MX269017A
Vector Modulation Analysis Software
Operation Manual
Operation

24th Edition

- For safety and warning information, please read this manual before attempting to use the equipment.
- Additional safety and warning information is provided within the MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Mainframe Operation), MS2830A Signal Analyzer Operation Manual (Mainframe Operation) or MS2840A Signal Analyzer Operation Manual (Mainframe Operation). Please also refer to this document 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 one year from the purchase date.
- The warranty period after repair or exchange will remain 6 months from the original purchase date, or 6 months 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 injury or financial loss of the customer due to the use of or a failure to be able to use this equipment.

Anritsu Corporation Contact

In the event that this equipment malfunctions, contact an Anritsu Service and Sales office. Contact information is available in a separate file (for the PDF version), and on the last page of this manual (for the printed version).

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a. If a fault (bug) is discovered in this Software, preventing operation as described in the operation manual or specifications whether or not the customer uses this software as described in the manual, Anritsu shall at its own discretion, fix the bug, or exchange the software, or suggest a workaround, free-of-charge. However, notwithstanding the above, the following items shall be excluded from repair and warranty.

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

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

   iii) Recovery of lost or damaged data.

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

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

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

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

4. Export Restrictions

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

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

6. Reparations

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

7. Responsibility after Termination

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

8. Dispute Resolution

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

9. Court of Jurisdiction

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

Cautions against computer virus infection

- Copying files and data

  Only files that have been provided directly from Anritsu or generated using Anritsu equipment should be copied to the instrument.

  All other required files should be transferred by means of USB or CompactFlash media after undergoing a thorough virus check.

- Adding software

  Do not download or install software that has not been specifically recommended or licensed by Anritsu.

- Network connections

  Ensure that the network has sufficient anti-virus security protection in place.

CE Conformity Marking

Anritsu affixes the CE conformity marking on the following product(s) in accordance with the Decision 768/2008/EC to indicate that they conform to the EMC and LVD directive of the European Union (EU).

CE marking

$$C \; E$$

1. Product Model

Software:　　　　MX269017A Vector Modulation Analysis Software

2. Applied Directive and Standards

When the MX269017A Vector Modulation Analysis Software is installed in the MS2690A/MS2691A/MS2692A, MS2830A or MS2840A, the applied directive and standards of this unit conform to those of the MS2690A/MS2691A/MS2692A, MS2830A or MS2840A main frame.
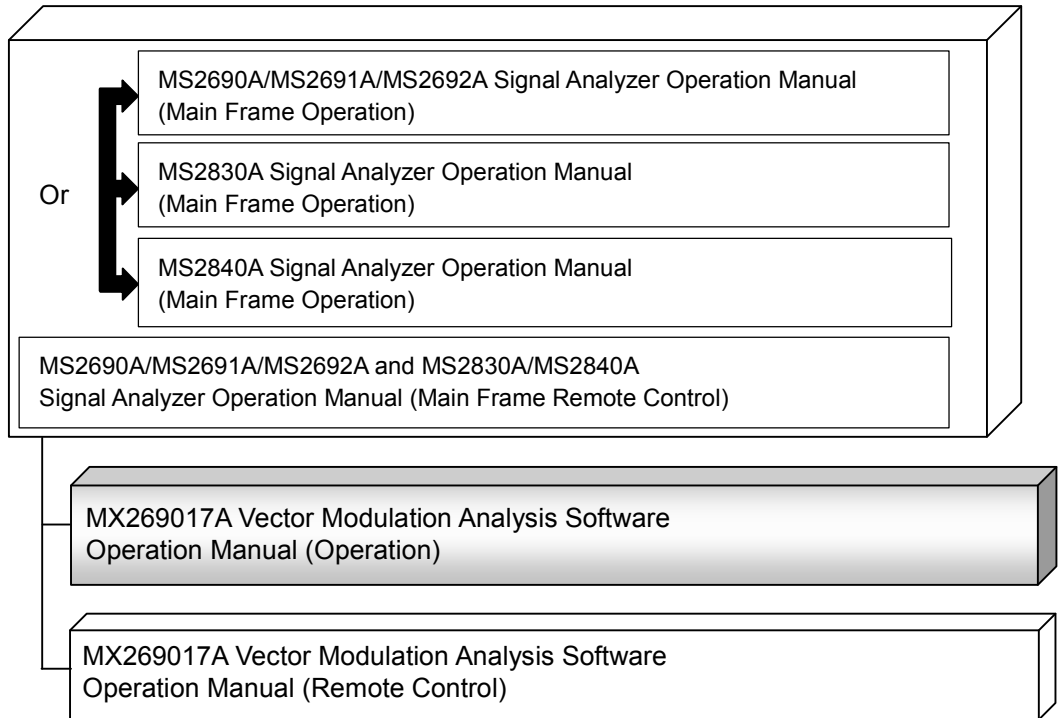
PS:　About main frame

Please contact Anritsu for the latest information on the main frame types that the MX269017A can be used with.

RCM Conformity Marking

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

RCM marking

1. Product Model

Software: MX269017A Vector Modulation Analysis Software

2. Applied Directive and Standards

When the MX269017A Vector Modulation Analysis Software is installed in the MS2690A/MS2691A/MS2692A, MS2830A or MS2840A, the applied directive and standards of this unit conform to those of the MS2690A/MS2691A/MS2692A, MS2830A or MS2840A main frame.

PS: About main frame

Please contact Anritsu for the latest information on the main frame types that the MX269017A can be used with.

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About This Manual

■ **Composition of Operation Manuals**

The operation manuals for the MX269017A Vector Modulation Analysis Software are comprised as shown in the figure below.

MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual
(Main Frame Operation)

MS2830A Signal Analyzer Operation Manual
(Main Frame Operation)

Or

MS2840A Signal Analyzer Operation Manual
(Main Frame Operation)

MS2690A/MS2691A/MS2692A and MS2830A/MS2840A
Signal Analyzer Operation Manual (Main Frame Remote Control)

MX269017A Vector Modulation Analysis Software
Operation Manual (Operation)

MX269017A Vector Modulation Analysis Software
Operation Manual (Remote Control)

- Signal Analyzer Operation Manual (Mainframe Operation)
- Signal Analyzer Operation Manual (Mainframe Remote Control)

These manuals describe basic operating methods, maintenance procedures, common functions, and common remote control of the signal analyzer mainframe.

- Vector Modulation Analysis Software Operation Manual (Operation) <This document>

This manual describes basic operating methods, and functions of the Vector Modulation Analysis Software.

As for signal analyzer hardware and its basic functions and operation outline, refer to "MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Mainframe Operation)", "MS2830A Signal Analyzer Operation Manual (Mainframe Operation)" or "MS2840A Signal Analyzer Operation Manual (Mainframe Operation)" for details.

- Vector Modulation Analysis Software Operation Manual (Remote Control)

This manual describes remote control of the Vector Modulation Analysis Software.

As for signal analyzer application's basic remote control functions and its definitions of common commands, refer to "MS2690A/MS2691A/MS2692A and MS2830A/MS2840A Signal Analyzer Operation Manual (Mainframe Remote Control)".

Convention Used in This Manual

Throughout this document, the use of MS269x Series is assumed unless otherwise specified. If using MS2830A or MS2840A, change MS269xA to read MS2830A or MS2840A.

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Appendix

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Chapter 1 Overview

This chapter provides an overview of the MX269017A Vector Modulation Analysis Software and describes the product configuration.

1

Overview

1.1 Product Overview

The MS269xA, MS2830A or MS2840A Signal Analyzer enables high-speed, high-accuracy, and simple measurements of transmission characteristics of base stations and mobile stations for various mobile communications types. The MS269xA, MS2830A or MS2840A is equipped with high-performance signal analyzer and spectrum analyzer functions as standard, with optional measurement software allowing modulation analysis functionality supporting various digital modulation modes.

The MX269017A Vector Modulation Analysis software is a software option for performing modulation analysis of modulated signals.

The MX269017A provides the following measurement features.

- Modulation accuracy measurement
- Carrier frequency measurement
- Transmitter power measurement

"MS2830A-005/105/006/106/007/009/109" is required to use the MX269017A on MS2830A.

