MX210002A
Transmission Analysis Software
Operation Manual

Eighth Edition

For safety and warning information, please read this manual before attempting to use the equipment.
Keep this manual with the equipment.

ANRITSU CORPORATION

Document No.: M-W3571AE-8.0

Safety Symbols

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

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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.

MX210002A
Transmission Analysis Software
Operation Manual

10 August 2011 (First Edition)
4 September 2015 (Eighth Edition)

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- Copying files and data
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  - 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 memory stick and CF memory card).
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1. Product Model

Software: MX210002A Transmission Analysis Software

2. Applied Directive and Standards

When the MX210002A Transmission Analysis Software is installed in the MP2100A or MP2100B, the applied directive and standards of this unit conform to those of the MP2100A/MP2100B main frame.

PS: About main frame
Please contact Anritsu for the latest information on the main frame types that MX210002A can be used with.

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C-Tick marking

1. Product Model

Software: MX210002A Transmission Analysis Software

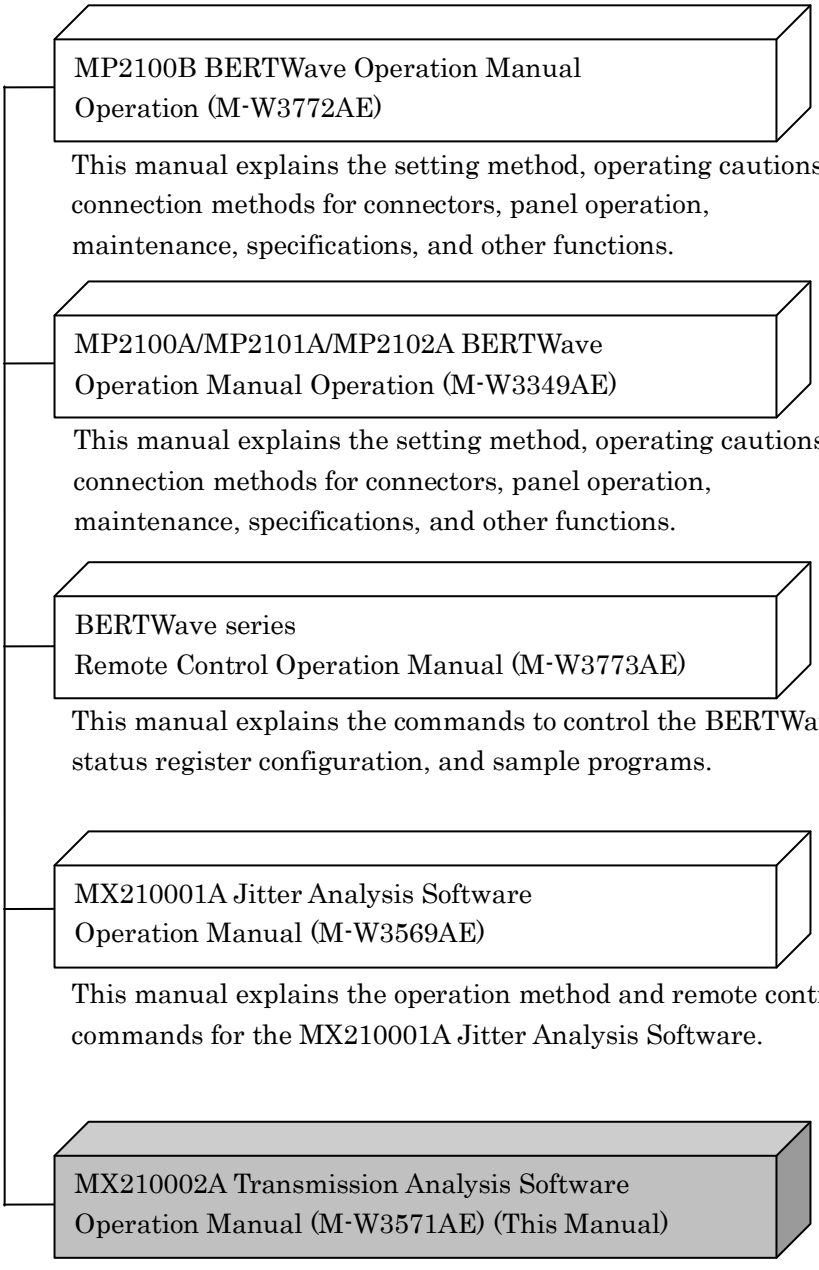
2. Applied Directive and Standards

When the MX210002A Transmission Analysis Software is installed in the MP2100A or MP2100B, the applied directive and standards of this unit conform to those of the MP2100A/MP2100B main frame.

PS: About main frame
Please contact Anritsu for the latest information on the main frame types that MX210002A can be used with.

About This Manual

The BERTWave Series has five operation manuals as below.



For the startup procedure and panel operation of the BERT Wave, refer to *MP2100A* BERT Wave, *MP2101A* BERT Wave PE, *MP2102A BERTWave SS Operation Manual* (W3349AE) or *MP2100B BERT Wave Operation Manual* (W3372AE).
For the remote control operation of the BERT Wave, refer to *BERTWave series Remote Control Operation Manual* (W3773AE).

This operation manual assumes the reader has the following basic knowledge of:

- Operations of BERT Wave
- Basic knowledge of frequency characteristics measurement

Convention Used In This Manual

The MX210002A Transmission Analysis Software is referred to as "MX210002A" in the main text.

The names of panel and function keys are in bold.
Example: **Power**

The user interface such as button and tag names are in angled parentheses.
Example: [PPG], [System Menu]

Table of Contents

Table of Commands

Chapter 1 Outline

This chapter explains the outline, features, and technical terms of MX210002A Transmission Analysis Software.
For the product configuration and specifications, refer to Appendix A "Specifications."

1.1 MX210002A Transmission Analysis Software Outline

The MX210002A Transmission Analysis Software is for analysis of the following with the use of the pulse pattern generator and sampling oscilloscope function of MP2100A/MP2100B BERTWave.

1.1.1 Frequency characteristics of parts

As shown in the following figure, a waveform of a signal input to the DUT and a waveform of a signal output from the DUT are obtained with the EYE/Pulse Scope.
The MX210002A measures the frequency characteristics of the DUT from the two waveforms.
In the same way as the VNA (Vector Network Analyzer), the frequency characteristics are displayed with the gain and phase difference.
A general VNA inputs signals to the DUT bi-directionally to measure each pass characteristics (S_{21}, S_{12}) and reflection characteristics (S_{11}, S_{22}).
The MX210002A measures only the one-way pass characteristics (S_{21}) due to measurement system restrictions.

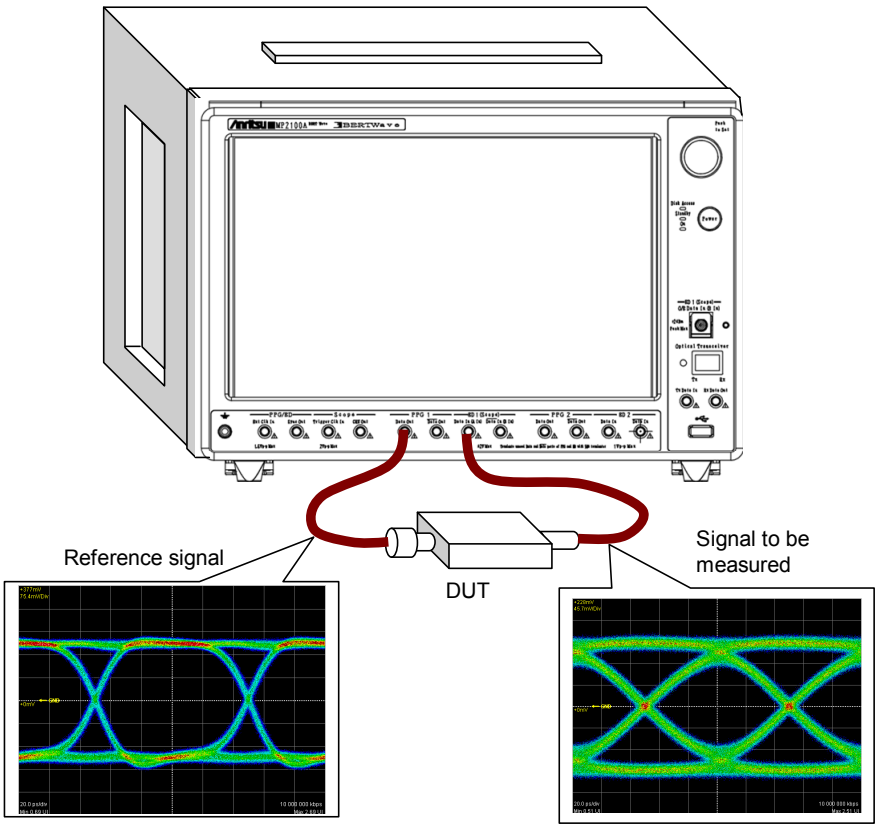


Figure 1.1.1-1 Waveforms Obtained on Frequency Characteristics Measurement

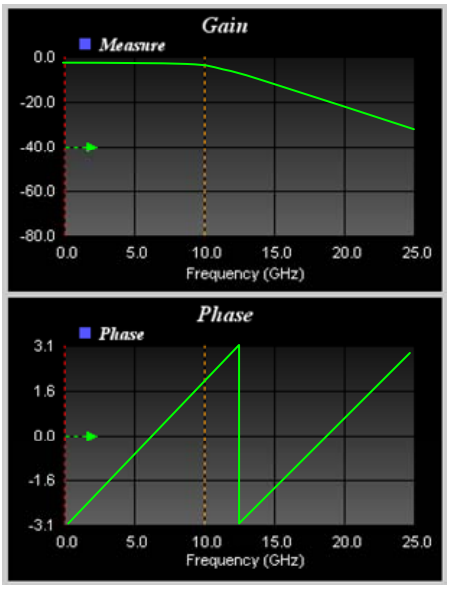


Figure 1.1.1-2 Display Example of Frequency Characteristics

1.1.2 Waveform estimation

The equalizer and frequency characteristic of the filter or amplifier are given to the waveform obtained with the EYE/Pulse Scope or the waveform data loaded from the file for estimation and the estimated waveform is displayed.

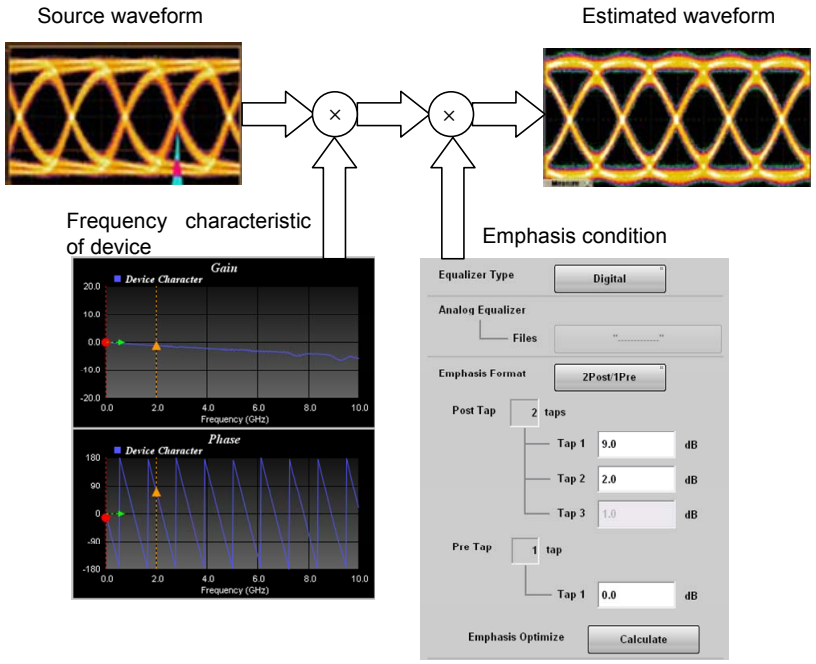


Figure 1.1.2-1 Waveforms Obtained on Frequency Characteristics Measurement

The emphasis condition for waveforms after passing the DUT to be optimal can be decided with the use of the frequency characteristics obtained in Section 1.1.1 "Frequency characteristics of parts."
The estimated waveform is displayed on the EYE/Pulse Scope.

The jitter of the estimated waveform can be measured with the MX210001A Jitter Analysis Software.

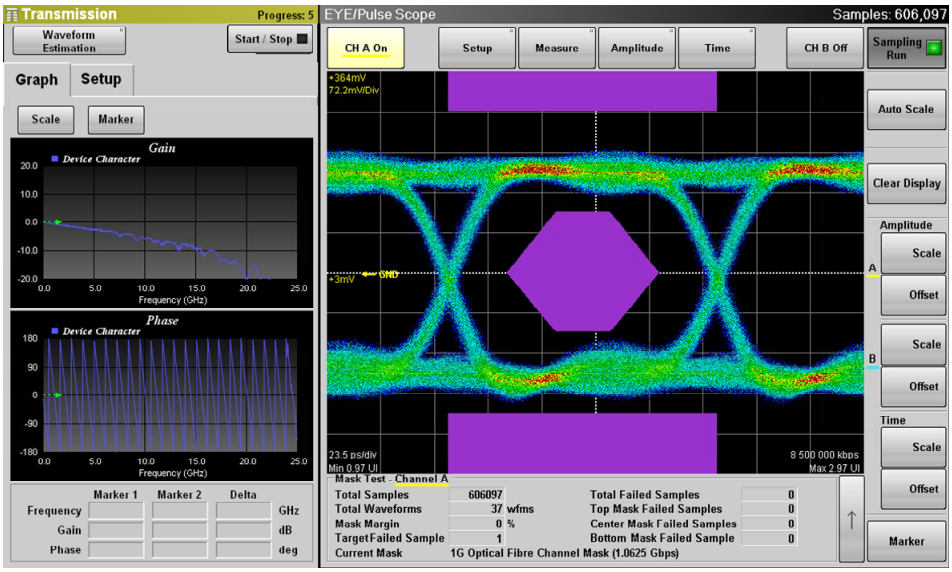


Figure 1.1.2-2 Display Example of Estimated Waveform

1.2 Features

The MX210002A has the following features:

- Coordination with the EYE/Pulse Scope enables simultaneous display of the estimated waveform and execution of the eye mask test.
- The frequency characteristics can be edited easily due to the use of the frequency characteristics data (s2p format, s4p format) described in text files.
- Not only the frequency characteristics data obtained with the MP2100A/MP2102A/MP2100B BERTWave, but also the frequency characteristics data obtained with our network analyzers below can be used (as of July, 2015).
  MS4640A Vector Network Analyzer
  37000E Vector Network Analyzer
- Remote control is available.
- When the MX210001A Jitter Analysis Software is installed, the jitter of the estimated waveform can be analyzed.

1.3 Glossary

1.3.1 Glossary

Emphasis

In high-speed data communications, sometimes the signal attenuation and waveform degradation occur with the frequency characteristics of the transmission path. When this type of degradation occurs, normal communications are not possible if bit errors occur at the receive side or frame synchronization is lost with deteriorated signal eye aperture rate. Emphasizing high-frequency elements of signals by amplitude correction by bit at the transmitter side to cancel degraded waveforms of the transmission path is called "emphasis" or "pre-emphasis."
Properly emphasized waveforms can be transmitted normally even via the transmission path.

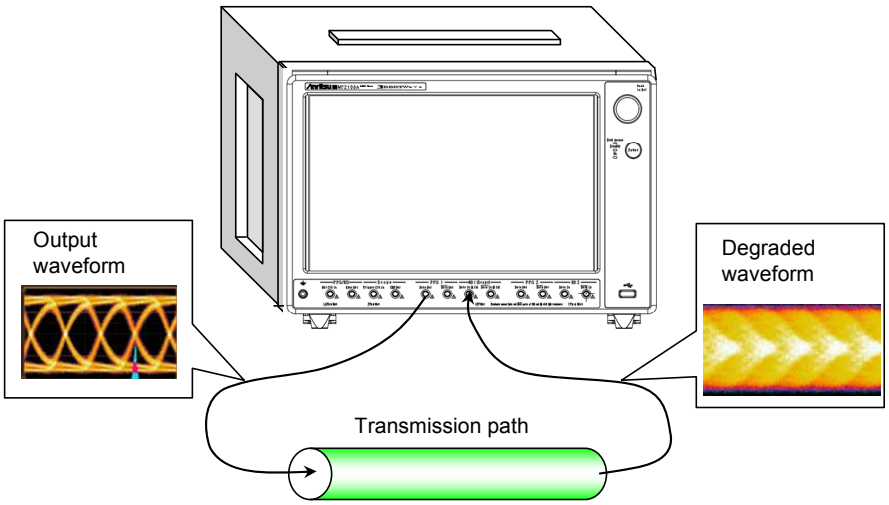


Figure 1.3.1-1 Waveform Degradation Due to Transmission Path

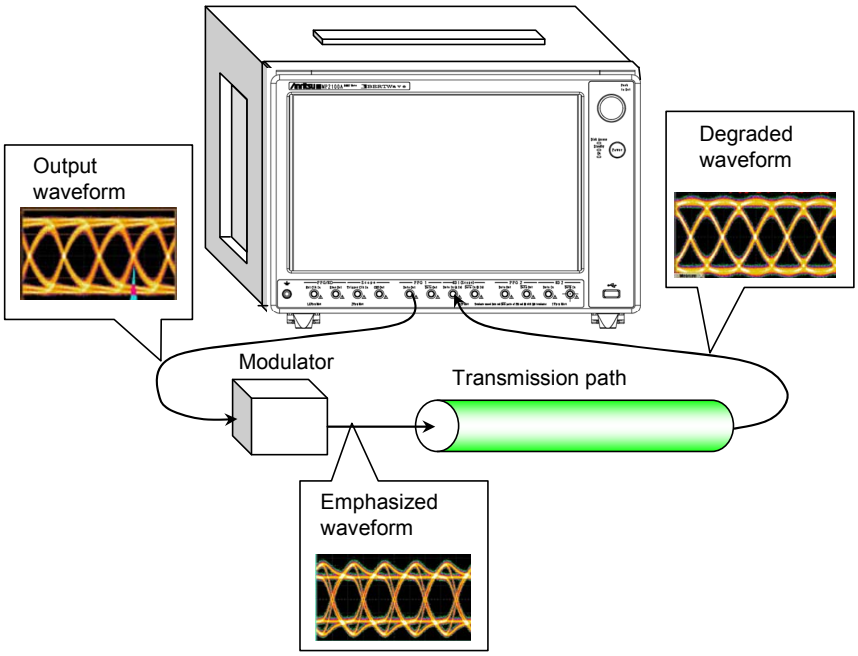


Figure 1.3.1-2 Waveform Correction by Emphasis

s2p format

Text files with description of 2D S parameter values

Frequency and amplitude/phase data of pass characteristics (S_{21}, S_{12}) and reflection characteristics (S_{11}, S_{22}) are described.

The MX210002A uses only S_{21} data of s2p format file.

