\test_setting"

:SENSe:MEASure:TABLedata:OPEN < file_name >

Parameter	\<file_name\>=\<STRING PROGRAM DATA\>

"\<drv\>:\\\<dir1\>\\\<dir2\>\\\<file\>"

\<drv\>=C,D,E,F		Drive name
\<dir\>=xxxxxxxx		Directory name
\<file\>=xxxxxxxxx		File name

"xxxxxx.MASK"   Specified table data file name

"xxxxxx.UMSK"   User table data file name

> ***Note:***
> File name + extension (.MASK/.UMSK) are required.

Function	Loads the table data.
Example	To load the specified table data "Fibre Channel-4.25G_CRPAT.MASK".

```
>:SENSe:MEASure:TABLedata:OPEN
"C:\ProgramFiles\Anritsu\MX181500A\Mask\Fibre
Channel_4.25G_CRPAT.MASK"
```

To load the user table data "Test_table.UMSK".

```
>:SENSe:MEASure:TABLedata:OPEN
"C:\Program
Files\Anritsu\MX181500A\Mask\User\Test_table.UMSK"
```

:SENSe:MEASure:TABLedata:SELect?

Response	\<item\>=\<STRING RESPONSE DATA\>

"xxxxxxxxxx"   File name

Function	Queries the selected table data.
Example	>:SENSe:MEASure:TABLedata:SELect?

```
<"Fibre Channel_4.25G_CRPAT" (for Standard)
<"User" (for User)
```

:SENSe:MEASure:BERCond:TLIMit <boolean>

Parameter	<boolean>=<BOOLEAN PROGRAM DATA>
	OFF or 0 Limit OFF
	ON or 1 Limit ON
Function	Sets whether to enable or disable the Amplitude limit for SJ/SJ2 when performing the Tolerance/Sweep measurement. (This parameter is available only when 32G PPG and 56G MUX are used.)
	ON: Sets the SJ Amplitude limit to the upper limit of the guaranteed operating range of the PPG to be used for measurement.
	OFF: Sets the SJ Amplitude limit to the maximum amplitude that the PPG can generate.
Example	Sets the Amplitude limit of SJ/SJ2 to ON.
	> :SENSe:MEASure:BERCond:TLIMit ON

:SENSe:MEASure:BERCond:TLIMit?

Response	<boolean>=<NR1 NUMERIC RESPONSE DATA>
	0 Limit OFF
	1 Limit ON
Function	Queries the ON/OFF setting of the Amplitude limit of SJ/SJ2.
Example	> :SENSe:MEASure:BERCond:TLIMit?
	< 1

:SENSe:MEASure:BERCond:SEQuence <type>

Parameter	<type>=<CHARACTER PROGRAM DATA>
	LOWerfreq Measures from lower modulation frequency side
	HIGHerfreq Measures from higher modulation frequency side
Function	Specifies the Tolerance/Sweep measurement sequence direction.
Example	Sets the measurement to start from higher modulation frequency side
	> :SENSe:MEASure:BERCond:SEQuence HIGHerfreq

:SENSe:MEASure:BERCond:SEQuence?

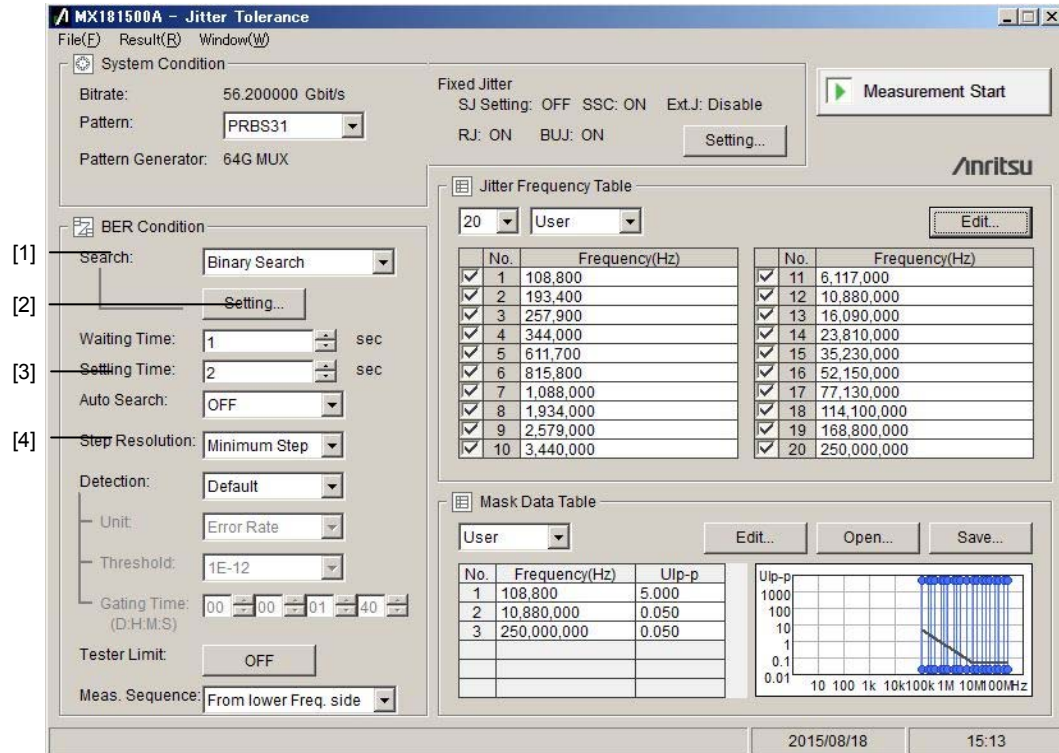|	
Response	None
Function	Queries the Tolerance/Sweep measurement sequence direction.
Example	> :SENSe:MEASure:BERCond:SEQuence?
	< HIGH