"MS2840A-005/105/006/106/009/109" is required to use the MX269017A on MS2840A.

1.2 Product Configuration

1.2.1 Standard configuration

Table 1.2.1-1 lists the standard configuration of the MX269017A.

Table 1.2.1-1 Standard configuration

Item	Model Name/Symbol	Product Name	Q'ty	Remarks
Application	MX269017A	Vector Modulation Analysis Software	1	
Accessory	—	Installation CD-ROM	1	Application software, operation manual CD-ROM

1.2.2 Applicable parts

Table 1.2.2-1 lists the applicable parts for the MX269017A.

Table 1.2.2-1 Applicable parts

Model Name/Symbol	Product Name	Remarks
W3305AE	MX269017A Vector Modulation Analysis Software Operation Manual (Operation)	English, printed version
W3306AE	MX269017A Vector Modulation Analysis Software Operation Manual (Remote Control)	English, printed version

1.3 Specifications

Table 1.3-1 shows the specifications for the MX269017A.

When MS269xA, MS2830A or MS2840A is used, this software's specification is specified by the condition below, unless otherwise noted.

Attenuator Mode: Mechanical Atten Only

Table 1.3-1 Specifications

Item	Specification				
Common Specifications					
Modulation method	BPSK, QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 64QAM, 256QAM, 2FSK, 4FSK, 2ASK, 4ASK				
Frequency setting range	MX269xA:				

MX269xA sub-table:

Condition				Frequency setting range
Options	Modulation method	Measuring Object	Symbol Rate [symbol/s]	
With 067/167	BPSK QPSK π/4DQPSK 8PSK 16QAM 64QAM 256QAM 2ASK 4ASK	Frame Format	>12.5 M	100 MHz to the upper limit of the main unit
		Non-Formatted (Span Up=On)	>12.5 M	
		Non-Formatted (Span Up=Off)	>35 M	
	2FSK 4FSK	-	>6.25 M	
	O-QPSK	-	>3.125 M	
Without 067/167	BPSK QPSK π/4DQPSK 8PSK 16QAM 64QAM 256QAM 2ASK 4ASK	Frame Format	>12.5 M	100 MHz to 6 GHz
		Non-Formatted (Span Up=On)	>12.5 M	
		Non-Formatted (Span Up=Off)	>35 M	
	2FSK 4FSK	-	>6.25 M	
	O-QPSK	-	>3.125 M	
Other than above				100 kHz to the upper limit of the main unit

Table 1.3-1   Specifications (Cont'd)

Item	Specification				
	MS2830A, MS2840A:				

	Condition				Frequency setting range
	Options	**Modulation method**	**Measuring Object**	**Symbol Rate [symbol/s]**	
Frequency setting range	With 067/167	BPSK QPSK π/4DQPSK 8PSK 16QAM 64QAM 256QAM 2ASK 4ASK	Frame Format	>12.5 M	300 MHz to the upper limit of the main unit
			Non-Formatted (Span Up=On)	>12.5 M	
			Non-Formatted (Span Up=Off)	>35 M	
		2FSK 4FSK	-	>6.25 M	
		O-QPSK	-	>3.125 M	
	Without 067/167	BPSK QPSK π/4DQPSK 8PSK 16QAM 64QAM 256QAM 2ASK 4ASK	Frame Format	>12.5 M	300 MHz to 6 GHz or the upper limit of the main unit, whichever is lower.
			Non-Formatted (Span Up=On)	>12.5 M	
			Non-Formatted (Span Up=Off)	>35 M	
		2FSK 4FSK	-	>6.25 M	
		O-QPSK	-	>3.125 M	
	Other than above				100 kHz to the upper limit of the main unit

Table 1.3-1   Specifications (Cont'd)

Item	Specification
Measurement symbol rate range	MS269xA: Table below MS2830A, MS2840A: Table below

MS269xA:

Modulation method	Measurement symbol rate range [symbol/s]
BPSK QPSK π/4DQPSK 8PSK 16QAM 64QAM 256QAM 2ASK 4ASK	0.1 k to 12.5 M
2FSK 4FSK	0.1 k to 6.25 M

MS2830A, MS2840A:

	Options	
	With 006/106	With 005/105 /007/009
Modulation method	Measurement symbol rate range [symbol/s]	
BPSK QPSK π/4DQPSK 8PSK 16QAM 64QAM 256QAM 2ASK 4ASK	0.1 k to 5 M	0.1 k to 12.5 M
2FSK 4FSK	0.1 k to 2.5 M	0.1 k to 6.25 M

Table 1.3-1 Specifications (Cont'd)

Item	Specification

Model	Options			
MS2830A	**006/106**	**005/105 /007/009**	**007**	**078**
MS2840A	**006/106**	**005/105 009/109**	**077/177**	**078/178**
MS269xA		**Other than the following options**	**077/177**	**004/078 /178**
Modulation method	**Symbol rate setting range [symbol/s]**			
BPSK QPSK π/4DQPSK 8PSK 16QAM 64QAM 256QAM 2ASK 4ASK	0.1 k to 5 M	0.1 k to 35 M (Non-Formatted) 0.1 k to 12.5 M (Frame Formatted)	0.1 k to 70 M (Non-Formatted) 0.1 k to 25M (Frame Formatted)	0.1 k to 140 M (Non-Formatted) 0.1 k to 50 M (Frame Formatted)
2FSK 4FSK	0.1 k to 2.5 M	0.1 k to 6.25 M	0.1 k to 12.5 M	0.1 k to 25 M
O-QPSK	0.1 k to 1.25 M	0.1 k to 3.125 M	0.1 k to 6.25 M	0.1 k to 12.5 M

Symbol rate setting range (left column Item).

Measurement level range	−15 to +30 dBm (at Pre-Amp Off, or Pre-Amp not installed.) −25 to +10 dBm (at Pre-Amp On)

Table 1.3-1 Specifications (Cont'd)

Item	Specification
Modulation/Frequency Measurement	
Measurement level range	–15 to +30 dBm (at Pre-Amp Off, or Pre-Amp not installed.) –25 to +10 dBm (at Pre-Amp On)
Carrier frequency accuracy (BPSK, QPSK, 8PSK, 16QAM, 64QAM, 256QAM, 2FSK, 4FSK)	After CAL execution at 18 to 28°C, For a signal of EVM = 1% **Model / Condition / Carrier frequency accuracy table:** MS269xA — Carrier Frequency: 30 MHz to 6.0 GHz (Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.) — ± (accuracy of reference frequency × carrier frequency + 10 Hz) MS2830A, MS2840A — Carrier Frequency: 30 MHz to 3.5 GHz — ± (accuracy of reference frequency × carrier frequency + 10 Hz)
Carrier frequency accuracy (π/4DQPSK, 2ASK, 4ASK)	After CAL execution at 18 to 28°C, For a signal of EVM = 1% **Model / Condition / Carrier frequency accuracy table:** MS269xA — Carrier Frequency: 30 MHz to 6.0 GHz (Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.) — ± (accuracy of reference frequency × carrier frequency + 10 Hz) MS2830A, MS2840A — Carrier Frequency: 30 MHz to 3.5 GHz — ± (accuracy of reference frequency × carrier frequency + 10 Hz) Carrier Frequency: 5.7 to 5.9 GHz — ± (accuracy of reference frequency × carrier frequency + 10 Hz) (Nominal)

Carrier frequency accuracy (BPSK, QPSK, 8PSK, 16QAM, 64QAM, 256QAM, 2FSK, 4FSK):

Model	Condition	Carrier frequency accuracy
MS269xA	Carrier Frequency: 30 MHz to 6.0 GHz (Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)	± (accuracy of reference frequency × carrier frequency + 10 Hz)
MS2830A, MS2840A	Carrier Frequency: 30 MHz to 3.5 GHz	± (accuracy of reference frequency × carrier frequency + 10 Hz)

Carrier frequency accuracy (π/4DQPSK, 2ASK, 4ASK):