S_{11}, S_{22}, and S_{12} data are not used even if they exist in the file loaded by the MX210002A.

```
!MX210002A 2011/6/20
!
!freq-unit   param-type   data-format   keyword   impedance-ohms
# GHz            S             MA            R          50
!-----------------------------------------------------------------------
!Freq          MagS11        AngS11        MagS21        AngS21        MagS12        AngS12        MagS22        AngS22
 0.000000       0.0           0.0         1.002635      -7.374129       0.0           0.0           0.0           0.0
 0.025000       0.0           0.0         1.002635      -7.374129       0.0           0.0           0.0           0.0
 0.050000       0.0           0.0         1.002635      -7.374129       0.0           0.0           0.0           0.0
 0.075000       0.0           0.0         1.002635      -7.374129       0.0           0.0           0.0           0.0
 0.100000       0.0           0.0         1.002635      -7.374129       0.0           0.0           0.0           0.0
 0.125000       0.0           0.0         1.002635      -7.374129       0.0           0.0           0.0           0.0
 0.150000       0.0           0.0         1.002509      -7.969909       0.0           0.0           0.0           0.0
 0.175000       0.0           0.0         1.002497      -8.516415       0.0           0.0           0.0           0.0
 0.200000       0.0           0.0         1.002532      -7.058710       0.0           0.0           0.0           0.0
 0.225000       0.0           0.0         1.002561      -6.454731       0.0           0.0           0.0           0.0
 0.250000       0.0           0.0         1.002616      -5.939568       0.0           0.0           0.0           0.0
 0.275000       0.0           0.0         1.002790      -6.543123       0.0           0.0           0.0           0.0
 0.300000       0.0           0.0         1.002752      -6.029175       0.0           0.0           0.0           0.0
 0.325000       0.0           0.0         1.002562      -5.344590       0.0           0.0           0.0           0.0
 0.350000       0.0           0.0         1.002473      -5.669611       0.0           0.0           0.0           0.0
 0.375000       0.0           0.0         1.002506      -5.325497       0.0           0.0           0.0           0.0
 0.400000       0.0           0.0         1.002543      -3.542136       0.0           0.0           0.0           0.0
 0.425000       0.0           0.0         1.002522      -3.351720       0.0           0.0           0.0           0.0
 0.450000       0.0           0.0         1.002260      -2.983581       0.0           0.0           0.0           0.0
 0.475000       0.0           0.0         1.002289      -3.177759       0.0           0.0           0.0           0.0
 0.500000       0.0           0.0         1.002500      -3.566260       0.0           0.0           0.0           0.0
 0.525000       0.0           0.0         1.002587      -3.764469       0.0           0.0           0.0           0.0
 0.550000       0.0           0.0         1.002462      -2.703423       0.0           0.0           0.0           0.0
 0.575000       0.0           0.0         1.002529      -1.676393       0.0           0.0           0.0           0.0
 0.600000       0.0           0.0         1.002482      -1.864907       0.0           0.0           0.0           0.0
 0.625000       0.0           0.0         1.002535      -2.331279       0.0           0.0           0.0           0.0
 0.650000       0.0           0.0         1.002554      -2.544649       0.0           0.0           0.0           0.0
 0.675000       0.0           0.0         1.002582      -2.113384       0.0           0.0           0.0           0.0
 0.700000       0.0           0.0         1.002786      -1.604808       0.0           0.0           0.0           0.0
 0.725000       0.0           0.0         1.002910      -1.886435       0.0           0.0           0.0           0.0
 0.750000       0.0           0.0         1.002988      -0.975934       0.0           0.0           0.0           0.0
 0.775000       0.0           0.0         1.003041      -1.125352       0.0           0.0           0.0           0.0
 0.800000       0.0           0.0         1.003146      -0.299080       0.0           0.0           0.0           0.0
```

Figure 1.3.1-3 File Example for s2p Format

s4p format

This software uses the pass characteristics (S_{31}, S_{32}, S_{41}, S_{42}) data as s2p format files. The amplitude/phase data of reflection characteristics is not used, even if it exists.

```
! 7/13/2011 3:38:22 PM
! E:¥H17_H18 27INCHES 334PTS WITH BLUE CABLES_D.S4P
! CHANNEL.1
! TR.MEASUREMENT
! CORRECTED.DATA
# GHZ S RI R 50.0
! FREQ.GHZ          S11RE         S11IM         S12RE         S12IM         S13RE         S13IM         S14RE         S14IM
!                    S21RE         S21IM         S22RE         S22IM         S23RE         S23IM         S24RE         S24IM
!                    S31RE         S31IM         S32RE         S32IM         S33RE         S33IM         S34RE         S34IM
!                    S41RE         S41IM         S42RE         S42IM         S43RE         S43IM         S44RE         S44IM
!; PortSelection: Port_1234
   0.000070000     0.0284027     0.0009668    -0.0004664     0.0006219     0.6584494    -0.0059120    -0.0008744    -0.0015127
                  -0.0006316     0.0005547     0.0240792    -0.0003294    -0.0006752    -0.0015253     0.6628518    -0.0041101
                   0.6619428    -0.0041337    -0.0003821    -0.0004105     0.0271173     0.0017439     0.0002420    -0.0008705
                  -0.0005134    -0.0004481     0.6647863    -0.0068479     0.0002165    -0.0008964     0.0256025     0.0025547
   0.125383108     0.0477104    -0.0024019     0.0420608     0.0259672     0.6144243    -0.4755415     0.0030628     0.0078372
                   0.0419931     0.0259166     0.0533130    -0.0087509     0.0030981     0.0084906     0.6184164    -0.4788730
                   0.6148008    -0.4766030     0.0030466     0.0085106     0.0478268     0.0277937     0.0225848     0.0419859
                   0.0031333     0.0079110     0.6191277    -0.4806471     0.0226212     0.0419986     0.0352512     0.0306154
   0.250696216     0.0380989    -0.0397731     0.0536892    -0.0084251     0.2395749    -0.6915352     0.0145061     0.0064102
                   0.0537139    -0.0084368     0.0392565    -0.0463589     0.0150198     0.0065719     0.2425124    -0.6948401
                   0.2405008    -0.6935092     0.0149321     0.0063964     0.0439622     0.0356846     0.0386077     0.0349467
                   0.0146098     0.0064701     0.2417046    -0.6973683     0.0385598     0.0349180     0.0384348     0.0395513
   0.376009323    -0.0123162     0.0053029     0.0070809    -0.0107661    -0.1586659    -0.6829085     0.0213362    -0.0074848
                   0.0071771    -0.0108284    -0.0212343     0.0074978     0.0213267    -0.0078433    -0.1570560    -0.6854615
                  -0.1599129    -0.6834644     0.0213164    -0.0079516    -0.0102746     0.0103038     0.0086972     0.0084908
                   0.0214681    -0.0075305    -0.1586202    -0.6876989     0.0086368     0.0084608    -0.0212463     0.0086875
   0.501322431     0.0303552     0.0294044     0.0181837     0.0341020    -0.4750811    -0.4722240     0.0180806    -0.0181143
                   0.0182229     0.0341093     0.0219857     0.0270775     0.0176553    -0.0179271    -0.4734309    -0.4775656
                  -0.4758781    -0.4729796     0.0175831    -0.0180549    -0.0447503     0.0175638    -0.0359664    -0.0008058
                   0.0179684    -0.0181908    -0.4753254    -0.4775926    -0.0360006    -0.0009413    -0.0434360     0.0242188
   0.626635539     0.0532951     0.0032990     0.0588308     0.0154733    -0.6255297    -0.1488052     0.0084022    -0.0282436
                   0.0587991     0.0156524     0.0550492     0.0005107     0.0093887    -0.0283406    -0.6276904    -0.1532331
```

Figure 1.3.1-4 File Example for s4p Format

1.3.2 Abbreviations

The abbreviations used in this manual are listed below.

Table 1.3.2-1 Abbreviations

Abbreviations	Formal name
CHA	Channel A
CHB	Channel B
TIE	Time Interval Error
VNA	Vector Network Analyzer

Chapter 2 Preparation

This chapter explains the installation method and restrictions of MX210002A.

2.1 Installation

Before installation, check if the installer version of MX210000A BERTWave control software is Ver. 3.00.00 or later.
Use the installer version Ver. 3.01.04 or later when installing MX210000A BERTWave control software to MP2102A.
Before installation, check if the installer version of MX210000A BERTWave control software is Ver. 3.00.00 or later.
If the earlier version is used, obtain the latest version and update the MX210000A BERTWave control software. Refer to 10.5 "Updating Software" in *MP2100A/MP2101A/MP2102A BERT Wave Operation Manual* (W3349AE) or *MP2100B BERT Wave Operation Manual* (W3772AE) for how to update.
The latest version of the MX210000A BERTWave control software can be checked and obtained at:
http://www.anritsu.com/en-US/Products-Solutions/Products/MP2100A.aspx

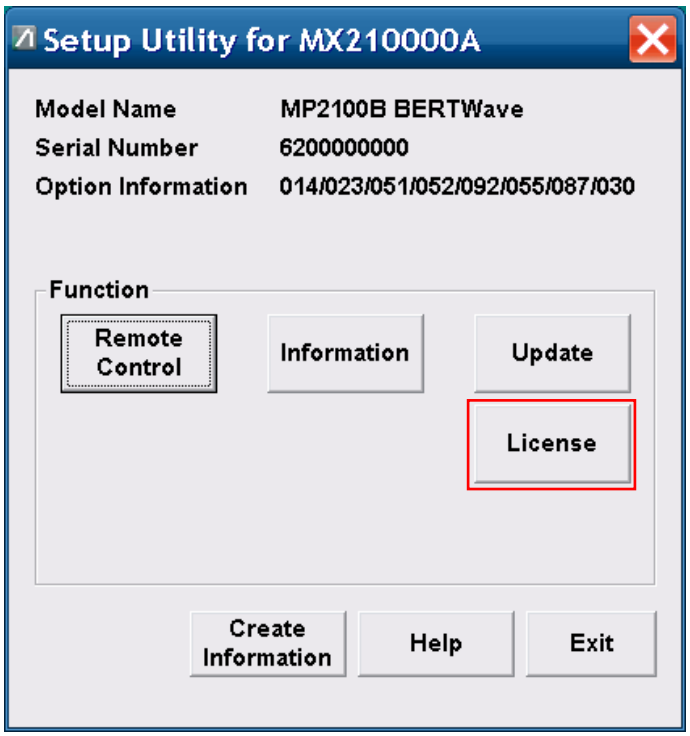
The method to install this software from CD-ROM to the MP2100A/MP2100B BERTWave is explained.

1. After loading the application, Touch [System Menu].
2. Touch [Exit].
3. Touch  on the Selector screen to close.
4. Using the USB memory, copy MX210002A_(serial number)_License.txt from CD-ROM to the hard disk of BERTWave. The actual file name comprises of a ten-digit number such as "620012345", which indicates the serial number.

   Copy source folder CD-ROM: \MX210002A

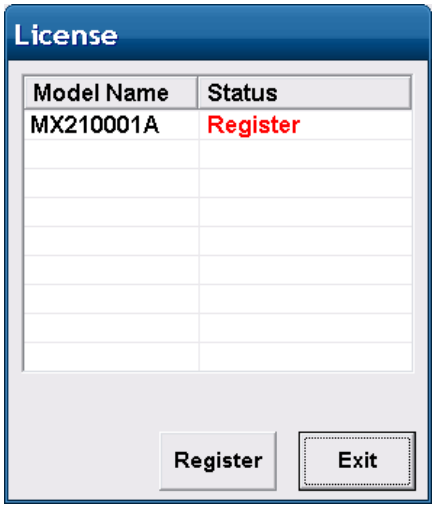
   Copy destination folder C:\Program Files\Anritsu\MP2100A\MX210000A
5. Touch twice the MX210000A desktop shortcut.

6. Touch [Setup Utility] at the Selector screen. The Setup Utility screen is opened.

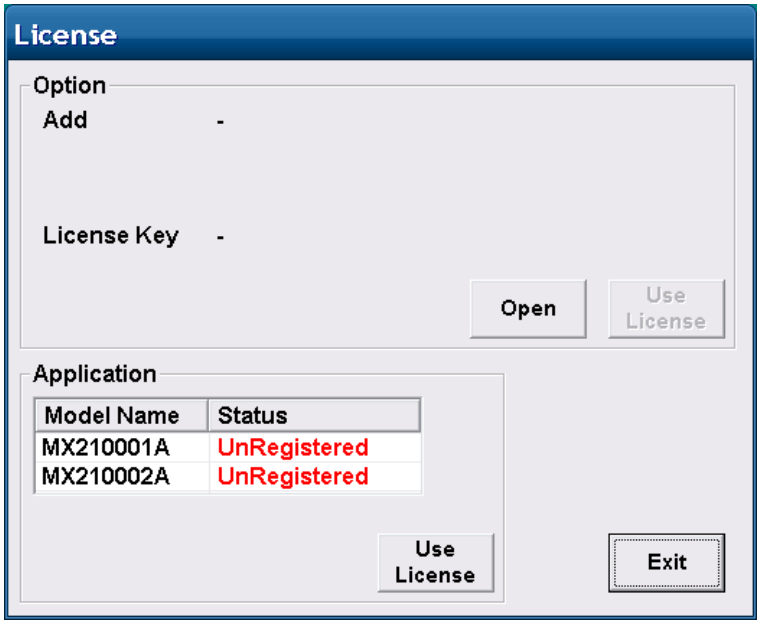


7. Touch [License] at the Setup Utility screen.

The License screen is displayed.



MP2100A, MP2102A



MP2100B

If an error message is displayed, check the following.

- 0x00024: File cannot be read. License key is wrong.

  Wrong license key

Check the context of text file as described in Step 4, and confirm if ModelName, SerialNumber, and Key is listed.

- 0x00025: File cannot be read. Serial number is wrong.

  The serial number of BERTWave is not correct. Check the serial number in the text file as described in Step 4, against the serial number of BERTWave.

When the error messages are displayed even after the handling above, contact the Anritsu Technical Support Center or your local Anritsu representative.

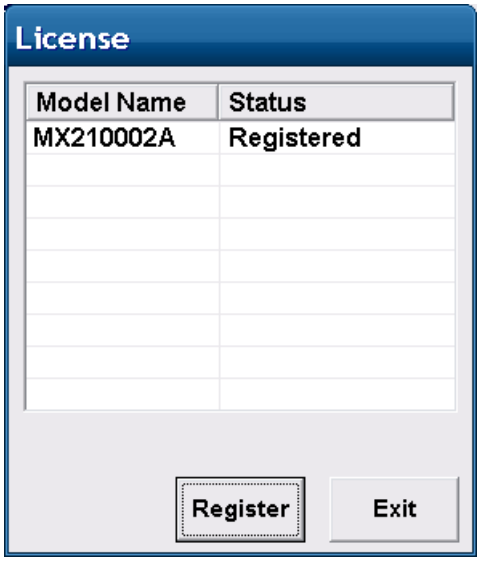
8. Touch [MX210002A] to select.

   If MX210002A is not displayed, check the copy destination folder in Step 4.

   Any of the following messages will be displayed in Status.

Register (Red Letter):	License not authorized (MP2100A, MP2102A)
UnRegisterd (Red Letter):	License not authorized (MP2100B)
Register:	License authorized
Certification Error:	Failed to authorize the license

9. Touch [Register] if the “Register (Red Letter)” is displayed. Or touch [Use License] if the “UnRegisterd (Red Letter)” is displayed.
10. When Registered is displayed in Status of MX210002A, the installation is completed.



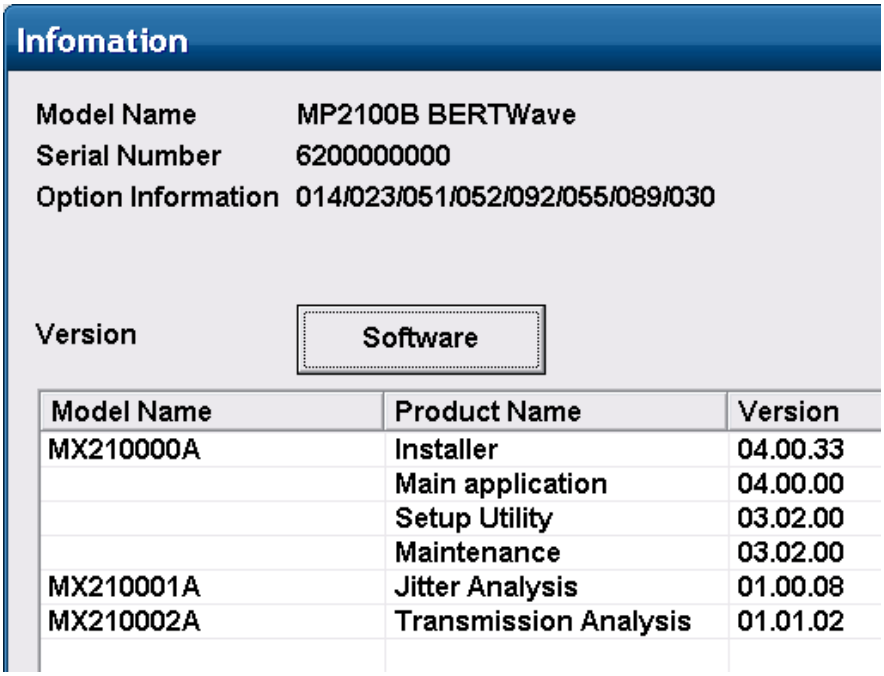
If [Certification Error] is displayed in Status of MX210002A, contact the Anritsu Technical Support Center or your local Anritsu representative.

11. Touch [Exit].

Confirmation of installation

1. Touch [Information] at the Setup Utility screen. The Information screen is displayed.
2. Touch the button to change display to [Software], if the "Firmware/FPGA" is displayed.

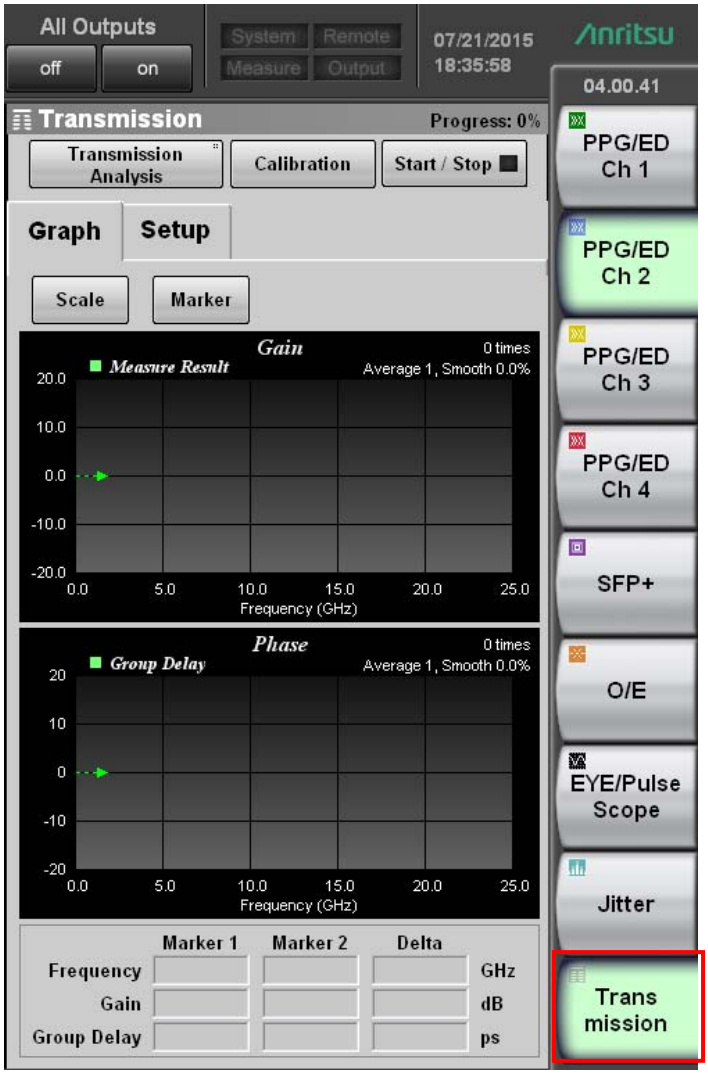
   Check that MX210002A is displayed.



3. Touch [Exit] at the Information screen.
4. Touch [Exit] at the Setup Utility screen.
5. Touch [Main Application] at the Selector screen.

   When MX210002A is installed, [Backup:Error] is displayed, indicating that the software status is different from the backup. This is not a malfunction, touch [OK].

6. Check that [Transmission] is displayed on the top menu at the Application screen.



2.2 Restrictions

The MX210002A has the following restrictions.

- To use the MX210002A, it must be installed to MP2100A BERTWave, MP2102A BERTWave SS or MP2100B BERTWave.
  It cannot be installed to the MP2101A, or a personal computer.
- The MX210002A cannot be installed to MP2100A, MP2102A or MP2100B with the serial number different from the contracted number.