5.8.2 Setting Tolerance measurement conditions

Figure 5.8.2-1 Tolerance Measurement Setting

Table 5.8.2-1 Tolerance Measurement Setting Command

No.	Setting Item	Command
[1]	Search	:SENSe:MEASure:BERCond:SEARch
		:SENSe:MEASure:BERCond:SEARch?
[2]	Search Setting	:SENSe:MEASure:BERCond:SSETting
		:SENSe:MEASure:BERCond:SSETting?
		:SENSe:MEASure:BERCond:USEMask
		:SENSe:MEASure:BERCond:USEMask?
		:SENSe:MEASure:BERCond:RATiosetting
		:SENSe:MEASure:BERCond:RATiosetting?
[3]	Settling Time	:SENSe:MEASure:BERCond:STIMe
		:SENSe:MEASure:BERCond:STIMe?
[4]	Step Resolution	:SENSe:MEASure:BERCond:RESolution
		:SENSe:MEASure:BERCond:RESolution?

:SENSe:MEASure:BERCond:SEARch <type>

Parameter	<type>=<CHARACTER PROGRAM DATA>
	BINary Binary Search
	DLINear D ownward Linear
	DLOG Downward Log
	ULINear Upward Linear
	ULOG Upward Log
	BLINear Binary+Linear
Function	Sets the tolerance measurement method.
Example	To set the tolerance measurement method to Binary Search.
	`> :SENSe:MEASure:BERCond:SEARch BINary`

:SENSe:MEASure:BERCond:SEARch?

Response	<type>=<CHARACTER RESPONSE DATA>
	BIN,DLIN,DLOG,ULIN,ULOG,BLIN
Function	Queries the tolerance measurement method.
Example	`> :SENSe:MEASure:BERCond:SEARch?`
	`< BIN`

:SENSe:MEASure:BERCond:SSETting
<range>,<upper>:,<lower>[,<step/ratio>]

Parameter	<range>=<CHARACTER NUMERIC PROGRAM DATA >
	VERYlow Range Low: 10 to 100 kHz (When interacting with 32G PPG)
	LOW Range Low: 10 to 1 MHz
	Range Low: 100k to 1 MHz (When interacting with 32G PPG)
	MIDDle Range Middle: 1 M to 10 MHz
	HIGH Range High: From 10 MHz
	<upper>=<DECIMAL NUMERIC PROGRAM DATA>
	0.000 to 2000.000 0.000 to 2000 UIp-p
	<lower>=<DECIMAL NUMERIC PROGRAM DATA>
	0.000 to 2000.000 0.000 to 2000 UIp-p
	<step>=<DECIMAL NUMERIC PROGRAM DATA>
	0.001 to 2000.000 0.001 to 2000 UIp-p
	<ratio>=<DECIMAL NUMERIC PROGRAM DATA>
	0.1 to 0.99
	The setting resolutions of <upper>, <lower>, and <step> depend on the setting values.
	Note:
	When Binary Search is selected, <step> or <ratio> cannot be specified. When <step> or <ratio> is specified, the error (Parameter Not allowed) is returned.

Function	Sets the measurement range such as jitter modulation amplitude upper and lower limits for the Tolerance measurement for each modulation frequency band.
Example	To set the modulation amount upper limit to 40 UIp-p, lower limit to 5 UIp-p, and step to 0.2 UI for the modulation frequency band 10 Hz to 1 MHz when the Tolerance measurement method is "Downward Linear".
	`> :SENSe:MEASure:BERCond:SSETting LOW,40,5,0.2`

:SENSe:MEASure:BERCond:SSETting? <range>

Parameter	<range>=<CHARACTER NUMERIC PROGRAM DATA >	
	VERYlow	Range Low: 10 to 100 kHz (When interacting with 32G PPG)
	LOW	Range Low: 10 to 1 MHz
		Range Low: 100k to 1 MHz (When interacting with 32G PPG)
	MIDDle	Range Middle: 1 M to 10 MHz
	HIGH	Range High: From 10 MHz
Response	<upper>,<lower>[,<step/ratio>]	
	<upper>=<DECIMAL NUMERIC PROGRAM DATA>	
	0.000 to 2000.000	0.001 to 2000 UIp-p
	<lower>=<DECIMAL NUMERIC PROGRAM DATA>	
	0.000 to 2000.000	0.001 to 2000 UIp-p
	<step>=<DECIMAL NUMERIC PROGRAM DATA>	
	0.001 to 2000.000	0.001 to 2000 UIp-p
	<ratio>=<DECIMAL NUMERIC PROGRAM DATA>	
	0.1 to 0.99	

> ***Note:***
> When Binary Search is selected, there are no responses of <step> or <ratio>.