Model	Condition	Carrier frequency accuracy
MS269xA	Carrier Frequency: 30 MHz to 6.0 GHz (Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)	± (accuracy of reference frequency × carrier frequency + 10 Hz)
MS2830A, MS2840A	Carrier Frequency: 30 MHz to 3.5 GHz	± (accuracy of reference frequency × carrier frequency + 10 Hz)
	Carrier Frequency: 5.7 to 5.9 GHz	± (accuracy of reference frequency × carrier frequency + 10 Hz) (Nominal)

Table 1.3-1 Specifications (Cont'd)

Item	Specification
Residual EVM (BPSK, QPSK, 8PSK, 16QAM, 64QAM, 256QAM)	After CAL execution, input at 18 to 28°C, when: Filter Type: Root Nyquist or Nyquist, The signal measured is within the measurement level range and less than or equal to Input Level, and Average = 20 times | Model	Condition	Residual EVM
---	---	---
MS269xA	Symbol rate: 4 to 500 ksps, Measurement time length: 50 ms or lower, Carrier Frequency: 50 to 500 MHz	<0.5% (rms)
	Symbol rate: 500 ksps to 5 Msps, Carrier Frequency: 50 MHz to 6 GHz (Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)	<1.0% (rms)
MS2830A, MS2840A	Symbol rate: 4 to 500 ksps, Measurement time length: 50 ms or lower, Carrier Frequency: 50 to 500 MHz	<1.0% (rms)
	Symbol rate: 500 ksps to 5 Msps, Carrier Frequency: 50 MHz to 3.5 GHz	<1.5% (rms) (Nominal)	
Residual EVM (π/4DQPSK)	After CAL execution, input at 18 to 28°C, when: Filter Type: Root Nyquist or Nyquist, The signal measured is within the measurement level range and less than or equal to Input Level, and Average = 20 times | Model	Condition	Residual EVM
---	---	---
MS269xA	Symbol rate: 4 to 500 ksps, Measurement time length: 50 ms or lower, Carrier Frequency: 50 to 500 MHz	<0.5% (rms)
	Symbol rate: 500 ksps to 5 Msps, Carrier Frequency: 50 MHz to 6 GHz (Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)	<1.0% (rms)
MS2830A, MS2840A	Symbol rate: 4 to 500 ksps, Measurement time length: 50 ms or lower, Carrier Frequency: 50 to 500 MHz	<1.0% (rms)
	Symbol rate: 500 ksps to 5 Msps, Carrier Frequency: 50 MHz to 3.5 GHz	<1.5% (rms)
	Symbol rate: 500 ksps to 5 Msps, Carrier Frequency: 5.7 to 5.9 GHz	<1.5% (rms) (Nominal)	

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Overview

Table 1.3-1   Specifications (Cont'd)

Item	Specification
Modulation/Frequency Measurement (Cont'd)	
Symbol rate error	After CAL execution at 18 to 28°C, according to the 10 MHz common reference*, when: Modulation Type： 2FSK, Filter Type: Gaussian, BT=0.5, Symbol Rate 100 ksps, slot length 160 symbol, The signal measured is within the measurement level range and less than or equal to Input Level, and Average = 10 times MS269xA:　　30 MHz to 6 GHz, 　　　　　　(Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.) MS2830A, MS2840A:　30 MHz to 3.5 GHz, Symbol rate error: <±1.0 ppm
Amplitude Measurement	
Measurement level range	MS269xA: −15 to +30 dBm (at Pre-Amp Off, or Pre-Amp not installed.) −25 to +10 dBm (at Pre-Amp On) MS2830A, MS2840A: −15 to +30 dBm (at Pre-Amp Off, or Pre-Amp not installed.)
Transmitter power accuracy	After CAL execution at 18 to 28°C, input attenuator ≥ 10 dB, The signal measured is within the measurement level range and less than or equal to Input Level. MS269xA:　　30 MHz to 6 GHz, 　　　　　　(Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.) ± 0.6 dB (at Pre-Amp Off, or Pre-Amp not installed.) ± 1.1 dB (at Pre-Amp On) MS2830A, MS2840A: 30 MHz to 3.5 GHz, ± 0.6 dB (at Pre-Amp Off, or Pre-Amp not installed.) Transmitter power accuracy is calculated from an RSS (root summed square) error of the absolute amplitude accuracy and the in-band frequency characteristics.
Power meter measurement	Performs the power meter function of the standard function.

*:　Connect 10 MHz Reference between signal source and signal analyzer.

This chapter describes the preparations required for using the application you are using. Refer to the *MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Mainframe Operation)*, *MS2830A Signal Analyzer Operation Manual (Mainframe Operation)* or *MS2840A Signal Analyzer Operation Manual (Mainframe Operation)* for common features not included in this manual.

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Preparation

2.1 Part Names

This section describes the panel keys for operating the instrument and connectors used to connect external devices. For general points of caution, refer to the *MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Mainframe Operation)*, *MS2830A Signal Analyzer Operation Manual (Mainframe Operation)* or *MS2840A Signal Analyzer Operation Manual (Mainframe Operation)* .

2.1.1 Front panel

This section describes the front-panel keys and connectors.
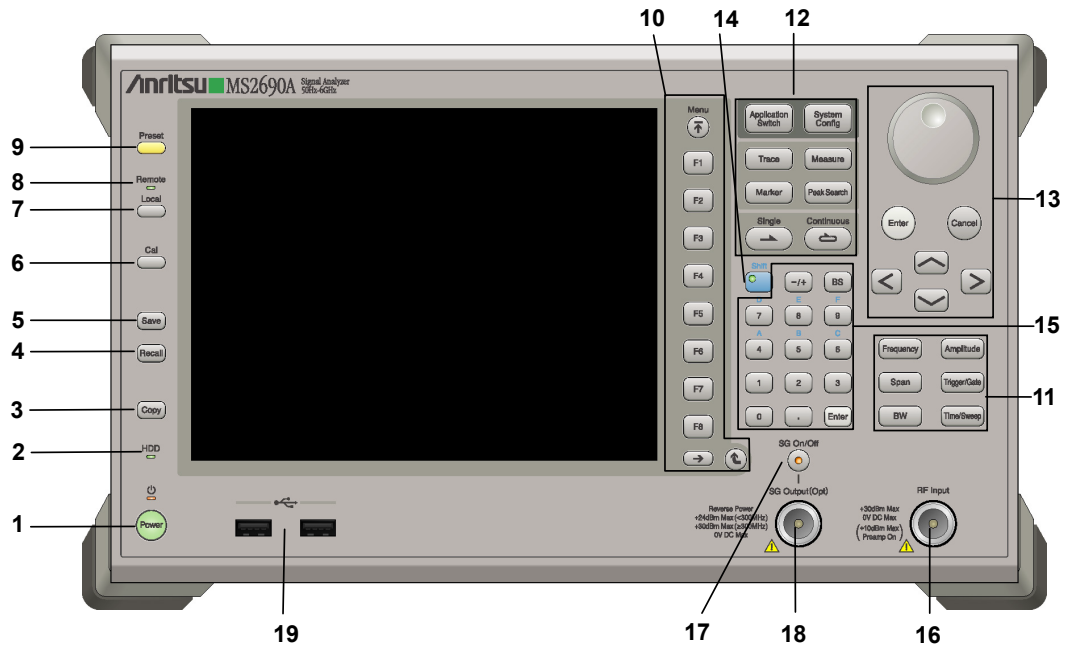
Figure 2.1.1-1   MS269x series front panel
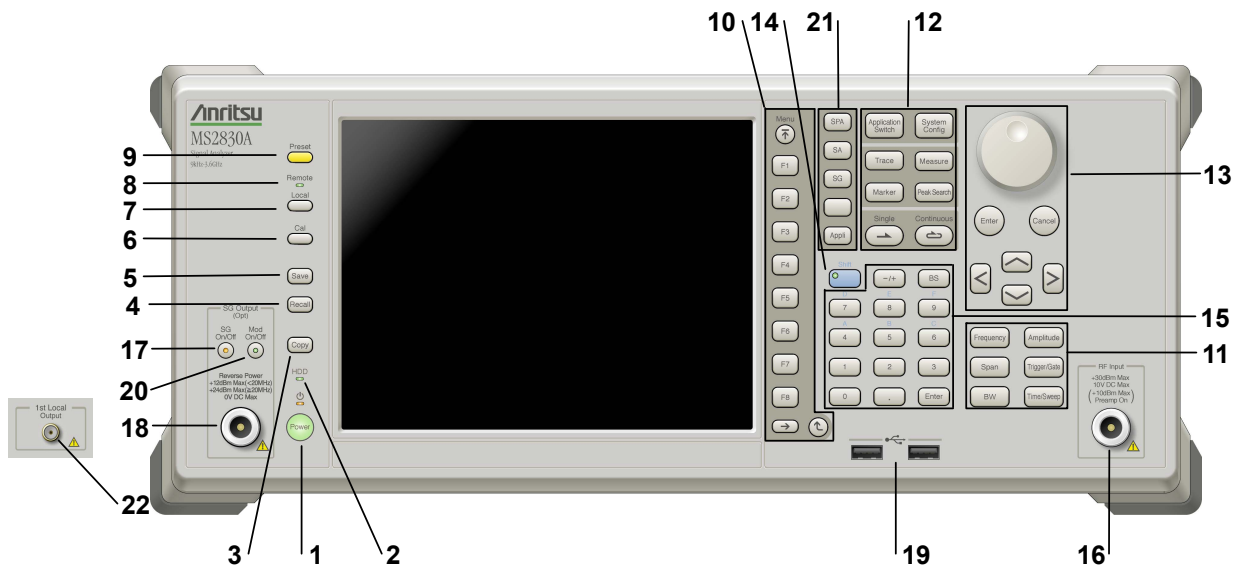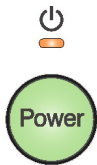
Figure 2.1.1-2   MS2830A/MS2840A front panel