The following restrictions apply when using the MX210002A on the MP2102A:

- Only 3.2.2 “Waveform estimation” can be operated. Mode button is fixed to “Waveform Estimation” and cannot be operated.
- Remote commands required in 3.2.1 “Frequency characteristics of parts” cannot be used.
- The MX210002A installed to the MP2102A cannot load the MX210002A measurement condition file saved by selecting System Menu and Save on the MP2100A.

Chapter 3 Panel Operation and Measurement Procedure

This chapter explains the panel operation and measurement procedure of the MX210002A. For the startup procedure and panel operation of the BERT Wave, refer to *MP2100A/MP2101A/MP2102A BERTWave Operation Manual (W3349AE)* or *MP2100B BERTWave Operation Manual (W3772AE)*.

3.1 Transmission Screen

When the MX210002A is installed to the BERTWave, [Transmission] is displayed on the top menu.

Touching [Transmission] on the top menu displays the Transmission panel of the MX210002A.

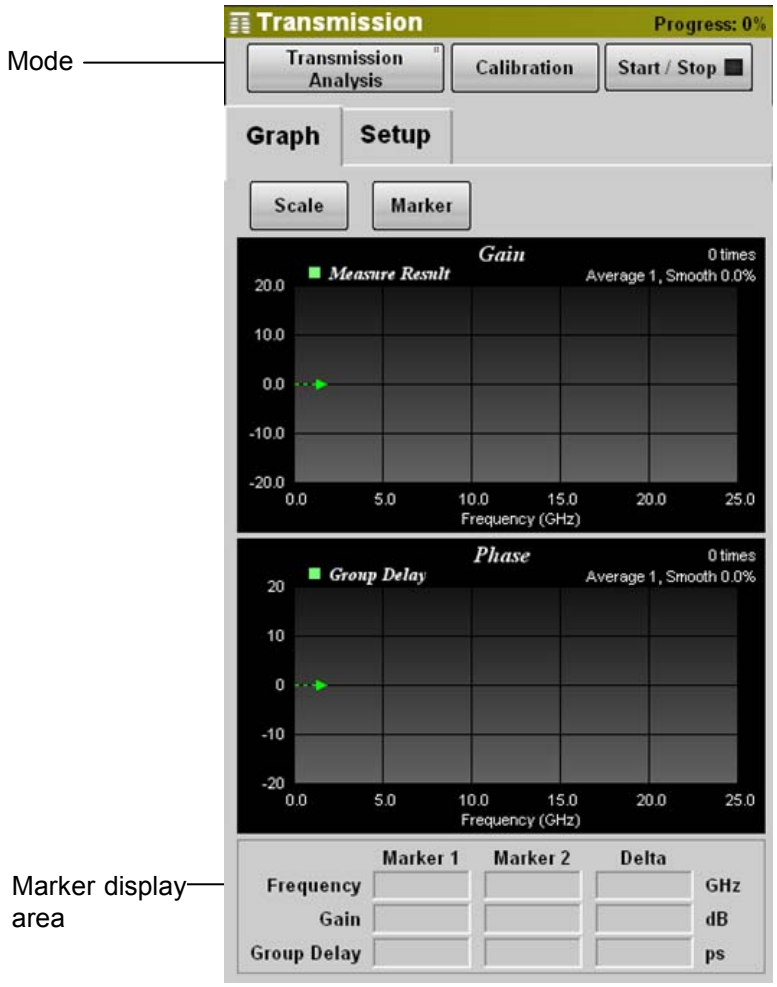


Figure 3.1-1 Transmission Panel (Graph Tab)

Table 3.1-1 Transmission Panel Item (Common)

Name	Description
(Mode)	[Transmission Analysis] Measures the frequency characteristics. This mode can be selected when using with the MP2100A/MP2100B. [Waveform Estimation] Estimates the waveform from the set parameters.
Calibration	Displays the Calibration dialog. It is displayed when the mode is [Transmission Analysis].
Start/Stop	Starts/stops the frequency characteristics measurement or waveform estimation. Lights in green during the frequency characteristics measurement.

Table 3.1-2 Graph Tab Item

Name	Description
Scale	Displays the Scale dialog.
Marker	Displays the Marker dialog.
Gain	Frequency characteristics graph for the gain of the DUT.*
Group Delay /Phase	Frequency characteristics graph for the phase or group delay of the DUT.*
(Marker display area)	Displays the marker frequency, gain, phase, or group delay.

*: When the mode is [Waveform Estimation], Device Character or Equalizer frequency characteristics are displayed in graph.

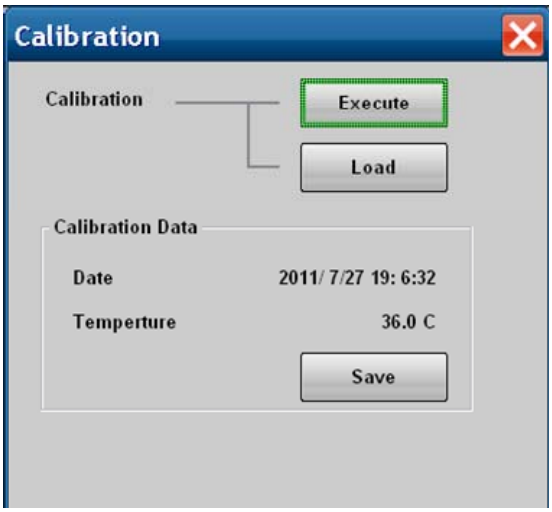


Figure 3.1-2 Calibration Dialog

Table 3.1-3 Calibration Dialog Item

Name	Description
Execute	Obtains the reference data for frequency characteristics measurement with the EYE/Pulse Scope.
Load	Loads the reference data for frequency characteristics measurement from the file (with the cal extension).
Save	Saves the reference data for frequency characteristics measurement in the file (with the cal extension).

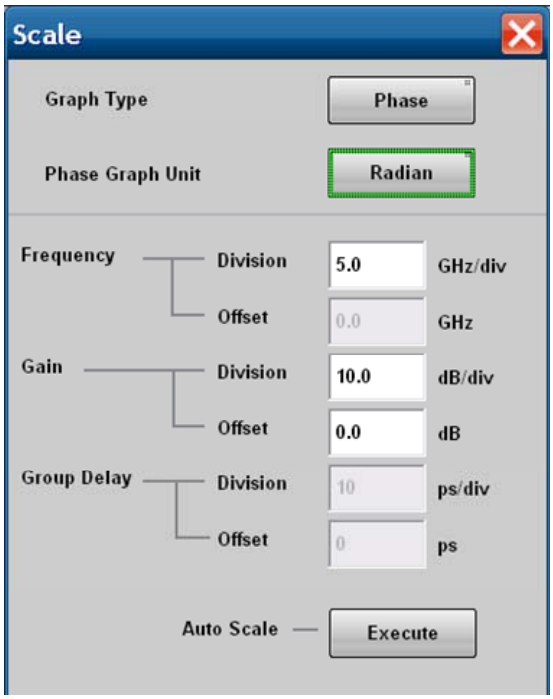


Figure 3.1-3 Scale Dialog

Table 3.1-4 Scale Dialog Item

Name	Description
Graph Type	Sets the graph under the Graph tab to [Phase] for phase display and [Group Delay] for group delay display.
Phase Graph Unit	Specifies the unit to Degree or Radian when the Graph Type is [Phase].
Frequency	Sets the horizontal axis of the graph. Division: 0.5 to 5.0 (GHz/div.) Offset: 0.0 to 22.5 (GHz) However, the setting range is limited for the right edge of the graph to be 25 GHz or less.
Gain	Sets the vertical axis of the Gain graph. Division: 0.5 to 20.0 (dB/div.) Offset: –80.0 to 80.0 (dB)
Group Delay	Sets the vertical axis of the graph when the Graph Type is [Group Delay]. This parameter cannot be set if Group Type is [Phase]. Division: 1 to 1000 (ps/div.) Offset: –500 to 500 (ps)
Auto Scale	Touching [Execute] sets the graph scale to the optimal value.

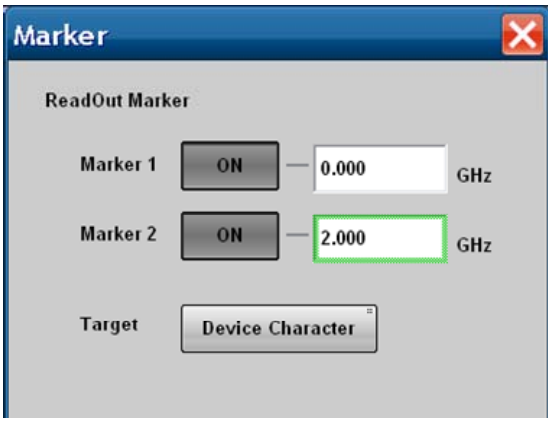


Figure 3.1-4 Marker Dialog

Table 3.1-5 Marker Dialog Item

Name	Description
Marker1, Marker2	When the button display is [ON], the marker is displayed on the graph. Set the marker frequency within 0.000 to 25.000 in the text box.
Target	Specifies the graph to be read out with the marker for Waveform Estimation. Device Character: Graph of Device Characteristics Equalizer: Graph of Analog Equalizer

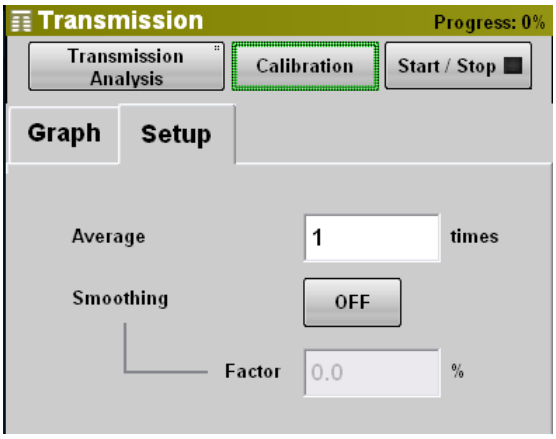


Figure 3.1-5 Setup Tab (Transmission Analysis)

Table 3.1-6 Setup Tab Item (Transmission Analysis)

Name	Description
Average	Sets the number of times for average calculation within 1 to 99.
Smoothing	Selects the graph smoothing processing.
Factor	Sets the range for the smoothing processing within 0.0 to 10.0 (%) when Smoothing is [ON].

Smoothing displays a graph with the average of multiple points of the source data.

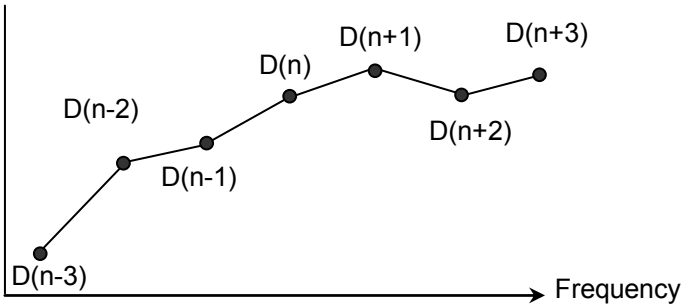


Figure 3.1-6 Data Used for Smoothing Processing

If the source data are D(n-3), D(n-2), ..., D(n), …D(n+2), and D(n+3) in Figure 3.1-6, the data Sm (n) after the smoothing processing can be expressed with the formula below.

$$Sm(n) = \frac{1}{2k+1}\sum_{i=-k}^{k}\left(D(n+i)\right)$$

The number of data items 2k+1 used for the smoothing processing depends on Factor (%).
If Factor is 0.0, Sm (n) = 0 which is same with the graph when k Smoothing is [OFF]. If Factor is 10.0, averaging is executed with the width of 10% of the graph.
If Factor is 10.0 for 1 GHz/Div. of frequency scale, averaging is executed with the width of 0.5 GHz.

The figure below shows how the smoothing processing compresses waveform noises.

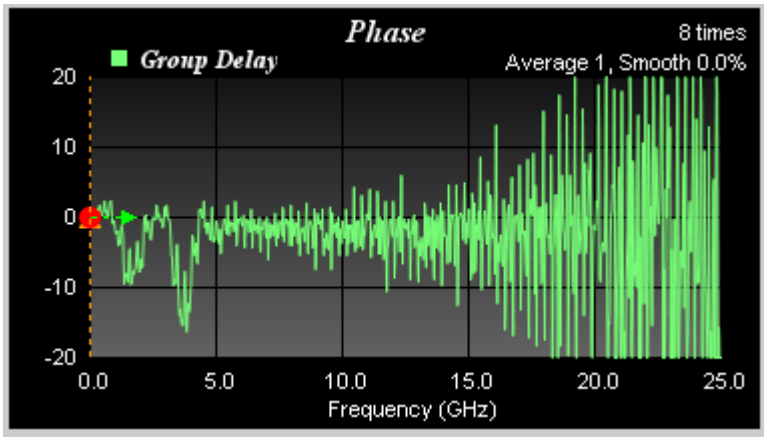


Figure 3.1-7 Waveform Before Smoothing Processing

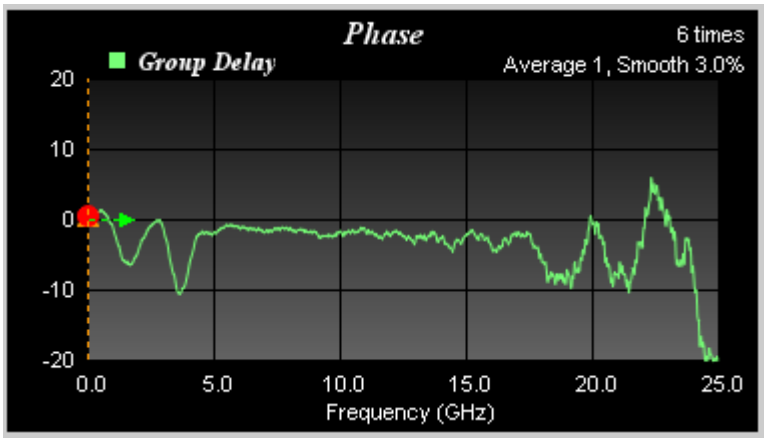


Figure 3.1-8 Waveform After Smoothing Processing

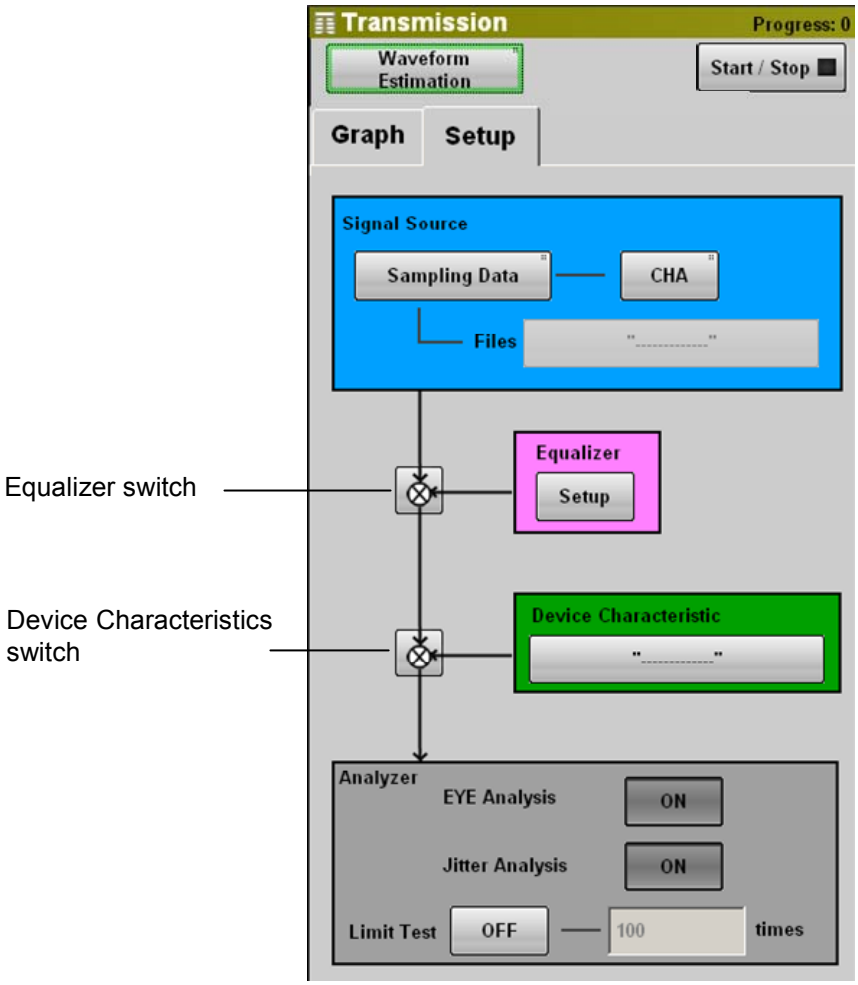


Figure 3.1-9 Setup Tab (Waveform Estimation)

Table 3.1-7 Setup Tab Item (Waveform Estimation)

Name	Description
Signal Source	Specifies the source waveform to be calculated. [Sampling Data] Obtains the waveform with the EYE/Pulse Scope. Touch [CHA] or [CHB] to specify the channel. [Waveform File] Loads the waveform data from the file.
Files	Specifies the waveform data file (with the WFE extension) when Signal Source is [Waveform File].
Equalizer	Touching [Setup] displays the parameter setting screen for the equalizer (Refer to Figure 3.1-11).
(Equalizer switch)	Sets the equalizer processing to On/Off.  : Off,  : On
Device Characteristics	Touching the button displays the selection screen for the frequency characteristics data file (with the s2p or s4p extension). For the explanation about the s2p or s4p format, refer to Section 1.3.1 “Glossary”.
(Device characteristics switch)	Sets the correction processing with the frequency characteristics data file to On/Off.  : Off,  : On
Analyzer	
EYE Analysis	Setting to [ON] displays the estimated waveform on the EYE/Pulse Scope. The operation and remote control of EYE/Pulse Scope are enabled.*
Jitter Analysis	[ON]: The histogram of the estimated waveform is measured with the EYE/Pulse Scope, and the value is loaded to the MX210001A Jitter Analysis Software. The jitter analyzed with the MX210001A Jitter Analysis Software is displayed at the marker display area. [OFF]: The marker reading is displayed at the marker display area.
Limit Test	Setting to [ON] transmits the estimated waveform to the EYE/Pulse Scope for the set number of times. This operation accumulates and displays the estimated waveforms on the EYE/Pulse Scope.

*: When the button on the upper right is set to [Stop], EYE/Pulse Scope can be remotely controlled.

The setting of Analyzer on the Setup tab and the data processing flow of the MX210002A are shown in the following diagram.