Function	Queries the measurement range such as jitter modulation amplitude upper and lower limits of the Tolerance measurement for each modulation frequency band.
Example	`> :SENSe:MEASure:BERCond:SSETting? LOW`
	`< 40,5,0.5`

:SENSe:MEASure:BERCond:USEMask <boolean>

Parameter	<boolean>=<BOOLEAN PROGRAM DATA>	
	OFF or 0	Use Mask Table Off
	ON or 1	Use Mask Table On
Function	Enables or disables Use Mask Table on the Search Setting dialog box.	
Example	To enable Use Mask Table.	
	`> :SENSe:MEASure:BERCond:USEMask 1`	

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:SENSe:MEASure:BERCond:USEMask?

Parameter	None
Function	Queries Use Mask Table setting.
Example	> :SENSe:MEASure:BERCond:USEMask?
	< ON

:SENSe:MEASure:BERCond:RATiosetting \<upper>,\<lower>

Parameter	\<upper>=\<DECIMAL NUMERIC PROGRAM DATA>
	1.000 to 1000.000 1.000 to 1000 times
	\<lower>=\<DECIMAL NUMERIC PROGRAM DATA>
	0.001 to 1.000 0.001 to 1.000 times
Function	Sets both upper limit and lower limit used for the jitter modulation amplitude for the tolerance measurement by the ratio of the mask line.
Example	To set upper limit to 10 times and lower limit to 0.1 times of the mask line respectively.
	> :SENSe:MEASure:BERCond:RATiosetting 10,0.1

:SENSe:MEASure:BERCond:RATiosetting?

Parameter	None
Function	Query both upper limit and lower limit used for the jitter modulation amplitude of the tolerance measurement by the ratio of the mask line.
Example	> :SENSe:MEASure:BERCond:RATiosetting?
	< 10,0.1

:SENSe:MEASure:BERCond:STIMe \<numeric>

Parameter	\<numeric>=\<DECIMAL NUMERIC PROGRAM DATA>
	1 to 99 1 to 99 s / 1s step
Function	Set the Settling Time for the Tolerance measurement.
Example	To set the Settling Time to 5 sec.
	> :SENSe:MEASure:BERCond:STIMe 5

:SENSe:MEASure:BERCond:STIMe?

Parameter	None
Response	<numeric>=<NR2 NUMERIC RESPONSE DATA>
	1 to 99 1 to 99 s
Function	Queries the Settling Time of the Tolerance measurement.
Example	> :SENSe:MEASure:BERCond:STIMe?
	< 5

:SENSe:MEASure:BERCond:RESolution <type>

Parameter	<type>=<CHARACTER PROGRAM DATA>	
	FINE	Fine mode
	NORMal	Normal mode
	COARse	Coarse mode
	MINimum	Minimum Step mode
Function	Sets the adjustment accuracy when the Tolerance measurement method is set to Binary Search.	
Example	To set Auto Search to ON (Fine mode).	
	> :SENSe:MEASure:BERCond:RESolution FINE	

:SENSe:MEASure:BERCond:RESolution?

Parameter	<type>=<CHARACTER RESPONSE DATA>
	FINE,NORM,COAR, MIN
Function	Queries the adjustment accuracy of the Tolerance measurement method.
Example	> :SENSe:MEASure:BERCond:RESolution?
	< FINE

5.8.3 Setting Sweep measurement conditions
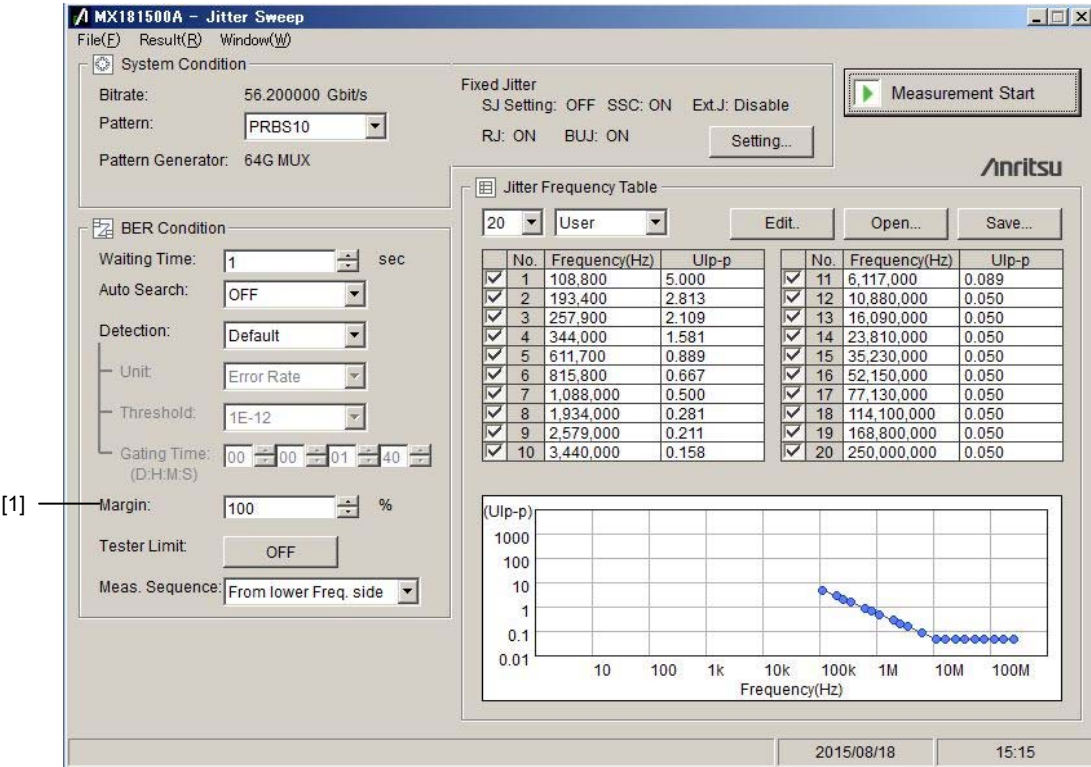
Figure 5.8.3-1 Sweep Measurement Setting