1 ⏻   Power Switch

Power

Press to switch between the standby state (AC power supplied) and power-on state. The Power lamp ⏻ lights orange at Standby and green at Power On. Press the power switch for about 2 seconds.

2 HDD   Hard disk access lamp (MS269x series, MS2830A)

Lights when accessing the internal hard disk.

SSD   SSD access lamp (MS2840A)

Lights when accessing the internal SSD.

3 Copy   Copy key

Press to capture display screen and save to file.

4 Recall   Recall key

Press to recall parameter file.

5 Save   Save key

Press to save parameter file.

6 Cal   Cal key

Press to display the Calibration menu.

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7   Local

Local key

Press to return to local operation from remote control via GPIB, Ethernet, or USB (B), and enable panel settings.

8   Remote

Remote lamp

Lights when in remote-control state.

9   Preset

Preset key

Resets parameters to initial settings.

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Menu

F1

F2

F3

F4

F5

F6

F7

F8

Function keys

Selects or configures function menu displayed on the right of the screen. The function menu is provided in multiple pages and layers.

Press ⟶ to fetch next function menu page. The current page number is displayed at the bottom of the function menu, as in "1 of 2".

Sub-menus may be displayed when a function menu is pressed. Press ⟲ to go back to the previous menu. Press (Menu ⬆) to go back to the top menu.

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Frequency Amplitude

Span Trigger/Gate

BW Time/Sweep

Main function keys 1

Press to set or execute main functions.
Executable functions vary with the current application. When nothing happens with the press, it indicates that the application in use does not support the key.

Frequency Press to set frequency parameters.

Amplitude Press to set level parameters.

Span No function is assigned to this key.

Trigger/Gate Press to set trigger parameters.

BW No function is assigned to this key.

Time/Sweep Press to set measurement item parameters.

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Application Switch System Config

Trace Measure

Marker Peak Search

Single Continuous
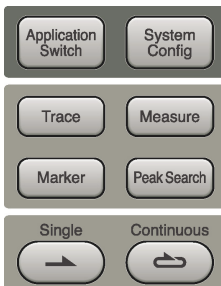
Main function keys 2

Press to set or execute main functions.
Executable functions vary with the current application. When nothing happens with the press, it indicates that the application in use does not support the key.

Application Switch Press to switch application.

System Config Press to display Configuration screen.

Trace Press to set the trace items or to switch the operation window.

Measure Press to set measurement item parameters.

Marker Use when switching graph marker operation.

Peak Search Press to set parameters related to the peak search function.

Single Press to start single measurement.

Continuous Press to start continuous measurements.

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Preparation

13
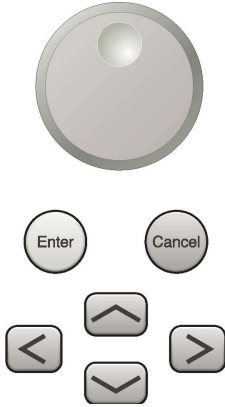
Rotary knob/Cursor key/Enter key/Cancel key

The rotary knob and cursor keys select display items or change settings.

Press (Enter) to set the entered or selected data.

Press (Cancel) to cancel input or selected data.

14

Shift

Shift key

Operates keys with functions in blue characters on panel. Press the Shift key so the key lamp is green and then press the target key.

15
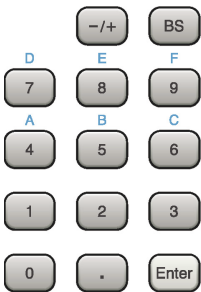
Numeric keypad

Enters numbers on parameter setup screens.

Press (BS) to delete the last entered digit or character.

[A] to [F] can be entered by pressing keys (4) to (9) while the Shift key lamp (Shift) is green.

16
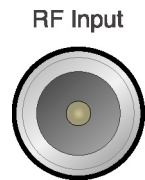
RF Input

RF Input connector

Inputs RF signal. This is an N type input connector.

This is a K type input connector when MS2830A-045, MS2840A-046 is installed.

17

SG On/Off
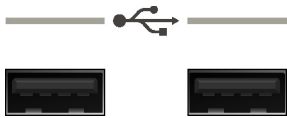
RF Output Control key (when MS269xA-020/120, MS2830A-020/120/021/121 is installed)

Press (SG On/Off) to switch on/off the modulation of RF signal when the Vector Signal Generator option is installed. The RF output control key lamp lights orange when the RF signal output is set to On.

This is not available when MS2830A-044/045, MS2840A-046 is installed.

18

SG Output(Opt)

RF Output connector (when MS269xA-020/120, MS2830A-020/120/021/121 is installed)

Outputs RF signal, when the Vector Signal Generator option is installed. This is an N type output connector.

This is not available when the MS2830A-044/045, MS2840A-046 is installed.

2

Preparation

19

USB connector (type A)

Connect the accessory USB keyboard, mouse or USB memory.

20

Mod
On/Off

Modulation control key (when MS2830A-020/120/021/121 is installed)

Press to switch on/off the modulation of RF signal when the Vector Signal Generator option is installed. The lamp on the key lights up in green in the modulation On state.

This is not available when the MS2830A-044/045, MS2840A-046 is installed.

21

SPA

SA

SG

Appli

Application key (MS2830A, MS2840A only)

Press to switch between applications.

SPA — Press to display the Spectrum Analyzer main screen.

SA — Press to display the Signal Analyzer main screen, when MS2830A-005/105/007/006/106/009/109/077/078 or MS2840A-006/106/009/109 is installed.

SG — Press to display the Signal Generator main screen, when Vector Signal Generator option is installed. (MS2830A only)

This is a blank key. Not used.

Appli — Displays the main screen of the application that is selected using the Application Switch (Auto), or displays that of the pre-selected application (Manual).

For details, refer to 3.5.4 "Changing application layout" in *MS2830A Signal Analyzer Operation Manual (Mainframe Operation), MS2840A Signal Analyzer Operation Manual (Mainframe Operation)*.

22
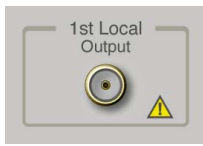
1st Local Output connector (Only for MS2830A, MS2840A)

This is available when MS2830A-044/045, MS2840A-046 is installed. Supplies local signal and bias current to the external mixer, and receives the IF signal with its frequency converted.