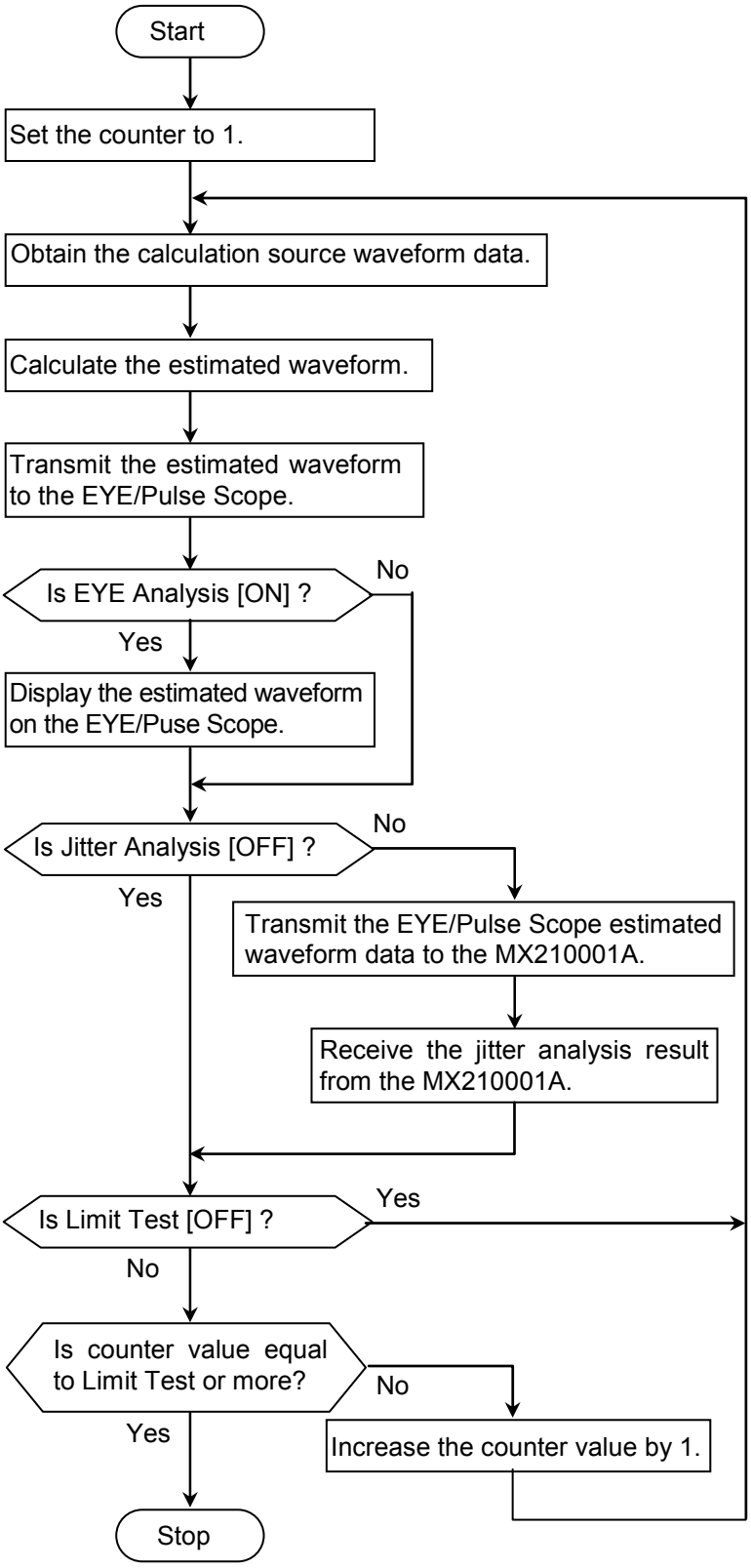


Figure 3.1-10 Analyzer Setting Item and Data Processing Flow

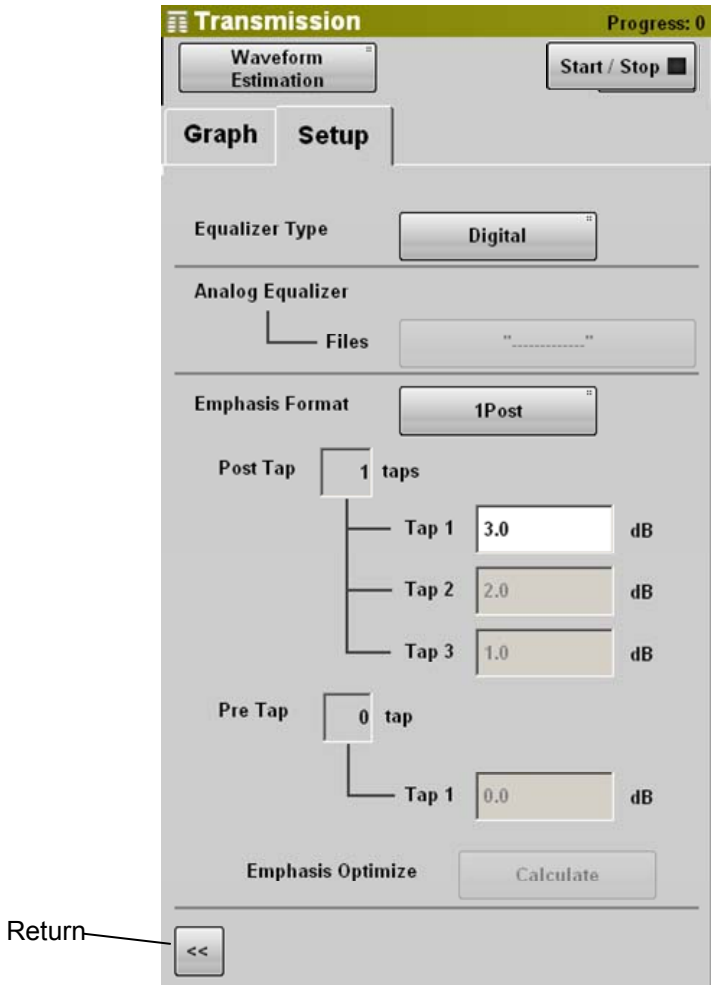


Figure 3.1-11 Setup Tab (Waveform Estimation-Equalizer)

Table 3.1-8 Setup Tab Item (Waveform Estimation-Equalizer)

Name	Description
Equalizer Type	[Analog]: Executes the equalizer processing according to the frequency characteristics data read from the file. [Digital]: Executes the equalizer processing according to the Equalizer Format setting.
Analog Equalizer	Specifies the frequency characteristics data file when Equalizer Type is [Analog].
Files	Touching the button displays the selection screen for the frequency characteristics data file (with the s2p or s4p extension) . For the explanation about the s2p or s4p format, refer to Section 1.3.1 “Glossary”.

Table 3.1-8 Setup Tab Item (Waveform Estimation-Equalizer) (Cont'd)

Name	Description
Emphasis Format	Specifies the number of bits for amplitude change and change amount when Equalizer Type is [Digital].
Post Tap	Inverts the pattern bits and then display the number of bits for amplitude change.
Tap 1 to 3	Sets the amplitude change amount.
Pre Tap	Displays the number of bits for amplitude change before the pattern bits are inverted.
Tap 1	Sets the amplitude change amount.
Emphasis Optimize	Available when the [Start/Stop] lamp is lit. When the s2p or s4p file name is dispalned on the Device Characteristics button and [Device characteristics switch] is set to On, touching [Calculate] changes the amplitude change amount for the calculated waveform eye pattern to be optimal.
(Back)	Returns to the display in Figure 3.1-9.

The equalizer processing has two types; Digital and Analog. The setting items vary according to the setting of Equalizer Type.
The Equalizer setting flow is shown in the following diagram.

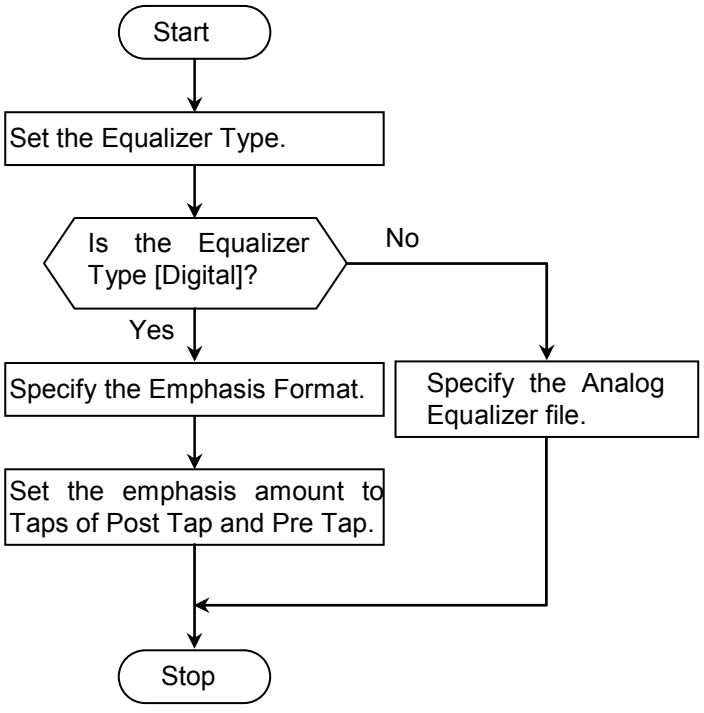


Figure 3.1-12 Equalizer Setting Flow

When the Emphasis Type is Analog

Specify the frequency characteristic data file (with the s2p or s4p extension) with Files of Analog Equalizer.
Execute the equalizer processing according to the frequency characteristics data for the waveform of the EYE/Pulse Scope.

When the Emphasis Type is Digital

Specify the location and number of bits to be modulated with Emphasis Format. This bit is called a tap.
Next, set the amplitude change amount for each tap in dB units.

For the Tap of Emphasis Format, the pattern where "1" and "0" are repeated for six bits each is explained as an example.
Post Tap is the number of bits with amplitude change after the pattern bits are inverted 0 → 1 and 1 → 0. The bits are referred to as Tap1, Tap2, and Tap3 in order of change.
Post Tap is the number of bits with amplitude change before the pattern bits are inverted 0 → 1 and 1 → 0.

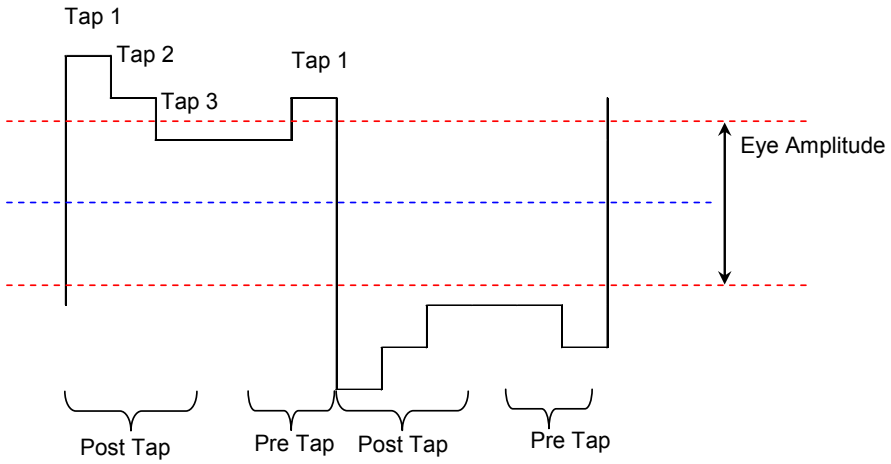


Figure 3.1-13 Location of Bits to be Modulated

The relation of the G value (dB) set to Tap 1 to 3 and amplitude is as follows:

$$G = 20 * \log\left(\frac{V_2}{V_1}\right)$$

V_1: Amplitude before modulation (V)

V_2: Amplitude after modulation (V)

The setting of Emphasis Format and the equalizer-processed waveform are shown the table below.

Table 3.1-9 Waveform Type

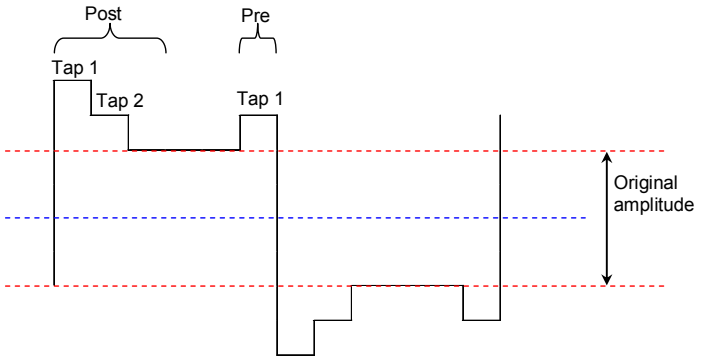
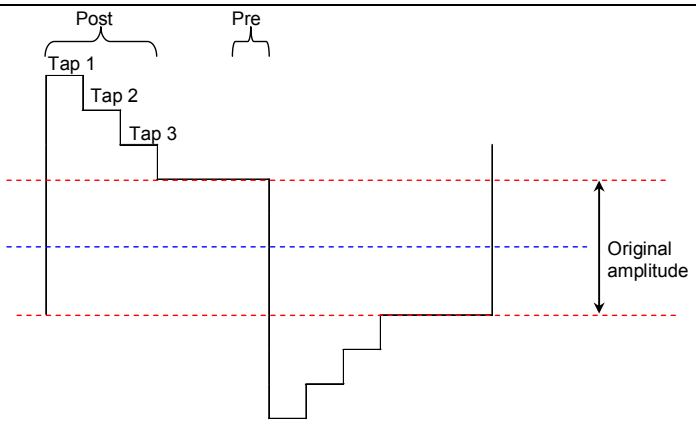
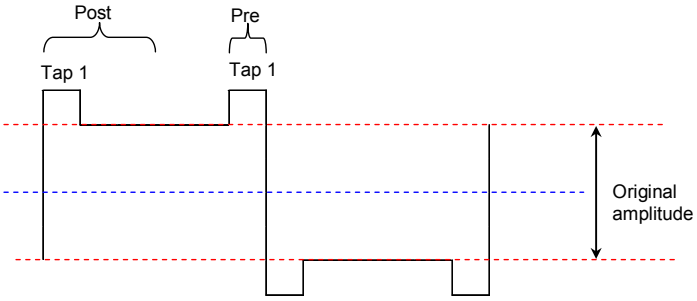
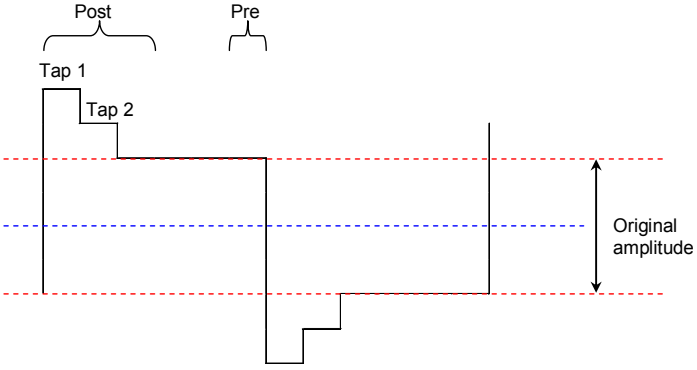
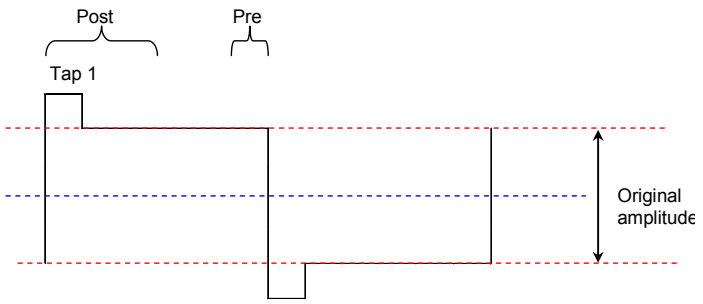
Emphasis Format setting	Equalizer-processed waveform
2Post/1Pre	
3Post	
1Post/1Pre	
2Post	

Table 3.1-9 Waveform Type (Cont'd)

Emphasis Format setting	Equalizer-processed waveform
1Post	

3.2 Measurement Procedures

3.2.1 Frequency characteristics of parts

In the measurement for frequency characteristics of parts, the standard data for the frequency characteristic data are obtained first. During calibration, the standard data can be selected whether to obtain EYE/Pulse Scope or load from the file.

Next the DUT is connected to the BERTWave, and the waveform output from the DUT is measured.

The frequency characteristics are measured from the waveform measured as the standard data and displayed on [Graph] tab. The graph can be zoomed in with graph scale/offset change, and the display position can be changed. In addition, with the use of the marker, the graph values can be read.

⚠ CATION

Changing measurement conditions or executing Calibration deletes the displayed measurement results.

Calibration setting

When obtaining the standard data through EYE/Pulse Scope, input the PPG1 output signal to ED1 (ChA) directly in advance to display the waveform with the EYE/Pulse Scope. In case of differential measurement, PPG1 $\overline{\text{Data}}$ Out also connect to Ch B Data In.

For details on operations, refer to Chapter 7 "Measuring Waveform" of *MP2100A/MP2101A/MP2102A BERT Wave Operation Manual (W3349AE)* or *MP2100B BERTWave Operation Manual (W3772AE).*

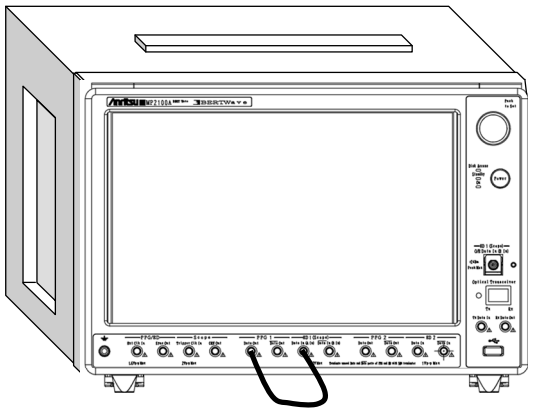
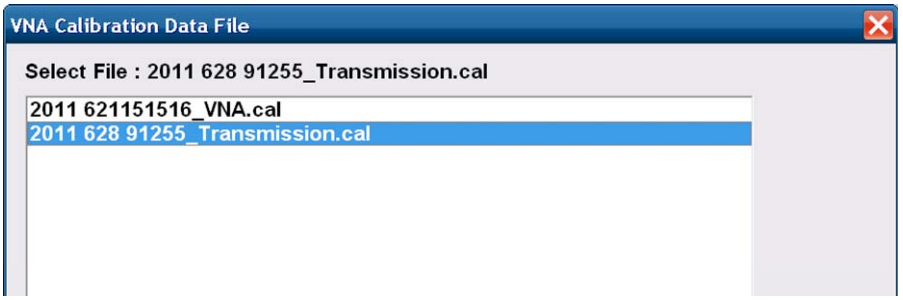


Figure 3.2.1-1 Connection for Calibration (MP2100A)

1. Touch [Transmission] on the top menu.
2. Touch the button for mode to display [Transmission Analysis].
3. Touch [Calibration].
4. When the standard waveform is obtained with the EYE/Pulse Scope, touch [Execute]. A dialog displays indicating that signal is input to BERTWave. Touch [OK], and the waveform is obtained according to the setting of the EYE/Pulse Scope.
5. When the standard waveform is loaded from the file, touch [Load]. The file selection screen is displayed.



   The extension of the standard data file is “cal”. Select the file and touch [OK].
6. If the standard waveform is saved, touch [Save].
   The file name is displayed. When changing the displayed file name, touch the keyboard display button. Enter the file name using the software keyboard. Touching [OK] saves the standard data file (with the cal extension).

Measurement conditions setting and results display

1. Connect the DUT to the BERTWave.
2. Touch [Setup] tab.
3. Touch the textbox of Average to set the averaging count.
   Obtain the waveform with the EYE/Pulse Scope for the set count.
4. When the waveform smoothing processing is executed, touch the Smoothing button to set the display to [ON]. Proceed to Step 6 when [OFF] is set.
5. Touch the Smoothing Factor text box to specify the range for the smoothing processing.
6. When touching [Start/Stop], the button lamp lights green.

   Touching [▶] of All Measurements does not start the measurement.

   Touching [■] of All Measurements can stop the measurement.

   The message "Processing" displays until the analysis result is displayed.
7. Touch [Graph] tab. When the waveform acquisition is completed, the frequency characteristics are displayed on the graph.
8. Touch [Scale] to change the graph display range.
9. Touch [Marker].
10. Touch the button to set the button's display to [On]. The marker will be displayed on the graph, and the gain of the marker position and group delay are displayed at the marker display area.

Note:

[O/E] and [EYE/Pulse Scope] on the top menu and [PPG/ED] button used for the measurement are unavailable during the measurement.

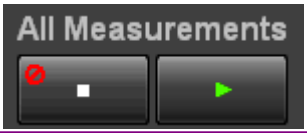
Operations of selection items [All], [PPG/ED Ch1], [O/E] and [EYE] under [Open] and [Save] of System Menu are disabled.