Table 5.8.3-1 Sweep Measurement Setting Command

No.	Setting Item	Command
[1]	Margin	:SENSe:MEASure:BERCond:MARGin
		:SENSe:MEASure:BERCond:MARGin?

:SENSe:MEASure:BERCond:MARGin <numeric>

Parameter	<numeric>=<DECIMAL NUMERIC PROGRAM DATA>
	10 to 100 10 to 100 % / 10 % step
Function	Sets the margin of the Pass/Fail judgment for the Sweep measurement.
Example	To set the Pass/Fail judgment margin to 50%.
	> :SENSe:MEASure:BERCond:MARGin 50

:SENSe:MEASure:BERCond:MARGin?

Parameter	None
Response	<numeric>=<NR2 NUMERIC RESPONSE DATA>
	10 to 100 10 to 100 %
Function	Queries the Pass/Fail judgment margin of the Sweep measurement.
Example	> :SENSe:MEASure:BERCond:MARGin?
	< 50

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5.9   Acquiring and Saving Measurement Results

5.9.1   Result screen
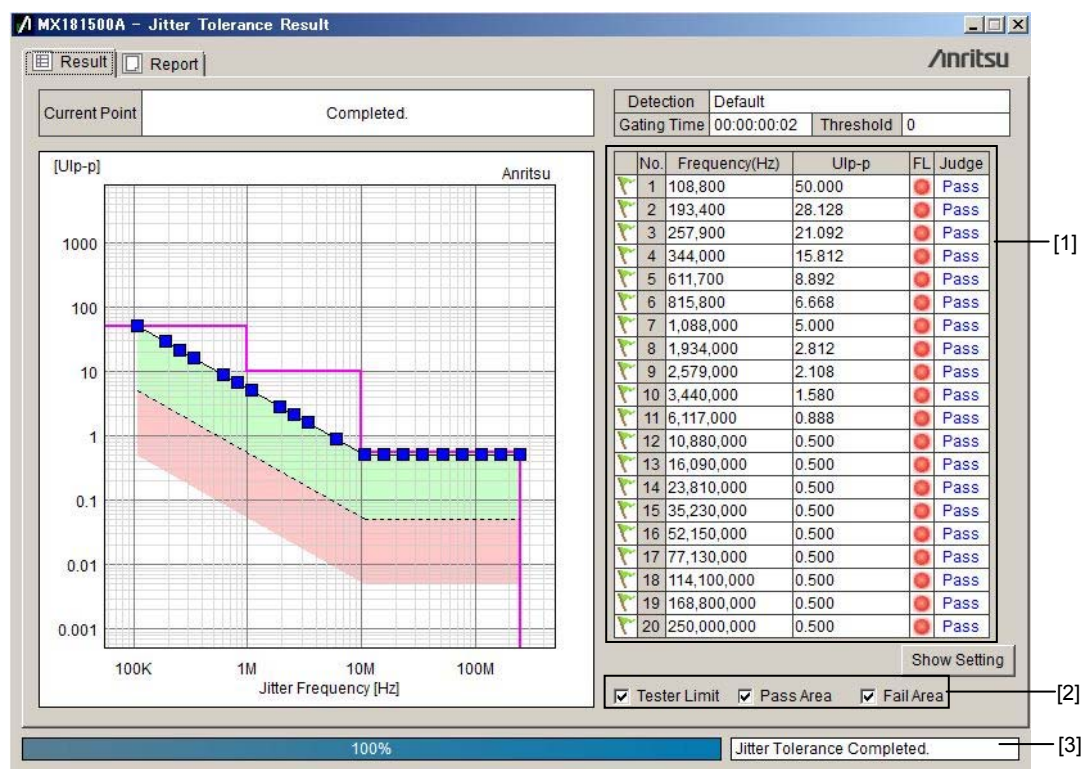
Figure 5.9.1-1   Tolerance Measurement Setting
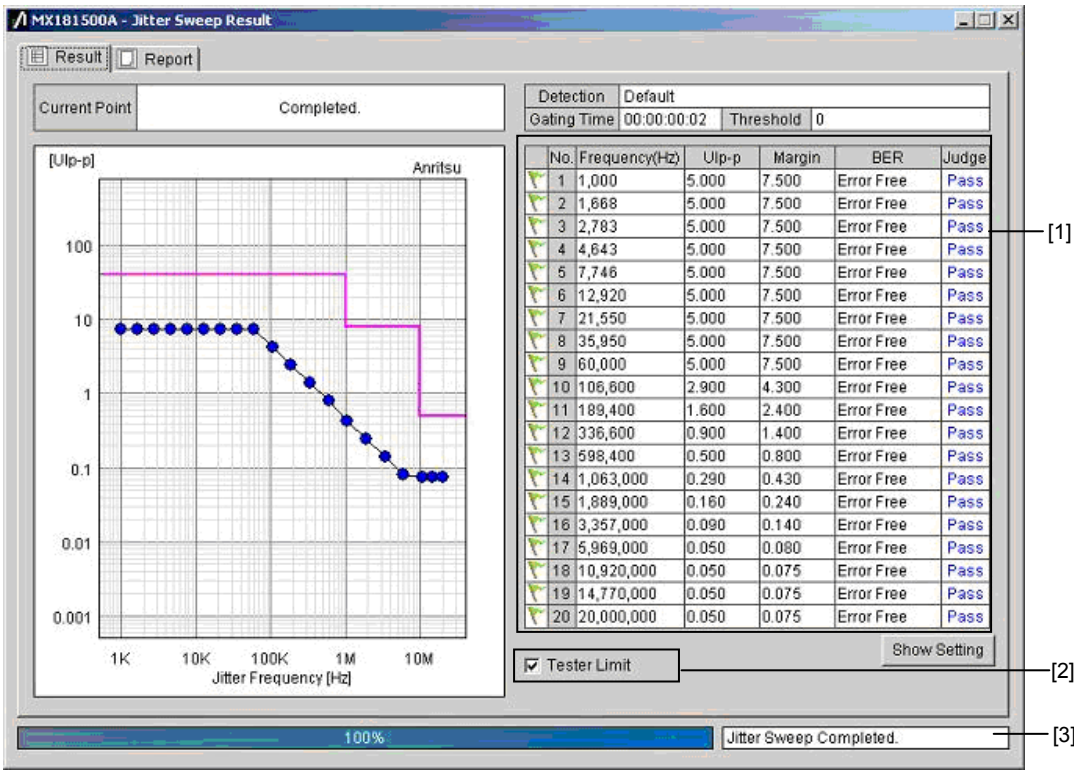
Figure 5.9.1-2   Sweep Measurement Result Screen