2.1.2 Rear panel

This section describes the rear-panel connectors.
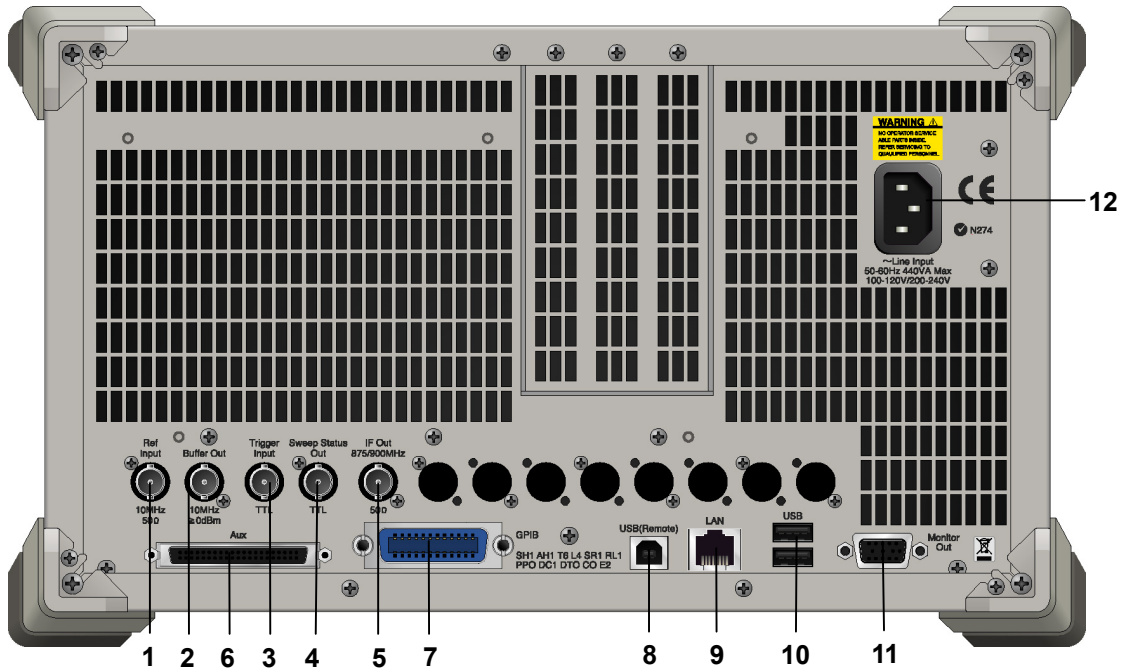
Figure 2.1.2-1   MS269x series rear panel
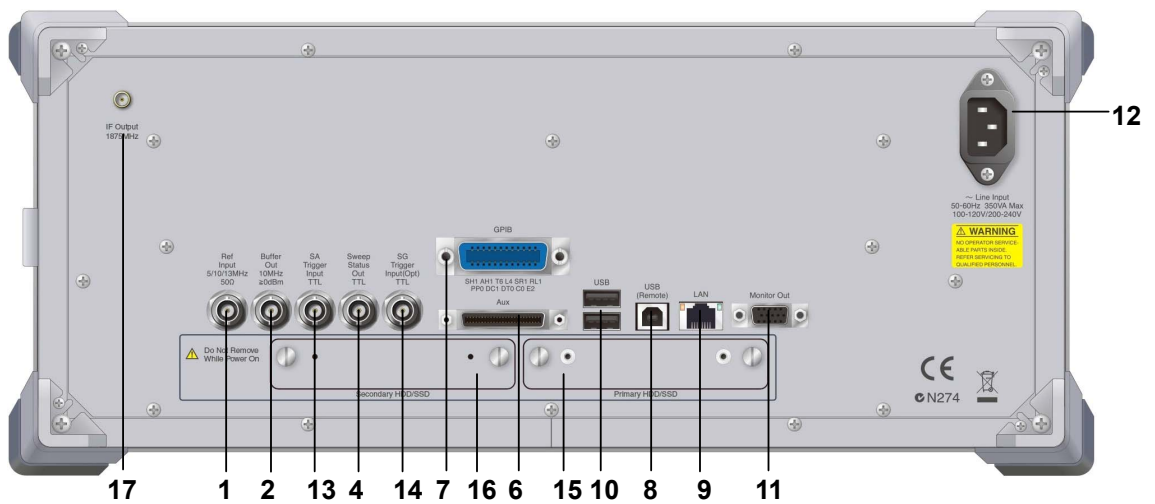
Figure 2.1.2-2   MS2830A/MS2840A rear panel

1

Ref
Input

Ref Input connector (reference frequency signal input connector)

Inputs external reference frequency signal. It is for inputting reference frequency signals with higher accuracy than the instrument's internal reference signal, or for synchronizing the frequency of the MS2690A/MS2691A/MS2692A, MS2830A, or MS2840A to that of other equipment. The following frequencies are supported:

MS269x series: 10 MHz/13 MHz
MS2830A, MS2840A: 5 MHz/10 MHz/13 MHz

2

Buffer Out

Buffer Out connector (reference frequency signal output connector)

Outputs the internal reference frequency signal (10 MHz). It is for synchronizing frequencies between other equipment and the MS2690A/MS2691A/MS2692A, MS2830A, or MS2840A.

3

Trigger
Input

Trigger Input connector (MS269x series only)

Inputs trigger signal from external device.

4

Sweep Status
Out
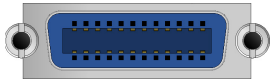
Sweep Status Out connector

Outputs signal when internal measurement is performed or measurement data is obtained.

5

IF Out
875/900MHz

IF Out connector (MS269x series only)

Not used.

6

Aux

AUX connector

Not used.

7

GP-IB

GPIB connector

For external control via GPIB.

8

USB(Remote)

USB connector (type B)

For external control via USB.

9	LAN	Ethernet connector
		Connects PC or Ethernet network.

10	USB	USB connector (type A)
		Used to connect a USB keyboard or mouse or the USB memory supplied.

11	**Monitor Out**	Monitor Out connector
		Connects external display.

12	~Line Input 50-60Hz 440VA Max 100-120V/200-240V	AC inlet
		Supplies power.

13	SA Trigger Input TTL	SA Trigger Input connector (MS2830A, MS2840A only)
		This is a BNC connector for inputting external trigger signal (TTL) for SPA and SA applications.

14	SG Trigger Input(Opt) TTL	SG Trigger Input connector (MS2830A only)
		This is a BNC connector for inputting external trigger signal (TTL) for Vector Signal Generator option.

15 Primary HDD/SSD	HDD slot (MS2830A), SSD slot (MS2840A)
	This is a standard HDD or SSD slot.

16 Secondary HDD/SSD	HDD slot (MS2830A), SSD slot (MS2840A)
	This is a HDD or SSD slot for the options.

17	IF Output	IF output connector (Only for MS2830A, MS2840A)
		Monitor output of the internal IF signal.
		This is available when MS2830A-044/045, MS2840A-046 is installed.

2

Preparation

2.2   Signal Path Setup

As shown in Figure 2.2-1, connect the instrument and the DUT using an RF cable, so that the signal to be tested is input to the RF Input connector. To prevent an excessive level signal from being input, do not input the signal before setting the input level using this application.

RF Input

DUT
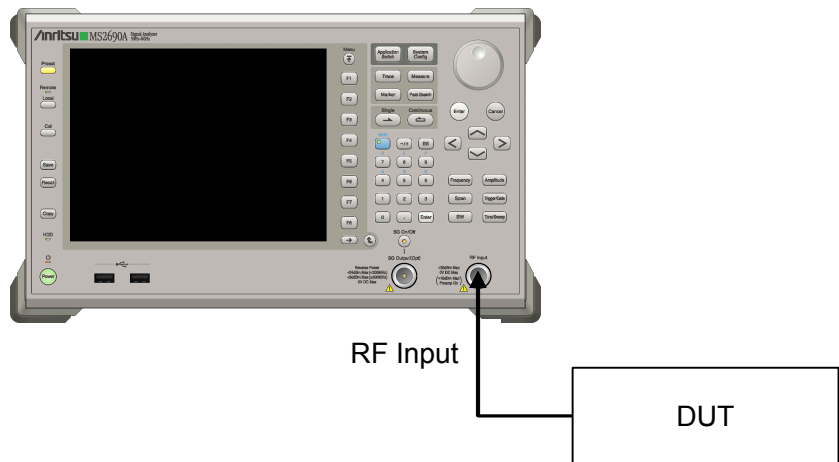
Figure 2.2-1   Signal path setup example

Set the reference signal and/or trigger signal paths from external sources, as required.