Operations of items below are limited while "Processing" is displayed.

System Menu: [Save], [Open], [Screen Copy], [Initialize], [System Alarm], [Block Diagram], [Exit]

All Measurements: [■]

⊘ is displayed on the button.

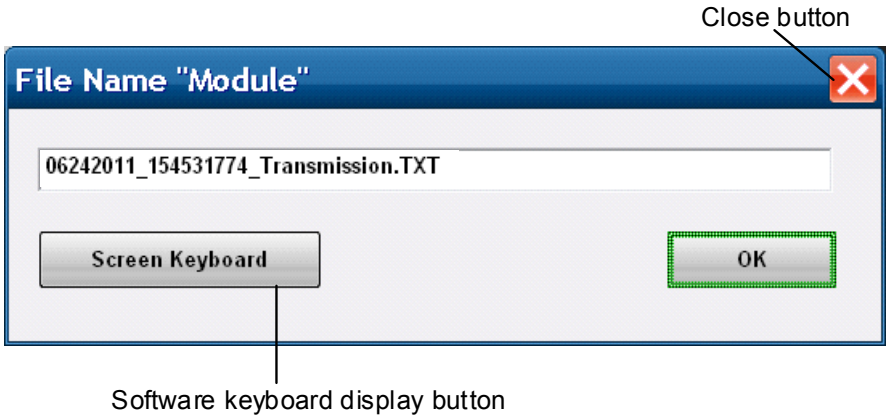


When measurement errors occur, the error message is displayed.

For the details of error messages, refer to Section 3.2.3 “Error Messages”.

Measurement results saving

1. Touch [System Menu].
2. Touch [Save].
3. Touch [Transmission].
4. Touch [Result].
5. The file name is displayed. When changing the displayed file name, touch the keyboard display button. Enter the file name using the software keyboard.



6. When saving the file name, touch [OK]. Also, when canceling the saving procedure, touch the close button.

The measurement result file is saved in the following folder.
C:\Program Files\Anritsu\MP2100A\MX210000A\UserData\Result\TXT

The measurement result frequency characteristics file (s2p format) is saved in the following folder.
C:\Program Files\Anritsu\MP2100A\MX210000A\UserData\Result

3.2.2 Waveform estimation

In the waveform estimation, the calculation source waveform is set first. The source waveform is obtained with the EYE/Pulse Scope or loaded from the file.

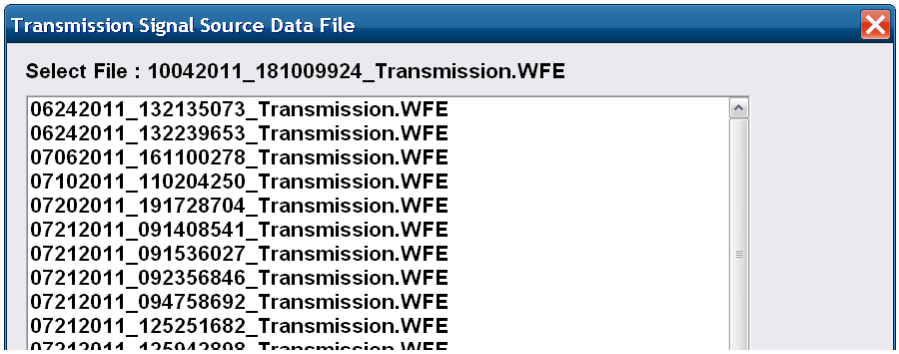
Next the equalizer conditions are set and the device frequency characteristics data is loaded from the file.

The display of estimated waveform on the EYE/Pulse Scope and the jitter measurement with the MX210001A Jitter Analysis Software are available.

Calculation source waveform setting

When the calculation source waveform is obtained with the EYE/Pulse Scope, input the signal to the BERTWave first to display the waveform with the EYE/Pulse Scope.
For details on operations, refer to Chapter 7 "Observing Waveform" of *MP2100A/MP2101A/MP2102A BERT Wave Operation Manual (W3349AE)* or *MP2100B BERTWave Operation Manual (W3772AE)*.

1. Touch [EYE/Pulse Scope] on the top menu.
2. Touch [Setup].
3. Touch the General tab.
4. Touch the Sampling Mode button to display [Pulse].
5. Touch the button at the top right to display [Sampling Run].
6. Adjust the graph scale.
7. Touch [Transmission] on the top menu.
8. Touch the button for mode to display [Waveform Estimation].
9. Touch [Setup] tab.
10. When the calculation source waveform is obtained with the EYE/Pulse Scope
    (1) Touch the Signal Source button to set the display to [Sampling Data].
    (2) Touch the right button of [Sampling Data] to specify the EYE/Pulse Scope channel.
11. When the calculation source waveform is loaded from the file
    (1) Touch the Signal Source button to set the display to [Waveform File].
    (2) Touch the Files button to display the file selection screen.

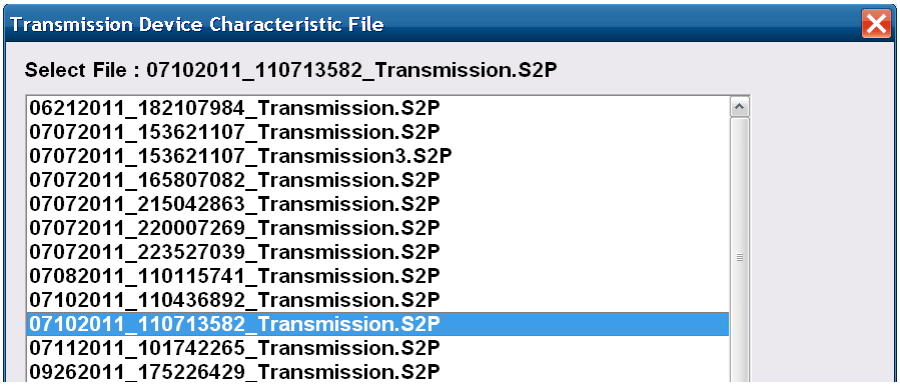


(3) Specify the waveform file name (with the WFD extension) and touch [OK].

(4) The file name is displayed on the button.

Equalizer setting and device frequency characteristics data loading

1. Touch [Setup] tab.
2. Touch [Setup] of Equalizer. The panel display changes.
3. Touch the Equalizer Type button to select the type.
4. When the Equalizer Type is [Analog]
   (1) Touch the Files button of Analog Equalizer to display the file selection screen.
   (2) Specify the file name (with the s2p or s4p extension) and touch [OK].
   (3) The file name is displayed on the button.
5. When the Equalizer Type is [Digital]
   (1) Touch the Emphasis Format button to set the bit for equalizer processing.
   (2) Touch the text boxes of Tap 1 to 3 to set the amplitude modulation amount.
6. Touch [<<].The panel display changes.
7. Touch the Device Characteristics button to load the frequency characteristics data. The file selection screen is displayed.



8. Specify the file name (with the s2p or s4p extension) and touch [OK]. The file name is displayed on the button.

Auto equalizer setting

When [Digital] is set to Equalizer Type, it automatically sets the amplitude modulation.

1. Touch [Setup] tab.
2. Touch the device characteristics button switch to turn on the display ( ).
3. Touch the button of Device Characteristics. The file selection screen is displayed.
4. Specify the file name (with the s2p or s4p extension) and touch [OK]. The file name is displayed on the button.
5. Touch [Setup] of Equalizer. The panel display changes.
6. When touching [Start/Stop], the lamp lights green. Now you can operate [Calculate] in the [Setup] tab.
7. Touch [Calculate], the values of Tap 1 to Tap 3 are updated.

If the configured amplitude modulation is already optimal, the values of Tap 1 to Tap 3 are not updated when you touch [Calculate].

Calculation and display of estimated waveform

1. Set the method for processing the estimated waveform.

   When displaying EYE/Pulse Scope:

   Touch the EYE Analysis button to set the display to [ON].

   When measuring Jitter using the MX210001A jitter analysis software:

   Touch the Jitter Analysis button to set the display to [ON].

   When either of the button display is set to [ON], [STOP] is enabled.

2. When limiting the number of the display of estimated waveform touch the Limit Test button of Analyzer to set the display to [ON].

   Touch the text box to set the limited count. The calculation source data from the EYE/Pulse Scope is obtained for the count set to the text box.

3. When touching [Start/Stop], the lamp lights green.

   Touching [►] of All Measurements does not obtain the waveform.
   Touching [■] of All Measurements does not stop the measurement.

Note:

The following buttons are not enabled while calculating the estimated waveform,

1. The target modules are displayed on the System Menu of [Save] and [Open] and they are displayed in the following table as well.

Analyzer Setting	Save	Open
When EYE Analysis is [ON]	[All], [O/E]	[All], [O/E], [Eye/Pulse Scope]
When Jitter Analysis is [ON]	[All], [O/E] , [Eye/Pulse Scope]	[All], [O/E] ,[Eye/Pulse Scope], [Jitter]

2. EYE/Pulse Scope at [Sampling Run]

3. MX210001A jitter analysis software at [STOP]

After calculating the estimated waveform, set the button display set at Step5 to [OFF]. Then, this button can be used.

Operation of EYE/Pulse Scope

When EYE Analysis of Analysis is [ON], EYE/Pulse Scope is enabled. However, the buttons to be operated are limited.

Measurement results saving

The waveform file (with the WFE extension) is saved when the estimated waveform is displayed in the EYE/Pulse Scope. The saved file can be read out as the calculated original waveform.

1. Touch [System Menu].
2. Touch [Save].
3. Touch [Transmission].
4. Touch [Result].
5. The file name is displayed. When changing the displayed file name, touch the keyboard display button. Enter the file name using the software keyboard.
6. When saving the file name, touch [OK]. Also, when canceling the saving procedure, touch the close button.

The test result file is saved in the following folder.

C:\Program Files\Anritsu\MP2100A\MX210000A\UserData\Result

The estimated waveform displayed in the EYE/Pulse Scope is saved in the text file and s2p file.

1. Touch [System Menu].
2. Touch [Save].
3. Touch [EYE/Pulse Scope].
4. Touch [Result].
5. The file name is displayed. When changing the displayed file name, touch the keyboard display button. Enter the file name using the software keyboard.
6. When saving the file name, touch [OK]. Also, when canceling the saving procedure, touch the close button.

The test result file is saved in the following folder.

C:\Program Files\Anritsu\MP2100A\MX210000A\UserData\Result
C:\Program Files\Anritsu\MP2100A\MX210000A\UserData\Result\TXT

The estimated waveform displayed in the MX210001A Jitter Analysis Software is saved in the text file and CSV file.

1. Touch [System Menu].
2. Touch [Save].
3. Touch [Jitter].
4. Touch [Result].
5. The file name is displayed. When changing the displayed file name, touch the keyboard display button. Enter the file name using the software keyboard.
6. When saving the file name, touch [OK]. Also, when canceling the saving procedure, touch the close button. The jitter analysis result file is saved in the following file.

C:\Program Files\Anritsu\MP2100A\MX210000A\UserData\Result\CSV
C:\Program Files\Anritsu\MP2100A\MX210000A\UserData\Result\TXT

Deleting the estimated waveform

- When touching the EYE Analysis button to set the display to [OFF], the EYE/Pulse Scope estimated waveform is deleted.
- When touching the Jitter Analysis button to set the display to [OFF], the waveform of the MX210001A Jitter Analysis Software is deleted.

Note:

The once deleted waveform cannot be displayed again.

3.2.3 Error Messages

Table 3.2.3-1 Error Messages for Transmission Analysis

Message	Content
Illegal Error	An unexpected error has occurred.
EYE?	EYE? error has occurred in EYE/Pulse Scope. To prevent a risk from occurring EYE? Error, change the EYE/Pulse Scope settings.
Pattern Lost	The set pattern length does not meet the actual pattern. length. Set Pattern Length of EYE/Pulse Scope correctly.
TIE Error*	The jitter has exceeded 1 UI.
Time Out	Data cannot be acquired from EYE/Pulse Scope. When waveforms are not displayed on EYE/Pulse Scope, check the following. - Sampling Run has been set. - For the histogram measurement, the display of the measurement channel is ON. - The trigger signal has been input.
Scope Error	The EYE/Pulse Scope setting is not appropriate. • Bit on screen is set to 1 bit. Set to 2 bit or more. • $\frac{\text{Number of Sampling}}{\text{Bit on Screen}} < 4$ Set so that Number of Sampling becomes four times as much as Bit on Screen. • For Waveform Estimation, EYE Mode is set. Select Pulse Mode instead.
Jitter Error	Jitter analysis failed.
File Error	Failed to read file. Check the file format and content.

*: Time Interval Error

Table 3.2.3-2 Error Messages When Reading WFE File

Message	Content
Bitrate is not available value. Please set bitrate in the range (100MHz to 15GHz).	Bitrate is out of range (100MHz to 15GHz).
Number of sample is not available value. Please set the parameter in the range(1 to 32768 samples).	Number Of Sample is out of range.
Pattern length is less than bit on screen value. Please increase pattern length, or decrease bit on screen.	When PatternLength is smaller than BitonScreen
Bit on screen is 1 bit. Please set the parameter more than 2 bit.	When BitonScreen is smaller than 2
Waveform file include unavailable parameters. Please select another waveform file.	Other than numbers such as alphabets and symbols can be entered in Parameter.
A 1-bit is described as less than 4 samples. Please increase data samples.	When the value changed to the positive number is the specified value or less, it is the same meaning of the current Scope Error.

Table 3.2.3-3 Error Messages When Reading s2p or s4p File

Message	Content
This file cannot be calculated because the data length is 1. Please increase data length.	This cannot be calculated because the file length is 1.
This file cannot be calculated because this frequency response data include unavailable format. Please check this file format.	The frequency data is not correct. • Minus value in frequency • Same frequency included • Frequency decreasing monotonically

Chapter 4 Remote Control Commands

This chapter describes commands to control the MX210002A.
For the connection method for BERTWave and a control PC and operation check method, refer to Chapter 2 "Before Use" in *BERTWave Series Remote Control Operation Manual (W3773AE)*.

When the MX210002A is controlled, transmit :MODule:ID 7 first.

4.1 Description of Message Explanations

For the message format, refer to Section 2.5 "Message Format" in *BERTWave Series Remote Control Operation Manual (W3773AE)*.

The following table shows the rules for describing messages.

Table 4.1-1 Rules for Describing Messages

Symbols	Usage
[]	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).
<binary>	This string is in binary data format.
<character>	Short alphabet or alphanumeric
<file_name>	Character string indicating file name and path. Double or single quotes are required before and after the data. The symbols \, /, :, *, ?, ", <, >, and | cannot be used. Example: "PATTERN005"
<integer>	Decimal integer value Example: –100, 12500000
<numeric>	Decimal numeric value Example: 0,–0.00062, 2.35

Omitting characters

Example: `:SENSe:VNA:MARKer:TARGet?`

This header can be described as follows:

```
:SENS:VNA:MARK:TARG?
:SENS:VNA:MARKER:TARG?
:SENSE:VNA:MARK:TARGET?
:SENSE:VNA:MARKER:TARGET?
```

The BERTWave interprets these messages as the same meaning.

4.2 Register

The MX210002A controls the PPG and EYE/Pulse Scope via the MX210000A BERTWave control software.
The status of the PPG and EYE/Pulse Scope which are running the MX210002A can be checked with the execution status register or device-unique register.

For the explanation of registers, refer to Section 2.6 "Checking Instrument Status" in *BERTWave Series Remote Control Operation Manual* (W3773AE).

The execution status (frequency characteristics data acquisition and waveform prediction processing completion) of the MX210002A is not reflected to the BERTWave execution status register.

The message processing of the MX210001A is reflected to the standard event register of the BERTWave.

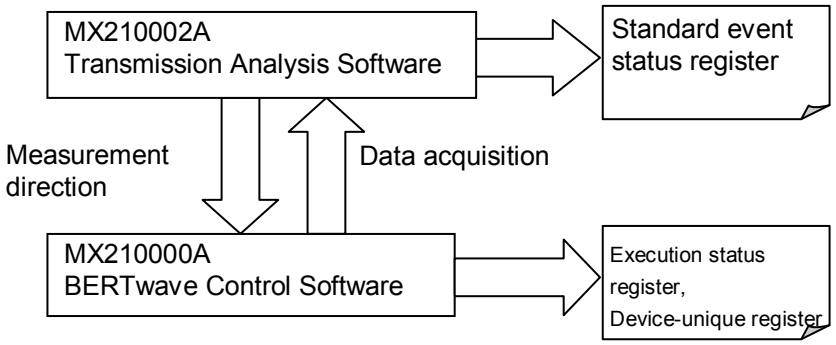


Figure 4.2-1 Relationship between Software and Register

4.3 Correspondence between Panel Operation and Message

This section explains correspondence between panel operation and message.

When the MX210002A is controlled, transmit :MODule:ID 7 first.