Table 5.9.1-1   Measurement Result Acquisition/Storage Command

No.	Setting Item	Command
[1]	Result acquisition	:CALCulate:RESult:DATA?
[2]	Graph display switching	:DISPlay:RESult:GRAPh
[3]	Measurement status	:CALCulate:RESult:STATus?

:CALCulate:RESult:DATA? <type>[,<numeric>]

Parameter	<type>=<CHARACTER PROGRAM DATA>
	ALL All measurement points
	POINt Specified point
	<numeric>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 20 Measurement points No.1 to 20
	When <type> is ALL, <numeric> can be omitted.
Response	<string>=<STRING RESPONSE DATA>
	On Tolerance measurement
	<string>="<number>,<freq>,<ui>,<flow>,<judge>"
	<number>=<NR1 NUMERIC RESPONSE DATA>
	1 to 20 Measurement point No.1 to 20
	<freq>=<NR1 NUMERIC RESPONSE DATA>
	10 to 250000000 Hz modulation frequency
	<ui>=<NR2 NUMERIC RESPONSE DATA>
	0.001 to 2000.000 UIp-p modulation amount
	<flow>=<NR1 NUMERIC RESPONSE DATA>
	1 Overflow exists
	0 No overflow
	−1 Not measured
	<judge>=<NR1 NUMERIC RESPONSE DATA>
	1 Pass
	0 Fail
	−1 Not measured
	On Sweep measurement
	<string>="<number>,<freq>,<ui>,<margin>,<ber>,<judge>"
	<margin>=<NR2 NUMERIC RESPONSE DATA>
	0.001 to 2000.000 Measurement modulation amount with addition of UIp-p margin
	<ber>=<STRING RESPONSE DATA>
	x.xxxxE-xx Measurement point BER
	Error Free For error free
	−1 Not measured
Function	Acquires the Tolerance/Sweep measurement result.

Example	To acquire all measurement results of the Tolerance measurement.
	`> :CALCulate:RESult:DATA? ALL`
	`< "1,1000,5.000,1,1", "2,1000,5.000,1,1",`
	`"3,1000,5.000,1,1",•••"20,200000000,0.150,1,1"`
	To acquire the No.10 measurement data of the Tolerance measurement.
	`> :CALCulate:RESult:DATA? POINt,10`
	`< "10,100000,1.000,0,0"`
	To acquire the No.10 measurement data of the Sweep measurement
	`> :CALCulate:RESult:DATA? POINt,10`
	`< "10,2860000,0.160,0.240,1.2242E-03,0"`

:DISPlay:RESult:GRAPh <type>,<boolean>

Response	<type>=<CHARACTER RESPONSE DATA>	
	LIMit	Tester Limit (Tolerance/Sweep measurement)
	PASS	Pass Area (Tolerance measurement)
	FAIL	Fail Area (Tolerance measurement)
	<boolean>=<BOOLEAN PROGRAM DATA>	
	OFF or 0	Display Off
	ON or 1	Display On
Function	Sets ON/OFF of each display of the measurement result graph.	
Example	To set the Tester Limit display to ON.	
	`> :DISPlay:RESult:GRAPh LIMit,ON`	

:CALCulate:RESult:STATus?