Trigger signal (TTL)

Reference frequency signal
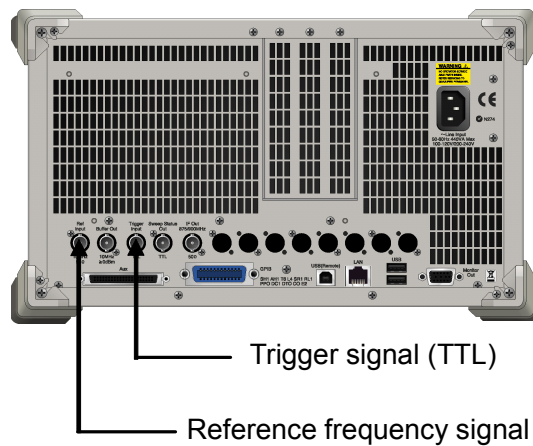
Figure 2.2-2   External signal input

2.3   Application Startup and Selection

To use this application, it is necessary to load (start up) and select the application.

2.3.1   Launching application

The application startup procedure is described below.

Note:

The XXX indicates the application name currently in use.

<Procedure>

1.   Press [System Config] to display the Configuration screen.

2.   Press [F4] (Application Switch Settings) to display the Application Switch Registration screen.

3.   Press [F1] (Load Application Select), and move the cursor to "XXX" in the **Unloaded Applications** list.
If "XXX" is displayed in the **Loaded Applications** list, this means that the application is already loaded.
If "XXX" appears in neither the **Loaded Applications** nor **Unloaded Applications** list, this means that the application has not been installed.

4.   Press [F7] (Set) to load the application. If "XXX" is displayed in the **Loaded Applications** list, this means that the application is already loaded.

2.3.2   Selecting application

The selection procedure is described below.

<Procedure>

1.   Press [Application Switch] to display the Application Switch menu.

2.   Press the menu function key displaying "XXX".

The application can also be selected with mouse, by clicking "XXX" on the task bar.

2.4 Initialization and Calibration

This section describes the parameter settings and the preparations required before starting measurement.

2.4.1 Initialization

After selecting this application, first perform initialization. Initialization returns the settable parameters to their default value in order to clear the measurement status and measurement results.

Note:

When another software application is switched to or this application is unloaded (ended), the application keeps the parameter settings at that time. The parameter values that were last set will be applied when this application is selected next time.

The initialization procedure is as follows.

\<Procedure\>
1. Press ⬭ᴾʳᵉˢᵉᵗ to display the Preset function menu.
2. Press ⬜ F1 (Preset).

2.4.2 Calibration

Perform calibration before performing measurement. Calibration sets the level accuracy frequency characteristics for the input level to flat, and adjusts level accuracy deviation caused by internal temperature fluctuations. Calibration should be performed when first performing measurement after turning on power, or if beginning measurement when there is a difference in ambient temperature from the last time calibration was performed.

\<Procedure\>
1. Press ⬭ᶜᵃˡ to display the Application Cal function menu.
2. Press ⬜ F1 (SIGANA All).

For details on calibration functionality only executable with this instrument, refer to the *MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Mainframe Operation)* ,*MS2830A Signal Analyzer Operation Manual (Mainframe Operation) or MS2840A Signal Analyzer Operation Manual (Mainframe Operation)*.

Chapter 3   Measurement

This chapter describes the measurement function, the parameter contents and the setting methods for the MX269017A.

3

Measurement

3.1 Basic Operation

> *Note:*
>
> This application includes operations that are done using a mouse.

3.1.1 Screen layout

This section describes the screen layout of the MX269017A.
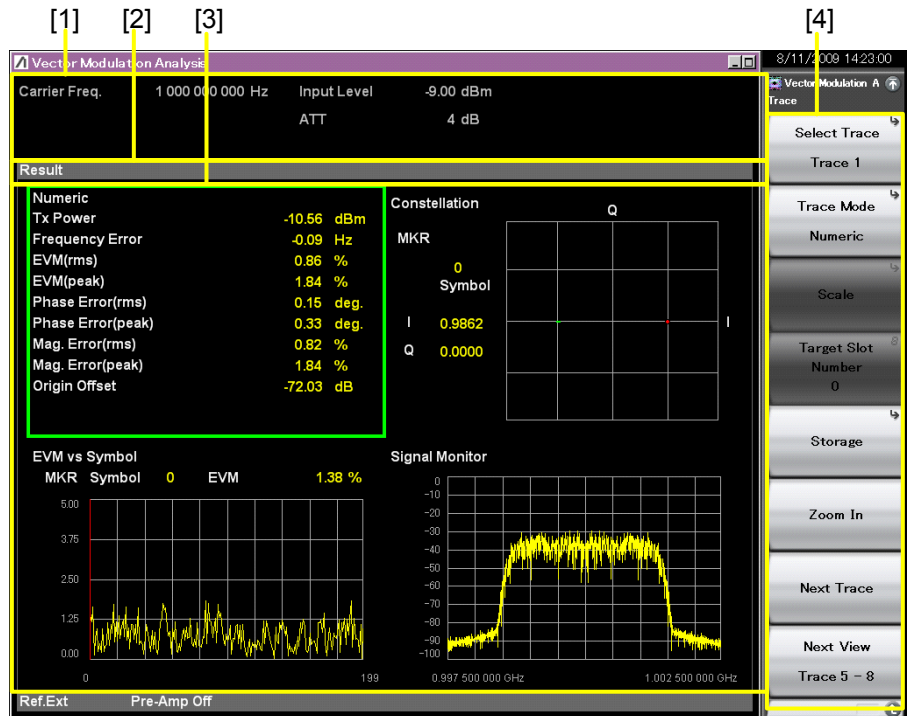
Figure 3.1.1-1   Screen Layout

[1]   Measurement parameter
Displays the specified parameter.

[2]   Status message
Displays signal status.

[3]   Trace window
Displays the measurement results in the form of a four-trace split screen or one-trace screen. For a four-trace split screen, Trace 1 to 4 and Trace 5 to 8 are simultaneously displayed.

[4]   Function menu
Displays the functions executable with function keys.

Figure 3.1.1-2   Trace Window (4-Split Screen)

Figure 3.1.1-3   Trace Window (one-trace screen)

3.1.2　Main function menu

This section describes the main function menu on the main screen.

F1
F2
F3
F4
F5
F6
F7
F8
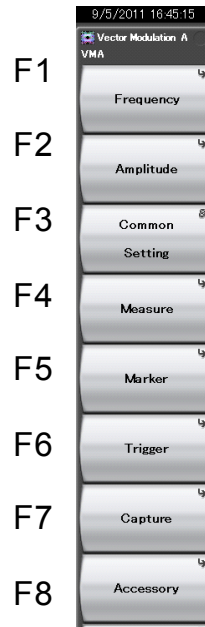
Figure 3.1.2-1　Main Function Menu

Table 3.1.2-1　Main Function Menu

Menu	Function
Frequency	Sets frequency ☞3.2 Setting Frequency
Amplitude	Sets level. ☞3.3 Setting Level
Common Setting	This sets common items. ☞3.4 Setting Common Items
Measure	Sets measurement items. ☞3.5 Setting Measurement Items
Marker	Sets a marker. ☞3.6 Setting markers
Trigger	Sets a trigger. ☞ 3.7 Setting Trigger
Capture	Recalls Capture function menu. ☞3.9 Setting Capture
Accessory	Performs settings for other functions. ☞6.1 Selecting Other Functions

3.1.3   Performing measurement

There are two measurement modes: single and continuous. Measurement is performed once in the single measurement mode, and continuously in the continuous measurement mode.

Single Measurement
The selected measurement items are measured only for the measurement count (Storage Count) before measurement is stopped.

<Procedure>
1.   Press .

Continuous Measurement
The selected measurement items are continuously measured for the measurement count (Storage Count). Measurement will continue even if parameters are changed or the window display is changed. Measurement will be stopped if another application is selected.

<Procedure>
1.   Press .