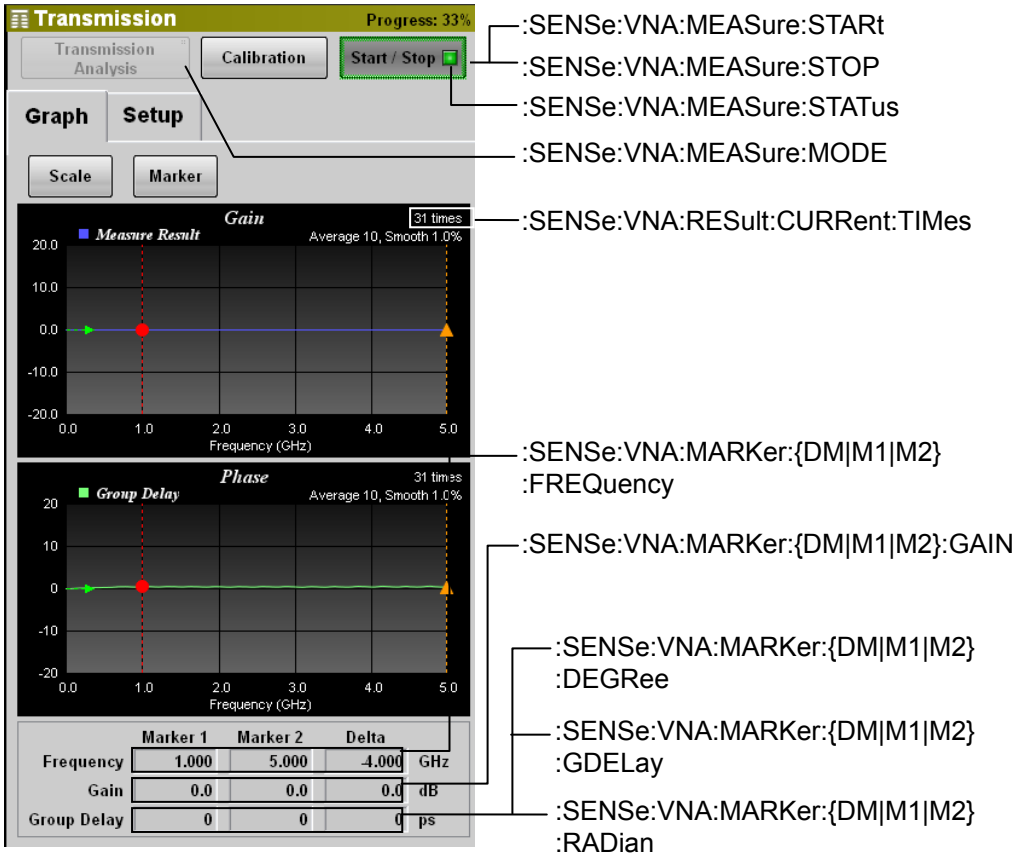


Figure 4.3-1 Message Corresponding to Graph Tab

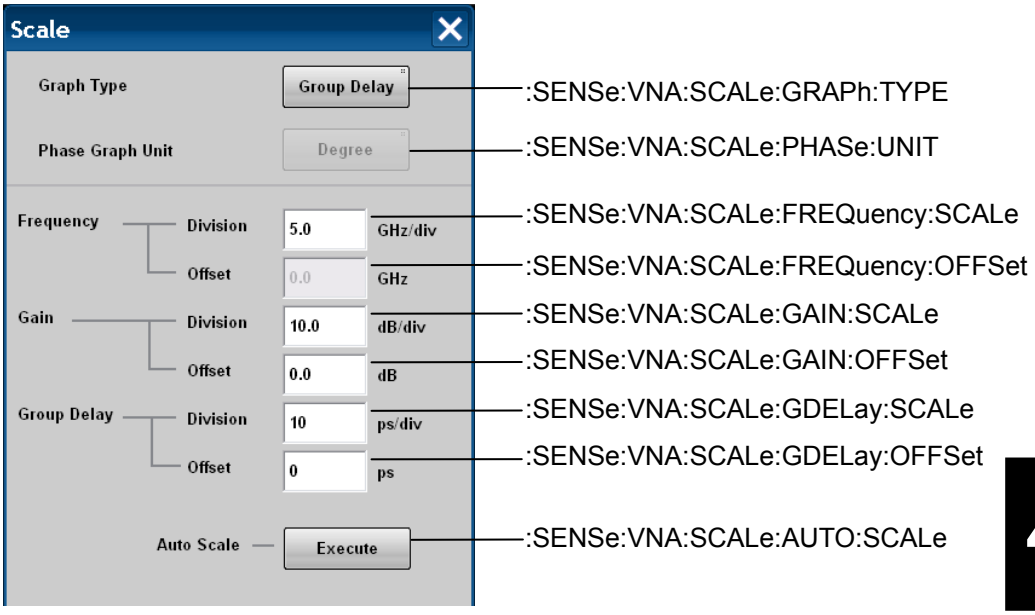


Figure 4.3-2 Message Corresponding to Scale Dialog

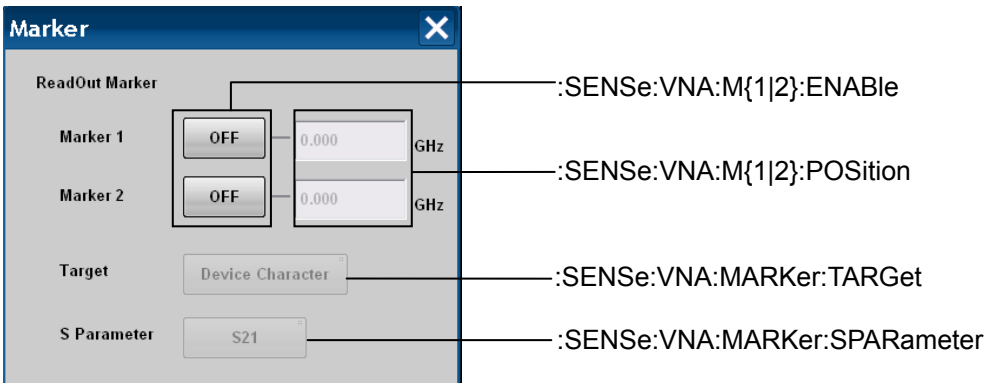


Figure 4.3-3 Message Corresponding to Marker Dialog

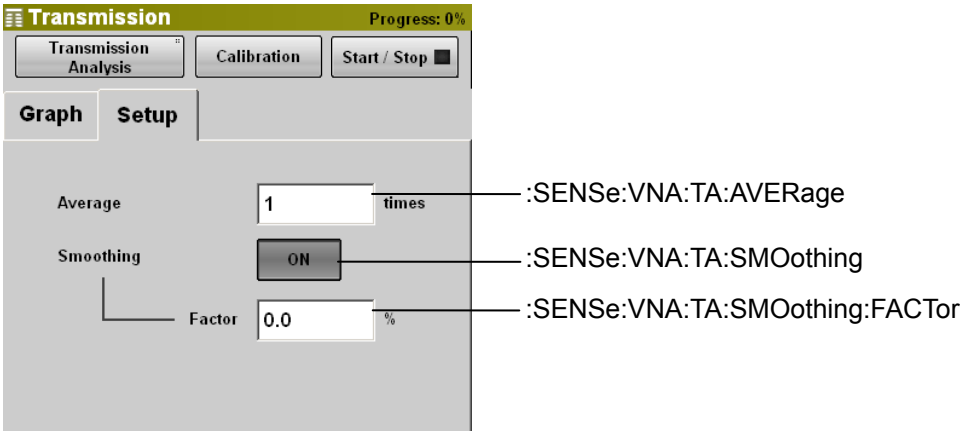


Figure 4.3-4 Message Corresponding to Setup Tab (Transfer Function)

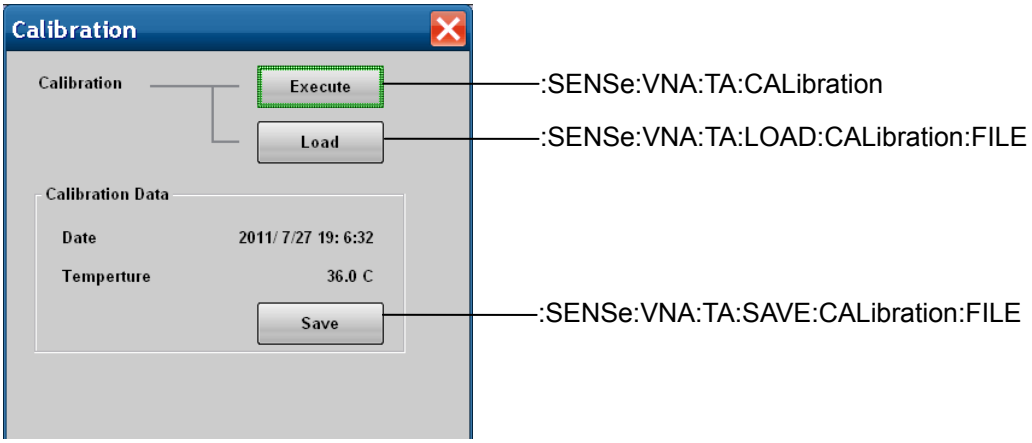


Figure 4.3-5 Message Corresponding to Calibration Dialog

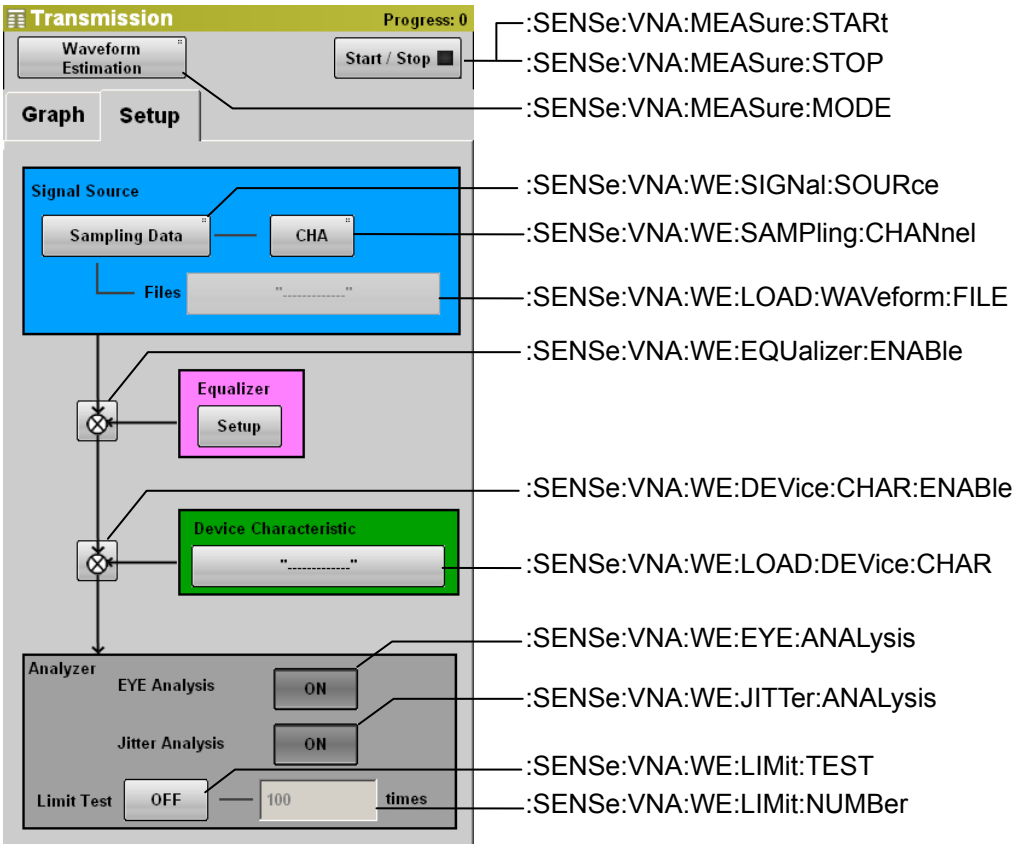


Figure 4.3-6 Message Corresponding to Setup Tab (Waveform Estimate)

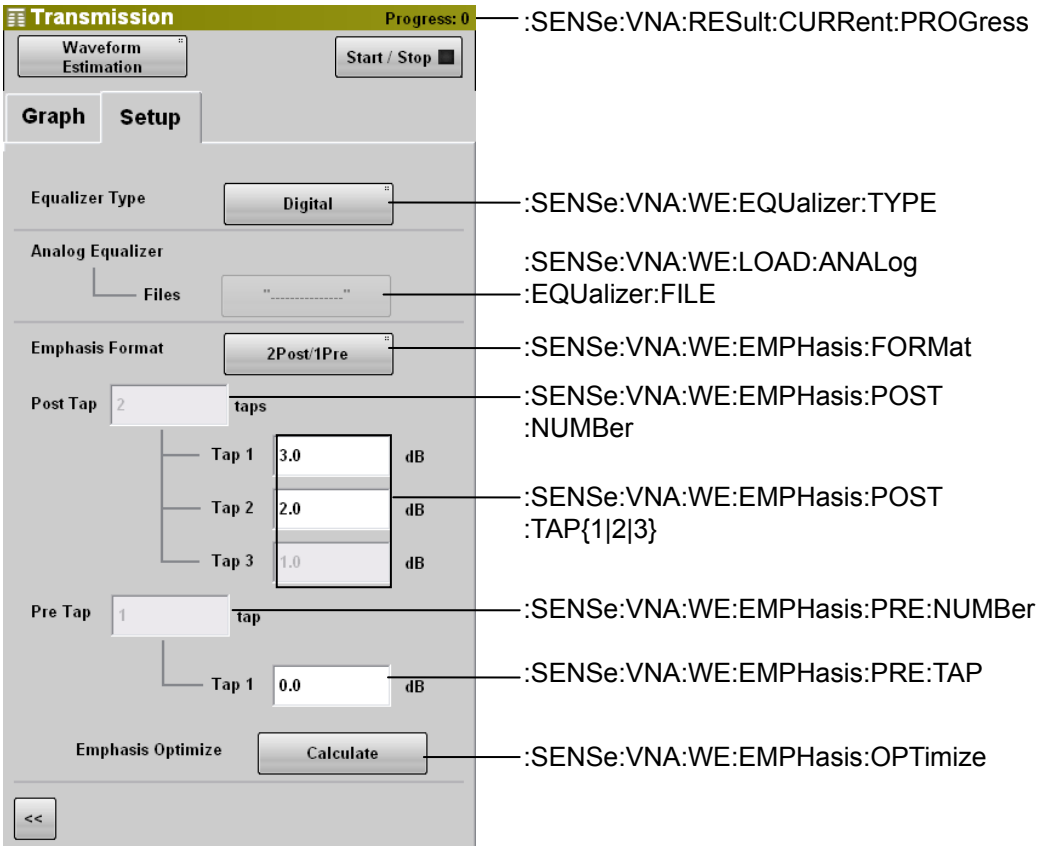


Figure 4.3-7 Message Corresponding to Setup Tab (Waveform Estimate-Equalizer)

There is no corresponding panel operation for the following messages.

:SENSe:VNA:TA:CALibration:STATus
:SENSe:VNA:RESult:ERRor

For the messages corresponding to the following panel operations, refer to Chapter 3 "Message Details" in *BERTWave Series Remote Control Operation Manual (W3773AE).*

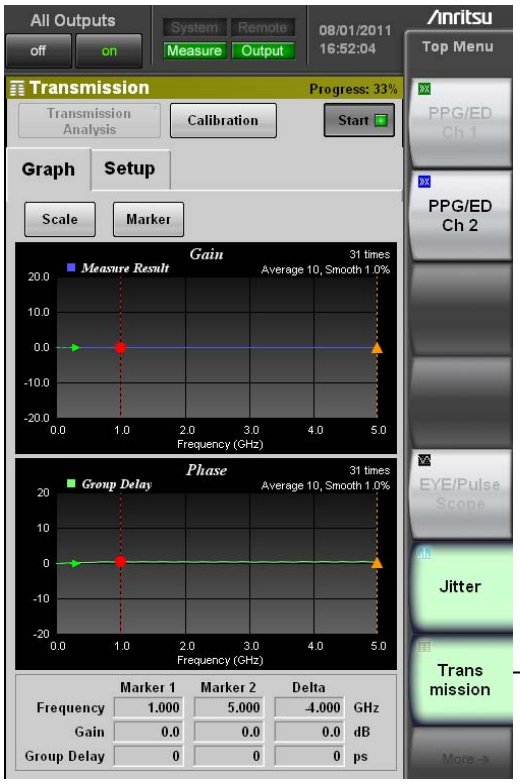


Figure 4.3-8 Message Corresponding to Top Menu

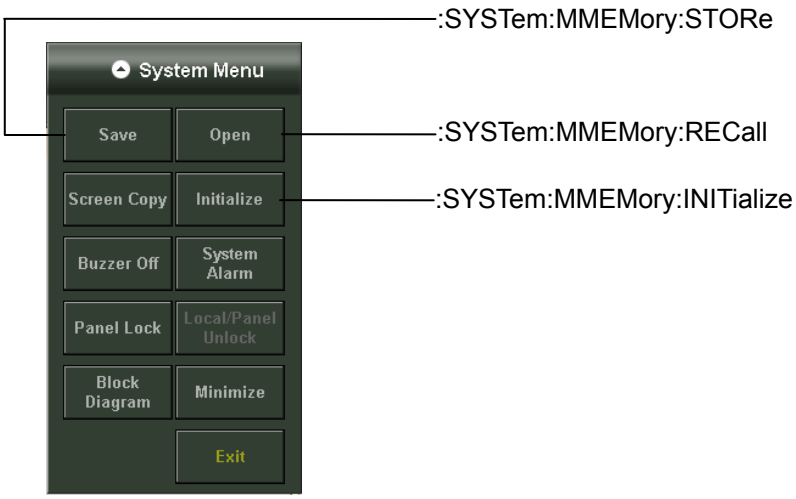


Figure 4.3-9 Message Corresponding to System Menu

4.4 Device Message Details

:SENSe:VNA:M{1|2}:ENABle

Function

This command sets/queries the display of Marker 1 or Marker 2.

Syntax

```
:SENSe:VNA:MARKer{1|2}:ENABle 0|1|OFF|ON
:SENSe:VNA:MARKer{1|2}:ENABle?
```

Response Data

0|1

Example of Use

To enable Marker 1.

```
:SENSe:VNA:MARKer1:ENABle ON
:SENSe:VNA:MARKer1:ENABle?
> 1
```

:SENSe:VNA:M{1|2}:POSition

Function

This command sets/queries the frequency of Marker 1 or Marker 2 in GHz units.

Syntax

```
:SENSe:VNA:MARKer{1|2}:POSition <numeric>
:SENSe:VNA:MARKer{1|2}:POSition?
```

<numeric>: 0.000 to 25.000, 0.025 step (GHz)

Response Data

<numeric>: 0.000 to 25.000, 0.025 step (GHz)

Example of Use

To set the Marker 1 frequency to 12.5 GHz.

```
:SENSe:VNA:MARKer1:POSition 12.5
```

To query the frequency of Marker 2.

```
:SENSe:VNA:MARKer2:POSition?
> 25.000
```

:SENSe:VNA:MARKer:{DM|M1|M2}:DEGRee

Function

This command queries the marker phase in degree.

Syntax

```
:SENSe:VNA:MARKer:{DM|M1|M2}:DEGRee?
```

Response Data

<integer>: –180 to 180 (degree)

Example of Use

To query the phase of delta marker.

```
:SENSe:VNA:MARKer:DM:DEGRee?
> -50
```

To query the phase of Marker 1.

```
:SENSe: VNA:MARKer:M1:DEGRee?
> 150
```

To query the phase of Marker 2.

```
:SENSe:VNA:MARKer:M2:DEGRee?
> 110
```

:SENSe:VNA:MARKer:{DM|M1|M2}:FREQuency

Function

This command queries the marker frequency.

Syntax

```
:SENSe:VNA:MARKer:{DM|M1|M2}:FREQuency?
```

Response Data

<numeric>: 0.000 to 25.000, 0.025 step (GHz)

Example of Use

To query the frequency of delta marker.

```
:SENSe:VNA:MARKer:DM:FREQuency?
> 2.53
```

To query the frequency of Marker 1.

```
:SENSe:VNA:MARKer:M1:FREQuency?
> 8.5
```

To query the frequency of Marker 2.

```
:SENSe:VNA:MARKer:M2:FREQuency?
> 11.03
```

:SENSe:VNA:MARKer:{DM|M1|M2}:GAIN

Function

This command queries the marker gain.

Syntax

```
:SENSe:VNA:MARKer:{DM|M1|M2}:GAIN?
```

Response Data

<numeric>: –120.0 to 120.0 (dB)

Example of Use

To query the gain of delta marker.

```
:SENSe:VNA:MARKer:DM:GAIN?
> -35.6
```

To query the gain of Marker 1.

```
:SENSe:VNA:MARKer:M1:GAIN?
> 6.5
```

To query the gain of Marker 2.

```
:SENSe:VNA:MARKer:M2:GAIN?
> -29.1
```

:SENSe:VNA:MARKer:{DM|M1|M2}:GDELay

Function

This command queries the marker group delay.

Syntax

```
:SENSe:VNA:MARKer:{DM|M1|M2}:GDELay?
```

Response Data

<integer>: –2500 to 2500 (ps)

Example of Use

To query the group delay of delta marker.

```
:SENSe:VNA:MARKer:DM:GDELay?
> -1369
```

To query the group delay of Marker 1.

```
:SENSe:VNA:MARKer:M1:GDELay?
> 1892
```

To query the group delay of Marker 2.

```
:SENSe:VNA:MARKer:M2:GDELay?
> 523
```

:SENSe:VNA:MARKer:{DM|M1|M2}:RADian

Function

This command queries the marker phase in radian.

Syntax

```
:SENSe:VNA:MARKer:{DM|M1|M2}:RADian?
```

Response Data

<numeric>: –3.14 to 3.14 (Radian)

Example of Use

To query the phase of delta marker in radian.

```
:SENSe:VNA:MARKer:DM:RADian?
> -0.73
```

To query the phase of Marker 1 in radian.

```
:SENSe:VNA:MARKer:M1:RADian?
> 2.62
```

To query the phase of Marker 2 in radian.

```
:SENSe:VNA:MARKer:M2:RADian?
> 1.92
```

:SENSe:VNA:MARKer:SPARameter

Function

This command selects/queries the target marker of s Parameter when s4p file is selected for the target's Device Character or Equalizer in Waveform Estimation.

Syntax

```
:SENSe:VNA:MARKer:SPARameter S31|S32|S41|S42
:SENSe:VNA:MARKer:SPARamter?
```

S31 Selects S31 Marker.
S32 Selects S32 Marker.
S41 Selects S41 Marker.
S42 Selects S42 Marker.