Response	<string>=<STRING RESPONSE DATA>	
	"xxxxxxxx"	Measurement status
	On Tolerance measurement	
	"Jitter Tolerance Started."	Measurement started
	"Jitter Tolerance Completed."	Measurement completed
	"Jitter Tolerance Aborted."	Measurement aborted
	"Jitter Tolerance Failed."	Measurement failed
	On Sweep measurement	
	"Jitter Sweep Started."	Measurement started
	"Jitter Sweep Completed."	Measurement completed
	"Jitter Sweep Aborted."	Measurement aborted
	"Jitter Sweep Failed."	Measurement failed
Function	Queries the status of the Tolerance/Sweep measurement.	
Example	`> :CALCulate:RESult:STATus?`	
	`< "Jitter Tolerance Complete"`	

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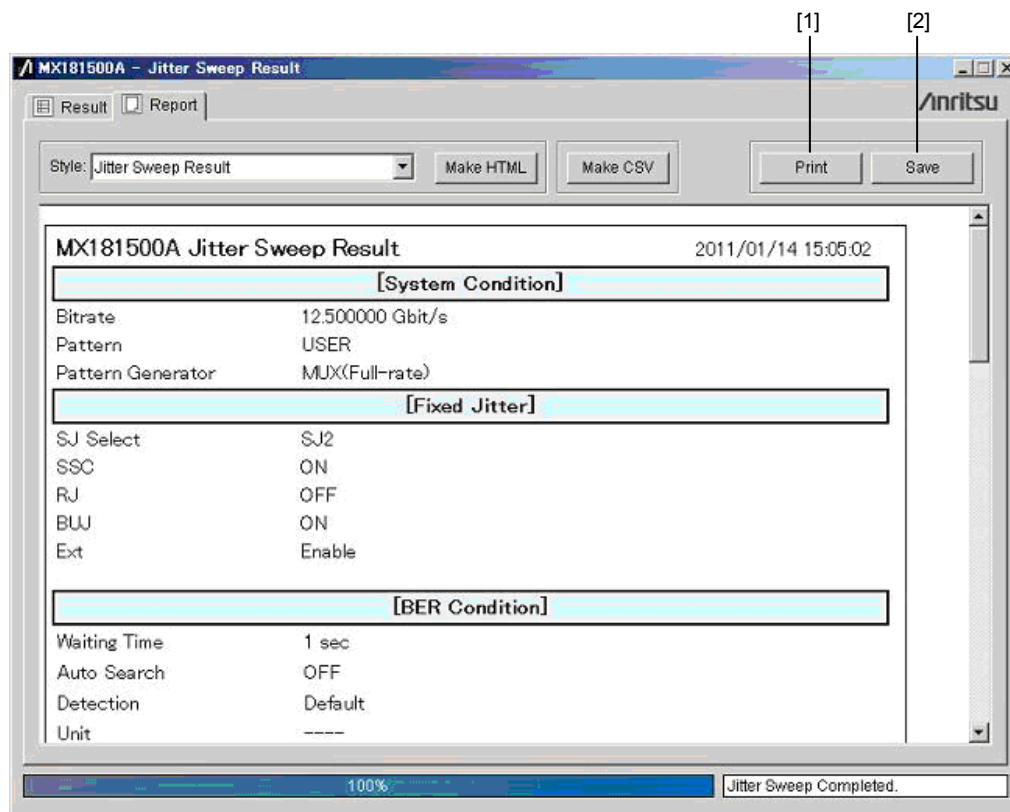
5.9.2   Report window

Figure 5.9.2-1   Report Window

Table 5.9.2-1   Report Screen Command

No.	Setting Item	Command
[1]	Report Print	:SYSTem:MMEMory:RESult:PRINt
[2]	Report Save	:SYSTem:MMEMory:RESult:STORe

:SYSTem:MMEMory:RESult:PRINt <type>

Parameter	<type>=<CHARACTER PROGRAM DATA>
	HTML HTML format
	CSV CSV format
Function	Prints the Tolerance/Sweep measurement result with specification of display format.
Example	To print the measurement result with the CSV format.
	`> :SYSTem:MMEMory:RESult:PRINt CSV`

:SYSTem:MMEMory:RESult:STORe <file_name>,<type>

Parameter	<file_name>=<STRING PROGRAM DATA>
	"<drv>:\<dir1>\<dir2>\<file>"
	<drv>=C,D,E,F Drive name
	<dir>=xxxxxxxx Directory name
	<file>=xxxxxxxxx File name
	<type>=<CHARACTER PROGRAM DATA>
	HTML HTML format
	CSV CSV format
Function	Stores the Tolerance/Sweep measurement result with specification of file name and file format.
Example	`> :SYSTem:MMEMory:RESult:STORe "D:\test_folder\test",CSV`

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Appendix A Specifications

Table A-1   Configuration

Item	Model	Specifications	Quantity
Standard Configuration	Z1500A	MX181500A Software CD (Installer, Operation manual)	1
	Z0897A	MP1820A Manual CD	1
	Z0918A	MX180000A Software CD	1
Application Parts	W3480AE	MX181500A Operation Manual (Printed, English)	1