3

Measurement

3.2 Setting Frequency

Press ⬚ (Frequency) in the main function menu to display the Frequency function menu. Pressing ⬚ displays the Frequency function menu and opens the Carrier Frequency dialog box.

3.2.1 Carrier Frequency dialog box

Carrier Frequency
■Summary

Sets a carrier frequency.

■Setting range

100 kHz to upper limit depending on main unit
Note that this may be limited according to parameters that are dependent on each other.

☞ 3.4.6 Modulation

RF Spectrum
■Summary

Sets whether to reverse the input signal IQ spectrum.

■Setting options

Off: Measures without reversal
On: Measures with reversal

Preselector Auto Tune
■Summary

Auto-tunes preselector. Only available for MS2691A/MS2692A, MS2830A-044/045 or MS2840A-044/046.

☞ 6.1 Selecting Other Functions

Frequency Band Mode
■Summary

Selects frequency band mode (Spurious or Normal). Only available for MS2691A/MS2692A-003, MS2830A-041/043/044/045 or MS2840A-041/044/046. Table 3.2-1 shows the preselector passthrough frequency when the frequency band mode is changed.

Table 3.2-1   Preselector Passthrough Low Frequency

Model	Frequency Band Mode	Preselector Passthrough Frequency
MS2691A/MS2692A	Normal	> 6.0 GHz
	Spurious	≥ 3.0 GHz
MS2830A	Normal	> 4.0 GHz
	Spurious	≥ 3.5 GHz
MS2840A	Normal	> 4.0 GHz
	Spurious	≥ 3.5 GHz

This cannot be selected when Span is 50 MHz or more. (Normal is internally selected.)

Micro Wave Preselector Bypass
■Summary

Disables/enables the preselector bypass. This function is available with MS2692A-067/167, MS2830A-007/067/167 or MS2840A-067/167.

Note that the preselector is bypassed regardless of On/Off status, when Span is set to 50 MHz or more.

■Setting options

Off: Does not bypass preselector.
On: Bypasses preselector

3.2.2   Preselector function menu

In addition, pressing [F7] (Accessory) at the Main function menu displays the Accessory function menu for setting the following preselector items.

☞ 6.1 Selecting Other Functions

Preselector Auto Tune
■Summary

Auto-tunes preselector. Only available for MS2691A/MS2692A, MS2830A-044/045 or MS2840A-044/046.

Manual
■Summary

Manually tunes preselector. Only available for MS2691A/MS2692A, MS2830A-044/045 or MS2840A-044/046.

Preselector Preset
■Summary

Sets to factory shipment defaults.

3

Measurement

3.3 Setting Level

Press 〔F2〕 (Amplitude) in the main function menu to display the Amplitude function menu. Pressing 〔Amplitude〕 displays the Amplitude function menu and opens the Input Level dialog box.

Input Level
■Summary

Sets the input level from the target DUT.

■Setting range

When Pre Amp is On:
(–80.00 + Offset Value) to (10.00 + Offset Value) dBm
When Pre Amp is Off:
(–60.00 + Offset Value) to (30.00 + Offset Value) dBm

Pre-Amp
■Summary

Turns the Pre-Amp function On/Off. Pre-Amp can be set when MS269xA-008/108, MS2830A-008/108/068/168 or MS2840A-008/108/068/168/069/169 is installed.

■Setting options

On, Off

Offset
■Summary

Turns the Offset function On/Off.

■Setting options

On, Off

Offset Value
■Summary

Sets the level offset coefficient.

■Setting range

–99.99 to 99.99 dB

■Setting example

```
┌─────────────────┐     ┌─────────────┐              ┌──────────────────────┐
│ DUT             │     │ Attenuator  │              │ MS269xA, MS2830A,    │
│   40 dBm Output │────▶│   30 dB     │─────────────▶│ or MS2840A           │
│                 │     │             │   10 dBm     │   Input Level   40 dBm│
└─────────────────┘     └─────────────┘              │   Offset Value  30 dB │
                                                     └──────────────────────┘
```
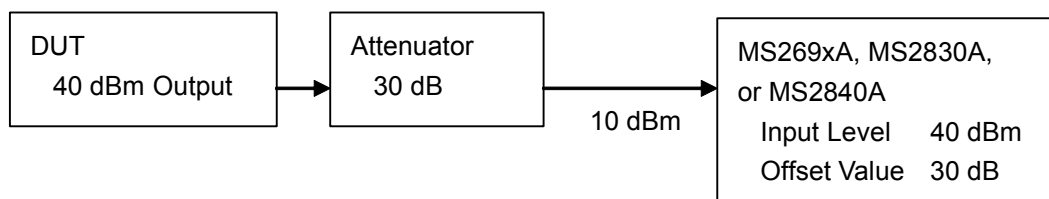
3.4 Setting Common Items

Press [F3] (Common Setting) on the main function menu to display the Common Setting Dialog.

For the common item settings, set the parameters required for modulation wave measurement.

For details about the settings while Replay function is being executed, refer to the following:

☞ 4.2.5 "Characteristics of Replayable IQ Data Files"

Note:

The common item settings require use of a mouse or keyboard.

3.4.1 Common Setting Dialog

This section describes the screen layout of the Common Setting dialog box:
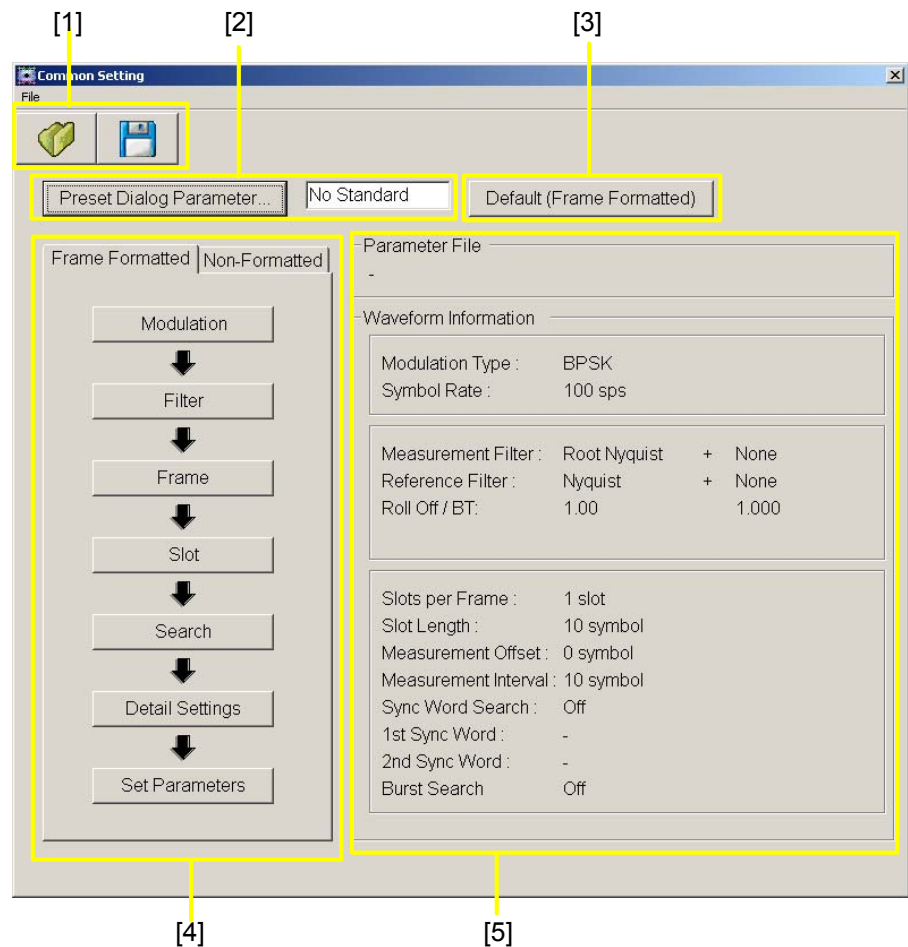
Figure 3.4.1-1   Common Setting Dialog

[1]   Save/Recall button
Saves/recalls the common setting parameters.