Response Data

S31|S32|S41|S42

Example of Use

```
:SENSe:VNA:MARKer:SPARameter S31
:SENSe:VNA:MARKer:SPARameter?
> S31
```

:SENSe:VNA:MARKer:TARGet

Function

This command sets/queries the graph to be the target of marker reading for Waveform Estimation.

Syntax

```
:SENSe:VNA:MARKer:TARGet DEVice|EQUalizer
:SENSe:VNA:MARKer:TARGet?
```

DEVice: Device Character
EQUalizer: Equalizer

Response Data

DEV | EQU

Example of Use

```
:SENSe:VNA:MARKer:TARGet DEV
:SENSe:VNA:MARKer:TARGet?
> DEV
```

:SENSe:VNA:MEASure:MODE

Function

This command sets/queries the mode.

Syntax

```
:SENSe:VNA:MEASure:MODE TA|WE
:SENSe:VNA:MEASure:MODE?
```

TA:	Transmission Analysis
WE:	Waveform Estimation

Response Data

TF|WE

Example of Use

```
:SENSe:VNA:MEASure:MODE TA
:SENSe:VNA:MEASure:MODE?
> TA
```

:SENSe:VNA:MEASure:STARt

Function

This command starts measurement.

Syntax

```
:SENSe:VNA:MEASure:STARt
```

:SENSe:VNA:MEASure:STATus

Function

This command queries the status of measurements.

Syntax

```
:SENSe:VNA:MEASure:STATus?
```

Response Data

0|1

0:	Measurement in progress
1:	Measurement paused

Example of Use

```
:SENSe:VNA:MEASure:STATus?
> 0
```

:SENSe:VNA:MEASure:STOP

Function

This command stops measurement.

Syntax

```
:SENSe:VNA:MEASure:STOP
```

:SENSe:VNA:RESult:CURRent:PROGress

Function

This command queries the progress status/count of measurement.

Syntax

```
:SENSe:VNA:RESult:CURRent:PROGress?
```

Response Data

<integer>:

Transmission Analysis: 0 to 100 (%)

Waveform Estimation: 0 to 9 223 372 036 854 775 807 (times)

Example of Use

```
:SENSe:VNA:RESult:CURRent:PROGress?
> 64
```

:SENSe:VNA:RESult:CURRent:TIMes

Function

This command queries the times of measurement of Transmission Analysis.

Syntax

```
:SENSe:VNA:RESult:CURRent:TIMes?
```

Response Data

<integer>: 0 to 9 999 999 (times)

Example of Use

```
:SENSe:VNA:RESult:CURRent:TIMes?
> 1902
```

:SENSe:VNA:RESult:ERRor

This command queries error that occurred during measurement. Error information, if there is any, will be displayed on the software screen.

Syntax

```
:SENSe:VNA:RESult:ERRor?
```

Response Data

<integer>: Total of values corresponding to error indications

Displayed Error	Value
EYE?	1
TIE Error	2
Pattern Lost	4
Time Out	8
Scope Error	256
Jitter Error	512
File Error	1024
Illegal Error	32768

When multiple errors occur simultaneously, their values are summed up. When Pattern Lost and Illegal Error occur, the response data is 4+32768=32772.

Example of Use

When Pattern Lost occurred

```
:SENSe:VNA:RESult:ERRor?
> 4
```

:SENSe:VNA:SCALe:AUTO:SCALe

Function

This command executes Execute for Auto Scale.

Syntax

```
:SENSe:VNA:SCALe:AUTO:SCALe
```

:SENSe:VNA:SCALe:FREQuency:OFFSet

This command sets/queries the Frequency Offset of graph.

Syntax

```
:SENSe:VNA:SCALe:FREQuency:OFFSet <numeric>
:SENSe:VNA:SCALe:FREQuency:OFFSet?
```

<numeric>: 0.0 to 22.5, 0.5 step (GHz)

Response Data

<numeric>: 0.0 to 22.5 (GHz)

Example of Use

```
:SENSe:VNA:SCALe:FREQuency:OFFSet 9.5
:SENSe:VNA:SCALe:FREQuency:OFFSet?
> 9.5
```

:SENSe:VNA:SCALe:FREQuency:SCALe

This command sets/queries the Frequency Division of graph.

Syntax

```
:SENSe:VNA:SCALe:FREQuency:SCALe <numeric>
:SENSe:VNA:SCALe:FREQuency:SCALe?
```

<numeric>: 0.5 to 5.0, 0.1 step (GHz/div.)

Response Data

<numeric>: 0.5 to 5.0 (GHz/div.)

Example of Use

```
:SENSe:VNA:SCALe:FREQuency:SCALe 5.0
:SENSe:VNA:SCALe:FREQuency:SCALe?
> 5.0
```

:SENSe:VNA:SCALe:GAIN:OFFSet

This command sets/queries the Offset of Gain graph.

Syntax

```
:SENSe:VNA:SCALe:GAIN:OFFSet <numeric>
:SENSe:VNA:SCALe:GAIN:OFFSet?
```

<numeric>: –80.0 to 80.0, 0.5 step (dB)

Response Data

<numeric>: –80.0 to 80.0 (dB)

Example of Use

```
:SENSe:VNA:SCALe:GAIN:OFFSet -20
:SENSe:VNA:SCALe:GAIN:OFFSet?
> -20.0
```

:SENSe:VNA:SCALe:GAIN:SCALe

This command sets/queries the Division of Gain graph.

Syntax

```
:SENSe:VNA:SCALe:GAIN:SCALe <numeric>
:SENSe:VNA:SCALe:GAIN:SCALe?
```

<numeric>: 0.5 to 20.0, 0.5 step (dB/div.)

Response Data

<numeric>: 0.5 to 20.0 (dB/div.)

Example of Use

```
:SENSe:VNA:SCALe:GAIN:SCALe 10.0
:SENSe:VNA:SCALe:GAIN:SCALe?
> 10.0
```

:SENSe:VNA:SCALe:GDELay:OFFSet

This command sets/queries the Offset of Group Delay graph.

Syntax

```
:SENSe:VNA:SCALe:GDELay:OFFSet <integer>
:SENSe:VNA:SCALe:GDELay:OFFSet?
```

<integer>: –500.0 to 500, 1 step (ps)

Response Data

<integer>: –500 to 500 (ps)

Example of Use

```
:SENSe:VNA:SCALe:GDELay:OFFSet -400
:SENSe:VNA:SCALe:GDELay:OFFSet?
> -400
```

:SENSe:VNA:SCALe:GDELay:SCALe

This command sets/queries the Division of Group Delay graph.

Syntax

```
:SENSe:VNA:SCALe:GDELay:SCALe <integer>
:SENSe:VNA:SCALe:GDELay:SCALe?
```

<integer>: 1 to 1000, 1 step (ps/div.)

Response Data

<integer>: 1 to 1000 (ps/div.)

Example of Use

```
:SENSe:VNA:SCALe:GDELay:SCALe 60
:SENSe:VNA:SCALe:GDELay:SCALe?
> 60
```

:SENSe:VNA:SCALe:GRAPh:TYPE

Function

This command sets/queries the Graph Type.

Syntax

```
:SENSe:VNA:SCALe:GRAPh:TYPE GDELay|PHASe
:SENSe:VNA:SCALe:GRAPh:TYPE?
```

GDELay:	Group Delay
PHASe:	Phase

Response Data

GDEL|PHAS

Example of Use

```
:SENSe:VNA:SCALe:GRAPh:TYPE PHASe
:SENSe:VNA:SCALe:GRAPh:TYPE?
> PHAS
```

:SENSe:VNA:SCALe:PHASe:UNIT

Function

This command sets/queries the Phase Unit.

Syntax

```
:SENSe:VNA:SCALe:PHASe:UNIT DEGRee|RADian
:SENSe:VNA:SCALe:PHASe:UNIT?
```

DEGRee:	Degree
RADian:	Radian

Response Data

DEGR|RAD

Example of Use

```
:SENSe:VNA:SCALe:PHASe:UNIT DEGRee
:SENSe:VNA:SCALe:PHASe:UNIT?
> DEGR
```

:SENSe:VNA:TA:AVERage

Function

This command sets/queries the Average for Transmission Analysis.

Syntax

```
:SENSe:VNA:TA:AVERage <integer>
:SENSe:VNA:TA:AVERage?
```

<integer>: Averaging count 1 to 99, 1 step

Response Data

<integer>: 1 to 99

Example of Use

```
:SENSe:VNA:TA:AVERage 10
:SENSe:VNA:TA:AVERage?
> 10
```

:SENSe:VNA:TA:CALibration

This command executes Calibration for Transmission Analysis.

Syntax

```
:SENSe:VNA:TA:CALibration
```

:SENSe:VNA:TA:CALibration:STATus

Function

This command queries the Calibration status for Transmission Analysis.

Syntax

```
:SENSe:VNA:TA:CALibration:STATus?
```

Response Data

0|1

0: Calibration stopped
1: Calibration in progress

Example of Use

```
:SENSe:VNA:TA:CALibration
:SENSe:VNA:TA:CALibration:STATus?
> 1
:SENSe:VNA:TA:CALibration:STATus?
> 0
```

:SENSe:VNA:TA:LOAD:CALibration:FILE

Function

This command loads the calibration file for Transmission Analysis.

Syntax

```
:SENSe:VNA:TA:LOAD:CALibration:FILE <file_name>
```

Example of Use

```
:SENSe:VNA:TA:LOAD:CALibration:FILE "110.cal"
```

:SENSe:VNA:TA:SAVE:CALibration:FILE

Function

This command saves the calibration file for Transmission Analysis.

Syntax

```
:SENSe:VNA:TA:SAVE:CALibration:FILE <file_name>
```

Example of Use

```
:SENSe:VNA:TA:SAVE:CALibration:FILE "FILT505A.cal"
```

:SENSe:VNA:TA:SMOothing

Function

This command sets/queries the Smoothing setting for Transmission Analysis.

Syntax

```
:SENSe:VNA:TA:SMOothing 0|1|OFF|ON
:SENSe:VNA:TA:SMOothing?
```

Response Data

0|1

Example of Use

```
:SENSe:VNA:TA:SMOothing ON
:SENSe:VNA:TA:SMOothing?
> 1
```

:SENSe:VNA:TA:SMOothing:FACTor

This command sets/queries the Smoothing factor for Transmission Analysis.

Syntax

```
:SENSe:VNA:TA:SMOothing:FACTor <numeric>
:SENSe:VNA:TA:SMOothing:FACTor?
```

<numeric>: Smoothing factor 0. 0 to 10. 0, 0.1 step (%)

Response Data

<numeric>: 0.0 to 10.0 (%)

Example of Use

```
:SENSe:VNA:TA:SMOothing:FACTor 1.0
:SENSe:VNA:TA:SMOothing:FACTor?
> 1.0
```

:SENSe:VNA:WE:DEVice:CHAR:ENABle

Function

This command sets/queries the Device Characteristics correction setting.

Syntax

```
:SENSe:VNA:WE:DEVice:CHAR:ENABle 0|1|OFF|ON
:SENSe:VNA:WE:DEVice:CHAR:ENABle?
```

Response Data

0|1

Example of Use

```
:SENSe:VNA:WE:DEVice:CHAR:ENABle ON
:SENSe:VNA:WE:DEVice:CHAR:ENABle?
> 1
```

:SENSe:VNA:WE:EMPHasis:FORMat

Function

This command sets/queries the Pre-emphasis format.

Syntax

```
:SENSe:VNA:WE:EMPHasis:FORMat 0|1|2|3|4
:SENSe:VNA:WE:EMPHasis:FORMat?
```

0: 2Post/1Pre
1: 3Post
2: 1Post/1Pre
3: 2Post
4: 1Post

Response Data

0|1|2|3|4

Example of Use

```
:SENSe:VNA:WE:EMPHasis:FORMat 0
:SENSe:VNA:WE:EMPHasis:FORMat?
> 0
```

:SENSe:VNA:WE:EMPHasis:OPTimize

Function

This command executes the Emphasis Optimize.

Syntax

```
:SENSe:VNA:WE:EMPHasis:OPTimize
```

:SENSe:VNA:WE:EMPHasis:POST:NUMBer

Function

This command queries the Post Tap count for Post-emphasis.

Syntax

```
:SENSe:VNA:WE:EMPHasis:POST:NUMBer?
```

Response Data

1|2|3

Example of Use

```
:SENSe:VNA:WE:EMPHasis:POST:NUMBer?
> 2
```

:SENSe:VNA:WE:EMPHasis:POST:TAP{1|2|3}

Function

This command sets/queries the gain of Post Tap 1 to 3, for Post-emphasis.

Syntax

```
:SENSe:VNA:WE:EMPHasis:POST:TAP{1|2|3} <numeric>
:SENSe:VNA:WE:EMPHasis:POST:TAP{1|2|3}?
```

<numeric>: –10.0 to 10.0, 0.1 step (dB)

Response Data

<numeric>: –10.0 to 10.0 (dB)

Example of Use

To set the gain of Tap 3 to –1.0.

```
:SENSe:VNA:WE:EMPHasis:POST:TAP3 -1.0
:SENSe:VNA:WE:EMPHasis:POST:TAP3?
> -1.0
```

:SENSe:VNA:WE:EMPHasis:PRE:NUMBer

Function

This command queries the Post Tap count for Pre-emphasis.

Syntax

```
:SENSe:VNA:WE:EMPHasis:PRE:NUMBer?
```

Response Data

0|1

Example of Use

```
:SENSe:VNA:WE:EMPHasis:PRE:NUMBer?
> 1
```

:SENSe:VNA:WE:EMPHasis:PRE:TAP

Function

This command sets/queries the gain of Pre Tap for Pre-emphasis.

Syntax

```
:SENSe:VNA:WE:EMPHasis:PRE:TAP <numeric>
:SENSe:VNA:WE:EMPHasis:PRE:TAP?
```

<numeric>: –10.0 to 10.0, 0.1 step (dB)

Response Data

<numeric>: –10.0 to 10.0 (dB)

Example of Use

```
:SENSe:VNA:WE:EMPHasis:PRE:TAP 5.0
:SENSe:VNA:WE:EMPHasis:PRE:TAP?
> 5.0
```

:SENSe:VNA:WE:EQUalizer:ENABle

Function

This command sets/queries the equalizer correction setting for Waveform Estimate.

Syntax

```
:SENSe:VNA:WE:EQUalizer:ENABle 0|1|OFF|ON
:SENSe:VNA:WE:EQUalizer:ENABle
```

Response Data

0|1

Example of Use

```
:SENSe:VNA:WE:EQUalizer:ENABle ON
:SENSe:VNA:WE:EQUalizer:ENABle?
> 1
```

:SENSe:VNA:WE:EQUalizer:TYPE

Function

This command sets/queries the equalizer type for Waveform Estimate.

Syntax

```
:SENSe:VNA:WE:EQUalizer:TYPE ANALog|DIGital
:SENSe:VNA:WE:EQUalizer:TYPE?
```

ANALog: Analog
DIGital: Digital

Response Data

ANAL|DIG

Example of Use

```
:SENSe:VNA:WE:EQUalizer:TYPE ANALog
:SENSe:VNA:WE:EQUalizer:TYPE?
> ANAL
```

:SENSe:VNA:WE:EYE:ANALysis

Function

This command sets/queries the Analyzer-EYE synchronized analysis for Waveform Estimate.

Syntax

```
:SENSe:VNA:WE:EYE:ANALysis 0|1|OFF|ON
:SENSe:VNA:WE:EYE:ANALysis?
```

Response Data

0|1

Example of Use

```
:SENSe:VNA:WE:EYE:ANALysis ON
:SENSe:VNA:WE:EYE:ANALysis?
> 1
```

:SENSe:VNA:WE:JITTer:ANALysis

Function

This command sets/queries the Analyzer-Jitter synchronized analysis for Waveform Estimate.

Syntax

```
:SENSe:VNA:WE:JITTer:ANALysis 0|1|OFF|ON
:SENSe:VNA:WE:JITTer:ANALysis?
```

Response Data

0|1

Example of Use

```
:SENSe:VNA:WE:JITTer:ANALysis OFF
:SENSe:VNA:WE:JITTer:ANALysis?
> 0
```

:SENSe:VNA:WE:LIMit:NUMBer

Function

This command sets/queries the Analyzer-Limited count for Waveform Estimate.

Syntax

```
:SENSe:VNA:WE:LIMit:NUMBer <integer>
:SENSe:VNA:WE:LIMit:NUMBer?
```

<integer>: 10 to 10000, 1 step

Response Data

<integer>: 10 to 10000

Example of Use

```
:SENSe:VNA:WE:LIMit:NUMBer 500
:SENSe:VNA:WE:LIMit:NUMBer?
> 500
```

:SENSe:VNA:WE:LIMit:TEST

Function

This command sets/queries the Analyzer-Limited setting for Waveform Estimate.

Syntax

```
:SENSe:VNA:WE:LIMit:TEST 0|1|OFF|ON
:SENSe:VNA:WE:LIMit:TEST?
```

Response Data

0|1

Example of Use

```
:SENSe:VNA:WE:LIMit:TEST ON
:SENSe:VNA:WE:LIMit:TEST?
> 1
```

:SENSe:VNA:WE:LOAD:ANALog:EQUalizer:FILE

Function

This command loads the Analog Equalizer file for Waveform Estimate.

Syntax

```
:SENSe:VNA:WE:LOAD:ANALog:EQUalizer:FILE <file_name>
```

Response Data

<file_name>

Example of Use

```
:SENSe:VNA:WE:LOAD:ANALog:EQUalizer:FILE "ref060.s2p"
```

:SENSe:VNA:WE:LOAD:DEVice:CHAR

Function

This command loads the Device Characteristics file for Waveform Estimate.

Syntax

```
:SENSe:VNA:WE:LOAD:DEVice:CHAR <file_name>
:SENSe:VNA:WE:LOAD:DEVice:CHAR?
```

Response Data

<file_name>

Example of Use

```
:SENSe:VNA:WE:LOAD:DEVice:CHAR "LPF01.s2p"
:SENSe:VNA:WE:LOAD:DEVice:CHAR?
> "LPF01.s2p"
```

:SENSe:VNA:WE:LOAD:WAVeform:FILE

Function

This command loads the Sampling Source file for Waveform Estimate.

Syntax

```
:SENSe:VNA:WE:LOAD:WAVeform:FILE <file_name>
```

Response Data

<file_name>

Example of Use

```
:SENSe:VNA:WE:LOAD:WAVeform:FILE "wave010.txt"
```

:SENSe:VNA:WE:SAMPling:CHANnel

Function

This command sets/queries the Sampling Channel for Waveform Estimate.

Syntax

```
:SENSe:VNA:WE:SAMPling:CHANnel CHA|CHB
:SENSe:VNA:WE:SAMPling:CHANnel?
```

CHA:	Channel A
CHB:	Channel B

Response Data

CHA|CHA

Example of Use

```
:SENSe:VNA:WE:SAMPling:CHANnel CHB
:SENSe:VNA:WE:SAMPling:CHANnel?
> CHB
```

:SENSe:VNA:WE:SIGNal:SOURce

Function

This command sets/queries the Sampling Source for Waveform Estimate. Specify the file name when Sampling Source is set for Waveform File.

Syntax

```
:SENSe:VNA:WE:SIGNal:SOURce FILE|SAMPling
:SENSe:VNA:WE:SIGNal:SOURce?
```

FILE:	Waveform File
SAMPling:	Sampling Data

Response Data

FILE| SAMP

Example of Use

```
:SENSe:VNA:WE:SIGNal:SOURce SAMP
:SENSe:VNA:WE:SIGNal:SOURce?
> SAMP
```

4.5 Limitation for EYE/Pulse Scope Remote Control

When the Waveform Estimation measurement is stopped and EYE Analysis of Analyzer is set to [On], EYE/Pulse Scope can be controlled remotely.