Table A-2   Operation Environment

Item	Specifications
Installation target	MP1800A or a personal computer
PC specifications	
OS	Windows XP Professional Service Pack 2 or later
	Windows 7 Professional/Enterprise/Ultimate
	English or Japanese version
CPU	Pentium III 800 MHz or higher (For Windows XP)
	1 GHz or higher (For Windows 7)
Memory	512 MB or more (For Windows XP)
	1 GB or more (For Windows 7, 32-bit)
	2 GB or more (For Windows 7, 64-bit)
Hard Disk	Free space 2 GB or more
CD Drive	For use at installation
Remote interface	Ethernet (10BASE-T, 100BASE-TX)
Display	Resolution 800 × 600 or more, Display color 32 bits
Target Equipment	MP1800A or MT1810A
Required accessory	MP1800A-002 LAN option
Number of Target Equipment	Three or less
Version	MX180000A Installer: Version 6.00.00 or later
	MU18302xA 32G PPG and MU18304x 32G ED: V7.00.00 or later
	MP1821A 56G MUX and MP1822A 56G DEMUX: V7.50.00 or later
	MP1861A 64G MUX and MP1862A 64G DEMUX: V8.00.00 or later

Table A-3   Main Screen Setup

Item	Specifications
Connection setup of MP1800A/MT1810A	IP address: 1.0.0.1 to 223.255.255.254
	Board number: 1024 to 65535
Find feature	Available
Equipment list display	Available
Measurement type selection	Jitter Tolerance, Jitter Sweep

Table A-4   Jitter Tolerance Screen

Item	Specifications
System Condition	
Bit Rate	A bit rate of MU181500B output
Pattern	PRBS7, PRBS9, PRBS10, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31, and USER
Pattern Generator	MUX (Full-rate), MUX (Half-rate), PPG, and 32G PPG, 64G MUX
Fixed Jitter *	SJ or SJ2, SSC, RJ, BUJ, and Ext.J of MU181500B
BER Condition	
Search	Binary Search, Downwards Linear, Downwards Log, Upwards Linear, and Upwards Log, Binary + Linear
Search Setting	Upper Value, Lower Value, Step, and Ratio, Upper Ratio, Lower Ratio
Waiting Time	1 to 99 seconds, in steps of one second
Setting Time	1 to 99 seconds, in steps of one second
Auto Search	On, Off
Step resolution	Fine, Normal, Coarse
Detection	Default, Error
Unit	Error Rate, Error Count
Threshold	Error Rate: 10^{-8}, 10^{-9}, 10^{-10}, 10^{-11}, 10^{-12}
	Error Count: 0 to 99999, in steps of 1
Gating Time	1 second to 99 days 23 hours 59 minute 59 seconds, in steps of one second
Tester Limit	On, Off
Meas.Sequence	From lower Freq. side, From higher Freq. side
Jitter Frequency Table	
Number of setting points	1 to 50 points
Table setting	User, Mask Table
Jitter frequency setup range	Refer to the sinusoidal jitter (SJ or SJ2) modulation frequency setup range shown in Table 1.3-2 "Jitter Modulation Performance" in the *MU181500B Jitter Modulation Source Operation Manual*

*:   The setting range conforms to Table 1.3-2 "Jitter Modulation Performance" in the *MU181500B Jitter Modulation Source Operation Manual*

Table A-4   Jitter Tolerance Screen (Cont'd)

Item	Specifications
Mask Table	
Number of setting points	1 to 10 points
Table setting	User, Standard
Jitter frequency setup range	Refer to the sinusoidal jitter (SJ or SJ2) modulation frequency setup range shown in Table 1.3-2 "Jitter Modulation Performance" in the *MU181500B Jitter Modulation Source. Operation Manual.*
Jitter amplitude setup range	

Jitter frequency [MHz]	Jitter amplitude setup range [UIp-p]	Setup resolution [UIp-p]
0.00001 to 1	0.000 to 50.000	0.002
1 to 10	0.000 to 10.000	0.002
10 to 250	0.000 to 0.550	0.002

When interacting with 32G PPG*

Jitter frequency [MHz]	Jitter amplitude setup range [UIp-p]	Setup resolution [UIp-p]
0.00001 to 0.1	0.000 to 2000.000	0.002
0.1001 to 1	0.000 to 200.000	0.002
1 to 10	0.000 to 16.000	0.002
10 to 250	0.000 to 1.000	0.002

Note that available jitter frequency and jitter amplitude for jitter measurement depend on the clock frequency set by controller and MU181500B.

Item	Specifications
Result	
Graph operation	Copy to the clipboard, saving in a file of the bitmap format, change of a graph scale, indication of a limit line of a jitter amplitude, and indication of the Pass and Fail areas
Items to be displayed	Jitter frequency, jitter amplitude, and Pass/Fail judgment result
System Condition	Refer to the System Condition column in Table A-4 "Jitter Tolerance Screen".

*:   The range will be extended in Version 2.04.00 or any later version of MX181500A. The version of MX180000A used simultaneously must be 7.09.00 or later.