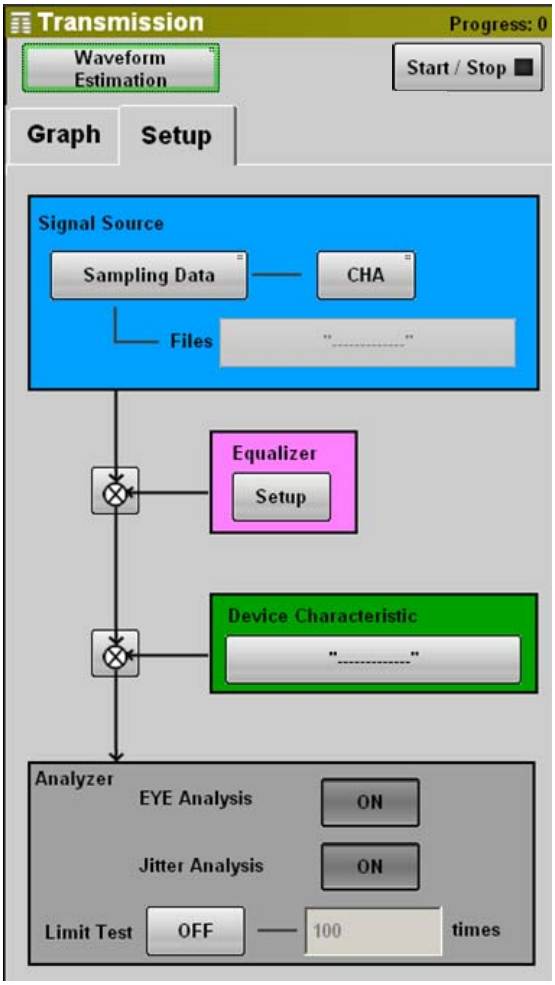


Figure 4.5-1 Screen Display Operating EYE/Pulse Scope

The usable EYE/Pulse Scope remote commands are listed in the following table.

Table 4.5-1 Usable EYE/Pulse Scope Remote Command

Command
:CALCulate:MARKer:AOFF
:CALCulate:MARKer:CENTer
:CALCulate:MARKer:LOCation:CHA|CHB:Y1|Y2
:CALCulate:MARKer:LOCation:X1|X2
:CALCulate:MARKer:X1|X2
:CALCulate:MARKer:Y1|Y2
:CONFigure:CLKRecovery
:CONFigure:HISTogram:AXIS
:CONFigure:MASK:ALGorithm
:CONFigure:MASK:AREa:RESTriction
:CONFigure:MASK:AREa:RESTriction:ANGLe
:CONFigure:MASK:AREa:RESTriction:WIDTh
:CONFigure:MASK:MARGin
:CONFigure:MASK:MARGin:CONTupdate
:CONFigure:MASK:TYPe
:CONFigure:MASK:USER:LOCation:X1|XDELta
:CONFigure:MASK:USER:LOCation:Y1|YDELta
:CONFigure:MEASure:AMPTIME{1|2|3|4}
:CONFigure:MEASure:AREa:DISPlay
:CONFigure:MEASure:DEFine
:CONFigure:MEASure:EYEBoundary:OFFSet
:CONFigure:MEASure:EYEBoundary:WIDTh
:CONFigure:MEASure:TRANsition:CORRect:FACTor
:CONFigure:MEASure:TRANsition:CORRection
:CONFigure:MEASure:TYPe
:DISPlay:WINDow:GRAPhics:CLEar
:DISPlay:WINDow:X[:SCALe]:UNIT
:FETCh:AMPLitude:AVEPower?
:FETCh:AMPLitude:CROSsing?
:FETCh:AMPLitude:EXTRatio?
:FETCh:AMPLitude:EYEAmplitude?
:FETCh:AMPLitude:EYEHeight?
:FETCh:AMPLitude:LEVel:ONE?
:FETCh:AMPLitude:LEVel:ZERO?
:FETCh:AMPLitude:MEASurement?

Table 4.5-1 Usable EYE/Pulse Scope Remote Command (Cont'd)

Command
:FETCh:AMPLitude:OMA:DBM?
:FETCh:AMPLitude:OMA:MW?
:FETCh:AMPLitude:SNR?
:FETCh:AMPTime:QUEStionableeye?
:FETCh:HISTogram:AMPLitude:HITS?
:FETCh:HISTogram:AMPLitude:MEAN?
:FETCh:HISTogram:AMPLitude:MEASurement?
:FETCh:HISTogram:AMPLitude:PPeak?
:FETCh:HISTogram:AMPLitude:STDDeviation?
:FETCh:HISTogram:TIME:HITS?
:FETCh:HISTogram:TIME:MEAN?
:FETCh:HISTogram:TIME:MEASurement?
:FETCh:HISTogram:TIME:PPeak?
:FETCh:HISTogram:TIME:STDDeviation?
:FETCh:MASK:MEASurement?
:FETCh:MASK:SAMPles:FAILed?
:FETCh:MASK:SAMPles:FAILed:BOTTom?
:FETCh:MASK:SAMPles:FAILed:CENTer?
:FETCh:MASK:SAMPles:FAILed:TOP?
:FETCh:MASK:SAMPles:TOTal?
:FETCh:TIME:DCD?
:FETCh:TIME:EYEWidth?
:FETCh:TIME:FTIMe?
:FETCh:TIME:JITTer:PPeak?
:FETCh:TIME:JITTer:RMS?
:FETCh:TIME:MEASurement?
:FETCh:TIME:TRISe?
[:SENSe]:EYEPulse:PRINt:COPY
[:SENSe]:HISTogram:CENTer
[:SENSe]:HISTogram:X1|X2
[:SENSe]:HISTogram:Y1|Y2
[:SENSe]:INPut:CLKRecovery
[:SENSe]:PRINt:INVerse
[:SENSe]:SAMPles:JUDGe
[:SENSe]:TMEMory:REFerence:CLEar
[:SENSe]:TMEMory:REFerence:SET

Appendix A Specifications

Table A-1 Configuration

Model	Product name	Q'ty	Remarks
Z1558A	CD-ROM	1	License file, Operation Manual
W3571AE	MX210002A Transmission Analysis Software Operation Manual	1	PDF file, included in CD-ROM

Table A-2 Common Settings

Item	Specifications
Graph display	
Graph type	Group Delay, Phase
Phase unit	Degree, Radian
Display range	
Frequency	0.0 to 25 GHz, 0.025 GHz step
Phase	When unit is Degree: –180 to +180° When unit is Radian: –3.14 to +3.14
Graph scale	
Frequency	Scale 0.5 to 5.0 GHz/div, 0.1 GHz step Offset 0.0 to 22.5 GHz, 0.5 GHz step
Gain	Scale 0.5 to 20.0 dB/div, 0.5 dB step Offset –80.0 to 80.0 dB, 0.5 dB step
Group delay	Scale 1 to 1000 ps/div, 1 ps step Offset –500 to 500 ps, 1 ps step
Auto scale	Available
Marker	
Number of Marker	2
Frequency range	0.0 to 25.0 GHz, 0.025 GHz step Marker 1, 2 can be set individually.
Measurement target	Device Character, Equalizer*
Measurement mode	Transmission Analysis, Waveform Estimation

*: Available when the equalizer type for Waveform Estimation is Analog.

Table A-3 Transmission Analysis Specifications

Item	Specifications
Measurement target	Gain Graph, Phase Graph*, Group Delay Graph*
Calibration	Data acquisition from EYE/Pulse Scope(Execute), Loaded from file(Load), Saved to file(Save)
Averaging	1 to 99, 1 step
Smoothing Factor	ON/OFF selectable
	0.0 to 10.0%, 0.1% step
File saving format	Text file (s2p format)

*: Displays either Phase Graph or Group Delay Graph.

Table A-4 Waveform Estimation Specifications

Item	Specifications
Analysis signal source	Sampling Data (CHA, CHB), Waveform File*1
Equalizer	ON/OFF selectable
Type	Analog, Digital
Analog Equalizer	
Equalizer characteristics file	Text file (s2p format, s4p format)
Digital Equalizer	
Emphasis Format	2 Post/ 1Pre, 2 Post/ 1Pre, 3 Post, 2 Post, 1 Post/ 1Pre, 1 Post
Number of Post Tap	1 to 3
Number of Pre Tap	0 to 1
Tap Gain	–10 to 10 dB, 0.1 dB step
Emphasis Optimize process	Available
Device frequency characteristics correction	ON/OFF selectable
Device characteristics file format	Text file (s2p format)
Analysis function	
Projected waveform display	ON/OFF selectable
Jitter Analysis*2	ON/OFF selectable
Limit of calculation count	ON/OFF selectable, 10 to 10000
File saving format	Text file*1

*1: The extension for saved files is WFE.

*2: Requires MX210001A Jitter Analysis Software.

Appendix B Default Value List

The following tables shows the value when the [Initialize] command is operated from the System Menu.

Table B-1 Transmission Analysis

Item	Defaults
Mode	Transmission Analysis
Start/Stop	Stop

Table B-2 Scale

Item	Default
Graph Type	Group Delay
Phase Graph Unit	Degree
Frequency Division	5.0 GHz/div
Frequency Offset	0.0 GHz
Gain Division	10.0 dB/div
Gain Offset	0.0 dB
Group Delay Division	10 ps/div
Group Delay Offset	0 ps

Table B-3 Marker

Item	Default
Marker1	OFF
Marker1 Frequency	0.0 GHz
Marker2	OFF
Marker2 Frequency	0.0 GHz
Target	Device Character

Table B-4 Transfer Function-Setup

Item	Default
Average	1
Smoothing	OFF
Smoothing Factor	0.0 %

Table B-5 Waveform Estimate-Setup

Item		Default
Signal Source		Sampling Data
	Channel	CHA
	Files	"----------"
Equalizer		ON
	Equalizer Type	Analog
	Analog Equalizer Files	"----------"
	Equalizer Format	2 Post/1 Pre
	Post Tap	2
	Tap 1	3.0
	Tap 2	2.0
	Tap 3	1.0
	Pre Tap	1
	Tap 1	0.0
Device Characteristics		ON
	(Files)	"----------"
Analyzer		
	EYE Analysis	OFF
	Jitter Analysis	OFF
	Limit Test	OFF
	Limit Number	100

Appendix C Sample Program

This appendix describes the sample program using the Tera Term macro function.

C.1 Executing sample Programs

1. Start the test editor such as the Windows memo pad.
2. Copy the sample program in this manual.
3. Past the copied sample program to the test editor.
4. The file can be saved in Tera Term macro format (with ttl extension).
5. Start Tera Term.
6. Confirm that it can be communicated with the BERTWave referring to Section "2.4.2 When using Ethernet (Windows 7/Vista) " in *BERTWave Series Remote Control Operation Manual* (W3773AE).
7. Click [Control] → [Macro] from the menu of Tera Term.
8. Open the file selection window.
   Select the file saved at step 4.

For the other execution method of macro, refer to the help of Tera Term.

C.2 Example 1: Frequency Characteristics of Parts

This sample program sets the mode to Transmission Analysis, queries the calibration and measurement status, and when the measurement is complete queries the marker value.

Processing Flow

1. Send :MODULE:ID to set the control target to Transmission Analysis on top menu.
2. Set the mode to [Transmission Analysis].
3. Set the marker as following.
   Marker 1: On, 1.0 GHz
   Marker 2: On, 2.0 GHz
4. Set the frequency scale of graph to 1.0 GHz/div.
5. Set the smoothing to On, factor to 1.0%.
6. Start Calibration.
7. Query the calibration status every one second. If the calibration does not finishes when 300 seconds elapses, the program stops processing.
8. Start the measurement of frequency characteristics.
9. Query the measure times every one second. When the measurement count reaches ten or more, stop the measurement. If the measurement count is less than ten when 300 seconds elapses, the program stops processing.
10. Query the gain of marker.
11. Query the phase of marker.
12. Save result data to file as s2p format.

```
; sample program for MX210002A ver 1.0
; Anritsu Corporation August,2011
;
; set local echo to on
setecho 1
flushrecv
; specify top menu to MX210002A
sendln ':MOD:ID 7'

; time out 3 second
timeout=3

; set measure mode to 'Tansmission Analysis'
sendln ':SENSe:VNA:MEASure:MODE TA'
call check_error_code

; set Marker on
sendln ':SENSe:VNA:M1:ENABle ON'
call check_error_code
sendln ':SENSe:VNA:M2:ENABle ON'
call check_error_code
; set Marker frequency
sendln ':SENSe:VNA:M1:POSition 1.0'
call check_error_code
sendln ':SENSe:VNA:M2:POSition 5.0'
call check_error_code
; set frequecy scale
sendln ':SENSe:VNA:SCALe:FREQuency:SCALe 1.0'
call check_error_code


messagebox  'Input signal for calibarion to BERTWave.' 'Confirm connection'
; execute calibration
sendln ':SENSe:VNA:TA:CALibration'
call check_error_code
for id 1 300
  sendln ':SENSe:VNA:TA:CALibration:STATus?'
  pause 1; wait 1 second
  waitln '0' '1'
  cal_stat=result
  if result=0 goto _timeout
  if result=1 break
  call check_error_code
next
```

```
if cal_stat=2 then
  messagebox  'Calibration dose not stop within 300 seconds.' 'Time over !'
  end
endif

messagebox  'Connect Device under the test.' 'Confirm connection'

; set averag to 10
sendln ':SENSe:VNA:TA:AVERage 10'
call check_error_code
; set smoothig to on
sendln ':SENSe:VNA:TA:SMOothing ON'
call check_error_code
; set smoothig factor to 1.0%
sendln ':SENSe:VNA:TA:SMOothing:FACTor 1.0'
call check_error_code
; Start measuring
sendln ':SENSe:VNA:MEASure:STARt'
call check_error_code
pause 1

; query measurement status
for id 1 300
  sendln ':SENSe:VNA:RESult:CURRent:TIMes?'
  pause 1; wait 1 second
  recvln
  recvln

  ;call check_response

  if result=1 then
         str2int ta_times inputstr
         if ta_times>9  then
                sendln ':SENSe:VNA:MEASure:STOP'
                call check_error_code
                break
         endif
  endif
  call check_error_code
next

if ta_times<10 then
```

```
  messagebox  'Measurement dose not stop within 300 seconds.' 'Time over !'
  end
endif

; data acquisition
sendln ':SENSe:VNA:MARKer:M1:GAIN?'
call check_error_code
sendln ':SENSe:VNA:MARKer:M2:GAIN?'
call check_error_code
sendln ':SENSe:VNA:MARKer:M1:DEGRee?'
call check_error_code
sendln ':SENSe:VNA:MARKer:M2:DEGRee?'
call check_error_code
sendln ':SYSTem:MMEMory:STORe "TA_sample_program.s2p",7,TAR,S2P'
call check_error_code

messagebox  'Macro end successfully' 'Finish'

End

;       ------------ subroutines -----------

:_timeout
  messagebox  'No response from BERTWave.' 'Time out!'
  call check_error_code
  End

:check_error_code
  ; query error
  sendln ':SYSTem:ERRor?'
  waitln 'No error'

  ; in case of timeout
  if result=0 goto _timeout
  ; in case of error occurring
  if result=2 then
         e_message='Error code = '
         strconcat e_message inputstr
         messagebox  e_message 'Command Error occurred'
         end
  endif

  ; in case of no error
```

```
return

:check_response

  ;for debug
  messagebox inputstr 'debug1'
  int2str result_str result
  messagebox result_str 'debug2'

  return
```

C.3 Example 2: Waveform Estimation

This sample program acquires the data from EYE/Pulse Scope, configures equalizer, and then saves the projected waveform.

Processing Flow

1. Send :MODULE:ID 5 to set the control target to EYE/Pulse Scope on top menu.
2. Set the Sampling Mode to [Pulse].
3. Set the CHA to [ON].
4. Send :MODULE:ID 7 to set the control target to Transmission on top menu.
5. Set the mod to [Waveform Estimation].
6. Set the Signal Source to Sampling Data, and CHA.
7. Set the equalizer switch to On.
8. Set the device characteristics switch to Off.
9. Set the Equalizer Type to Digital.
10. Set the Emphasis Format to 1Post/1Pre.
11. Set the Tap1 of Post to 1.5 dB, and Tap of Pre to 0.5 dB.
12. Set the EYE Analyzer to On.
13. Set the Jitter Analysis to Off3.
14. Set the Limit Test to On and 10 times.
15. Start the Waveform Estimation.
16. Query the measurement status every one second. If the Waveform Estimation does not finishes when 300 seconds elapses, the program stops processing.
17. Save result data to file.

```
; sample program for MX210002A ver 1.0
; Anritsu Corporation August,2011
;
; set local echo to on
setecho 1
flushrecv
; time out 3 second
timeout=3

; set top menu to EYE/Pulse Scope
sendln ':MOD:ID 5'

; set Sampling Mode to Pulse
sendln ':DISPlay:MODE PULSe'
call check_error_code
; set Channel A display to on
sendln ':INPut:CHA ON'
call check_error_code

; set top menu to MX210002A
sendln ':MOD:ID 7'

; set measure mode to 'Waveform Estimation'
sendln ':SENSe:VNA:MEASure:MODE WE'
call check_error_code

; set signal source
sendln ':SENSe:VNA:WE:SIGNal:SOURce SAMP'
call check_error_code
sendln ':SENSe:VNA:WE:SAMPling:CHANnel CHA'
call check_error_code
; set Equalizer switch
:SENSe:VNA:WE:EQUalizer:ENABle ON'
call check_error_code
; set Analog device switch
sendln ':SENSe:VNA:WE:DEVice:CHAR:ENABle OFF'
call check_error_code
; set Equalizer type
sendln ':SENSe:VNA:WE:EQUalizer:TYPE DIGital'
call check_error_code
; set Emphasis format to 1Post/1Pre
sendln ':SENSe:VNA:WE:EMPHasis:FORMat 2'
call check_error_code
```

```
; set Post tap1 to 1.5 dB
sendln ':SENSe:VNA:WE:EMPHasis:POST:TAP1 1.5'
call check_error_code
; set Pre tap1 to 0.5 dB
sendln ':SENSe:VNA:WE:EMPHasis:PRE:TAP 0.5'
call check_error_code
; set EYE analyzer on
sendln ':SENSe:VNA:WE:EYE:ANALysis ON'
call check_error_code
; set Jitter analyzer off
sendln ':SENSe:VNA:WE:JITTer:ANALysis OFF'
call check_error_code
; set Limit Test on
sendln ':SENSe:VNA:WE:LIMit:TEST ON'
call check_error_code
; set Limit Test times to 10
sendln ':SENSe:VNA:WE:LIMit:NUMBer 10'
call check_error_code

messagebox  'Input signal for waveform estimation to BERTWave.' 'Confirm
connection'
; Start measuring
sendln ':SENSe:VNA:MEASure:STARt'
call check_error_code
pause 1

; query measurement status
for id 1 300
  sendln ':SENSe:VNA:MEASure:STATus?'
  pause 1; wait 1 second
  waitln '0' '1'
  cal_stat=result
  if result=0 goto _timeout
  if result=1 break
  call check_error_code
next

if cal_stat=2 then
  messagebox  'Measurement dose not stop within 300 seconds.' 'Time over !'
  end
endif

; data acquisition
sendln ':SYSTem:MMEMory:STORe "WE_sample_program.WFE",7,WER,WFE'
```

```
call check_error_code

messagebox  'Macro end successfully' 'Finish'

End

;       ------------ subroutines -----------

:_timeout
  messagebox  'No response from BERTWave.' 'Time out!'
  call check_error_code
  End

:check_error_code
  ; query error
  sendln ':SYSTem:ERRor?'
  waitln 'No error'

  ; in case of timeout
  if result=0 goto _timeout
  ; in case of error occurring
  if result=2 then
         e_message='Error code = '
         strconcat e_message inputstr
         messagebox  e_message 'Command Error occurred'
         end
  endif

  ; in case of no error

return

:check_response

  ;for debug
  messagebox inputstr 'debug1'
  int2str result_str result
  messagebox result_str 'debug2'

  return
```

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