Appendix

Appendix A

Table A-5   Jitter Sweep Screen

Item	Specifications
BER Condition	
Waiting Time	1 to 99 seconds, in steps of one second
Auto Search	On, Off
Detection	Default, Error
Unit	Error Rate, Error Count
Threshold	Error Rate: 10^{-8}, 10^{-9}, 10^{-10}, 10^{-11}, 10^{-12}
	Error Count: 0 to 99999, in steps of 1
Gating Time	1 second to 99 days 23 hours 59 minutes 59 seconds, in steps of one second
Margin	0 to 100 %, in steps of 10 %
Tester Limit	On, Off
Jitter Frequency Table	
Number of setting points	1 to 50 points
Standard	User, Standard
Jitter frequency setup range	Refer to the sinusoidal jitter (SJ or SJ2) modulation frequency setup range shown in Table 1.3-2 "Jitter Modulation Performance" in the *MU181500B Jitter Modulation Source Operation Manual*.
Jitter amplitude setup range	(see tables below)

Jitter frequency [MHz]	Jitter amplitude setup range [UIp-p]	Setup resolution [UIp-p]
0.00001 to 1	0.000 to 50.000	0.002
1 to 10	0.000 to 10.000	0.002
10 to 250	0.000 to 0.550	0.002

When interacting with 32G PPG*

Jitter frequency [MHz]	Jitter amplitude setup range [UIp-p]	Setup resolution [UIp-p]
0.00001 to 0.1	0.000 to 2000.000	0.002
0.1001 to 1	0.000 to 200.000	0.002
1 to 10	0.000 to 16.000	0.002
10 to 250	0.000 to 1.000	0.002

Note that available jitter frequency and jitter amplitude for jitter measurement depend on the clock frequency set by controller and MU181500B.

Item	Specifications
Result	
Graph operation	Copy to the clipboard, saving in a file of the bitmap format, and change of a graph scale
Items to be displayed	Jitter frequency, jitter amplitude, bit error rate, and Pass/Fail judgment result

*:   The range will be extended in Version 2.04.00 or any later version of MX181500A. The version of MX180000A used simultaneously must be 7.09.00 or later.

Appendix B Default Settings

Table B-1 Main Screen

Item	Default
Equipment Setting	
Jitter Modulation Source	Not Use
PPG/MUX	Not Use
ED/DEMUX	Not Use
MP1800A/MT1810A Setting	
Check box	No.1:On
	No.2:Off
	No.3:Off
IP Address	127.0.0.1
Port	5001

Table B-2   System Condition

Item	Default
Bit rate	A value specified in MU181000A/B
Pattern Generator	A value specified in MU181500B
Pattern	User
Fixed Jitter Setting	
SJ	
SJ/SJ2 Select	A value specified in MU181500B
SJ(2)	A value specified in MU181500B
Frequency	A value specified in MU181500B
Amplitude	A value specified in MU181500B
SSC Setting	
SSC	A value specified in MU181500B
Type	A value specified in MU181500B
Frequency	A value specified in MU181500B
Deviation	A value specified in MU181500B
RJ Setting	
RJ	A value specified in MU181500B
Filter	A value specified in MU181500B
Amplitude	A value specified in MU181500B
Amplitude LF	A value specified in MU181500B
Amplitude HF	A value specified in MU181500B
HPF	A value specified in MU181500B
LPF	A value specified in MU181500B
BUJ Setting	
BUJ	A value specified in MU181500B
PRBS	A value specified in MU181500B
Amplitude	A value specified in MU181500B
Bit rate	A value specified in MU181500B
LPF	A value specified in MU181500B
Ext.J Setting	
Ext.J	A value specified in MU181500B

Table B-3   BER Condition

Item	Default
Search*1 Search Setting*1	Binary Search
Upper Value	Depends on the following setting configured with MU181500B: • Bitrate • Pattern Generator • SJ/SJ2 Select setting under Fixed Jitter Setting
Lower Value	<table><tr><th>Jitter Frequency (MHz)</th><th>Lower Value (UIp-p)</th></tr><tr><td>0.00001 to 1</td><td>0</td></tr><tr><td>1 to 10</td><td>0</td></tr><tr><td>10 to 250</td><td>0</td></tr></table>
Upper Ratio	10
Lower Ratio	0.1
Step	When using 32G PPG and 64G MUX <table><tr><th>Jitter Frequency (MHz)</th><th>Step (UIp-p)</th></tr><tr><td>0.00001 to 0.100</td><td>5.000</td></tr><tr><td>0.100 to 1</td><td>1.000</td></tr><tr><td>1 to 10</td><td>0.100</td></tr><tr><td>10 to 250</td><td>0.050</td></tr></table>When using 14G PPG <table><tr><th>Jitter Frequency (MHz)</th><th>Step (UIp-p)</th></tr><tr><td>0.00001 to 1</td><td>1.000</td></tr><tr><td>1 to 10</td><td>0.100</td></tr><tr><td>10 to 250</td><td>0.050</td></tr></table>
Ratio	0.5
Waiting Time	1
Setting Time	2
Auto Search	On

*1: In case of Jitter Tolerance

Table B-3   BER Condition (Cont'd)

Item	Default
Detection	Default
Unit *1	Error Rate
Threshold *1	0 *2
	1E–12 *3
Gating Time	0:0:1:40
Margin *4	0
Tester Limit	OFF
Meas.Sequence	From lower Freq. side

*2:   When Error Count is set as Unit

*3:   When Error Rate is set as Unit

*4:   In case of Jitter Sweep

Table B-4   Jitter Frequency Table

Item	Default
Standard	User

Table B-5   Mask Data Table *

Item	Default
Standard	User

*:   In case of Jitter Tolerance

Table B-6   Result

Item	Default
Test Limit	On
Pass Area *	On
Fail Area *	On

*:   In case of Jitter Tolerance

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References are to page numbers.