☞ 3.4.2 Parameter Save/Recall

[2]   Preset Dialog Parameter button
Recalls the preset parameters.

☞ 3.4.3 Preset Dialog Parameter

[3]   Default button
Changes the values specified for the common setting parameters to the defaults.

☞ 3.4.4 Default

[4]   Parameter setting buttons
Displays the dialog boxes for setting up the parameters.

☞ 3.4.5 Measuring Object
☞ 3.4.6 Modulation
☞ 3.4.7 Filter
☞ 3.4.8 Data
☞ 3.4.9 Frame
☞ 3.4.10 Slot
☞ 3.4.11 Search
☞ 3.4.12 Detail Settings
☞ 3.4.13 Set Parameters

[5]   Displays the value specified for each parameter.
If a parameter is not specified, the value for that parameter is displayed as a hyphen.

Table 3.4.1-1   Description of Parameters

Parameter Name	General Information
Parameter File	Displays the name of the parameter file whose parameters have been recalled.
Modulation Type	Displays the modulation scheme.
Symbol Rate	Displays the symbol rate.
Measurement Filter	Shows the filter setting of the reception signal.
Reference Filter	Shows the filter setting of the reference signal.
Roll Off / BT	Displays the Roll Off rate and/or BT of the measurement filter and reference filter.
Slots per Frame	Displays the number of slots per frame.
Slot Length	Displays the number of symbols per slot.
Measurement Offset	Displays the measurement start position in symbols.
Measurement Interval	Displays the measurement interval.
Sync Word Search	Displays whether sync word search can be executed.
1st Sync Word	Displays the 1st sync word pattern.
2nd Sync Word	Displays the 2nd sync word pattern.
Burst Search	Displays whether burst search can be executed.

3

Measurement

3.4.2   Parameter Save/Recall

How to save parameters to or recall parameters from a file is described below.

Parameter Save

To display Save Parameter File dialog, do one of the followings:

* Press the **Save** button ⊟ in the Common Setting Dialog.
* Select **Save Parameter File** from the **File** menu.
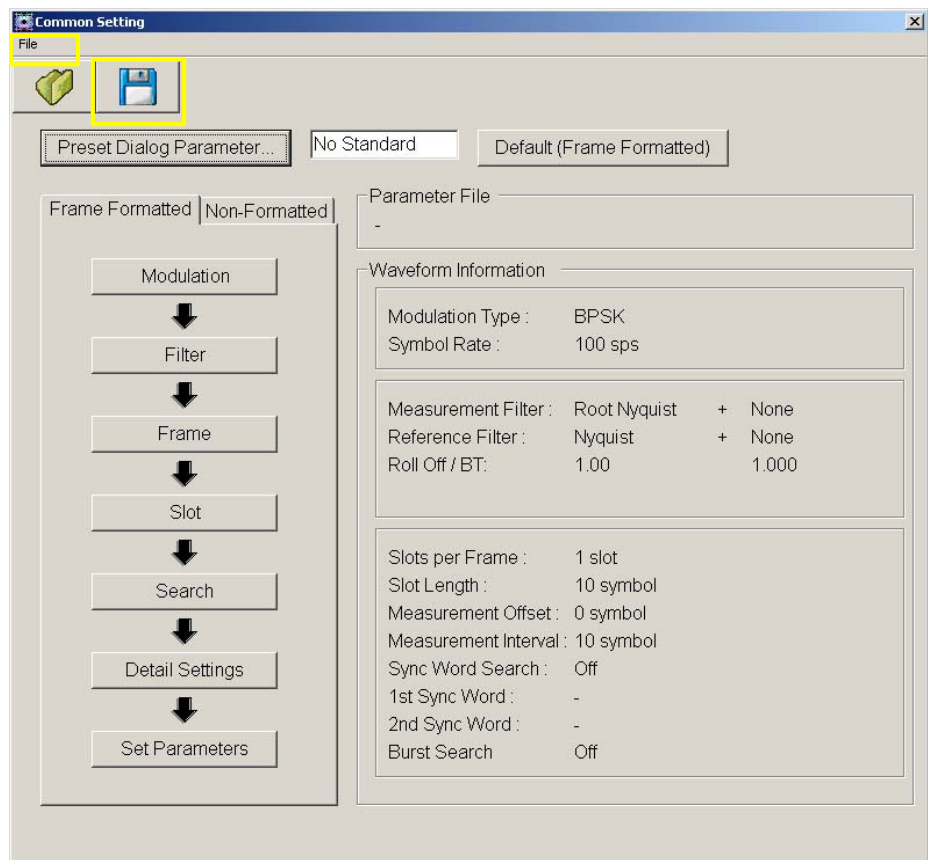
Figure 3.4.2-1   Common Setting Dialog (Save Parameter)

Specify any file name and then press **Save** to save the common setting parameters. The file can be saved at any location.

Recalling Parameter

To display Recall Parameter File dialog, do one of the followings:

- Press the Recall button   in the Common Setting Dialog.
- Select **Recall Parameter File** from the **File** menu.
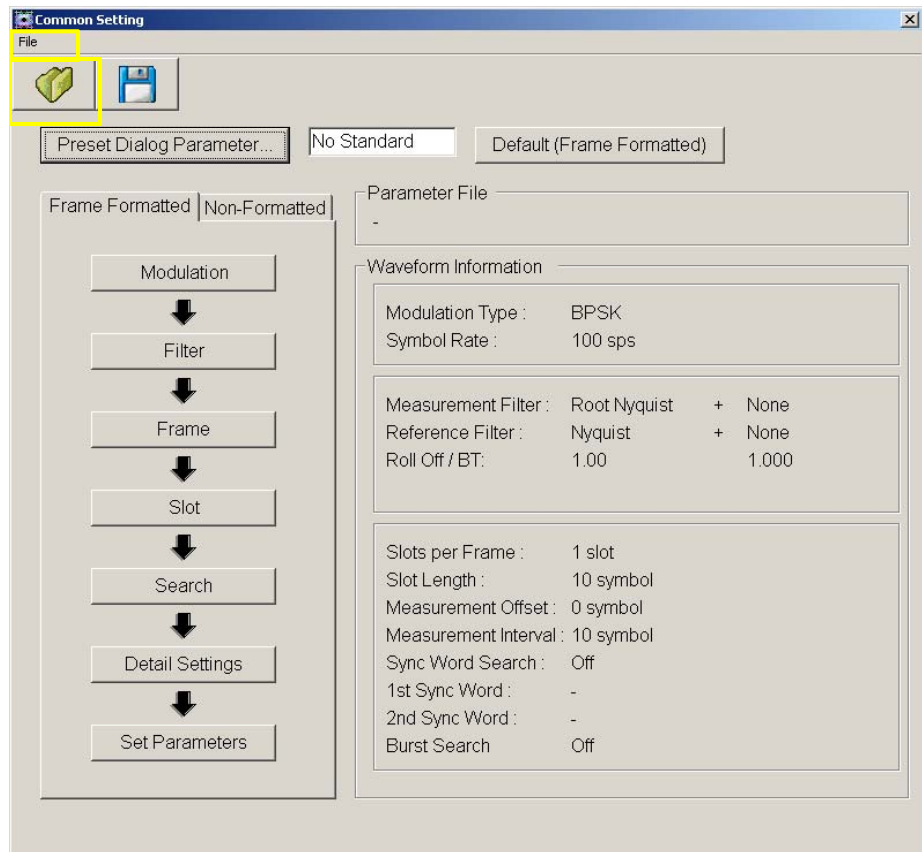
Figure 3.4.2-2   Common Setting Dialog (Recall Parameter)

Specify the file to be recalled and then press **Open** to recall the common setting parameters from the file.

3.4.3 Preset Dialog Parameter

Recall the parameters corresponding to the various standards. Click the **Preset Dialog Parameter** button and select from the parameter sets (Predefined setting values) displayed.

For the standards and parameter values, refer to Appendix C.

☞ Appendix C List of Predefined Setting Values

3.4.4 Default

Change the values of the common setting parameters to the defaults. If **Frame Formatted** is selected for the signal to be measured, change the **Frame Formatted** values to the defaults. If **Non-Formatted** is selected, change the **Non-Formatted** values to the defaults.
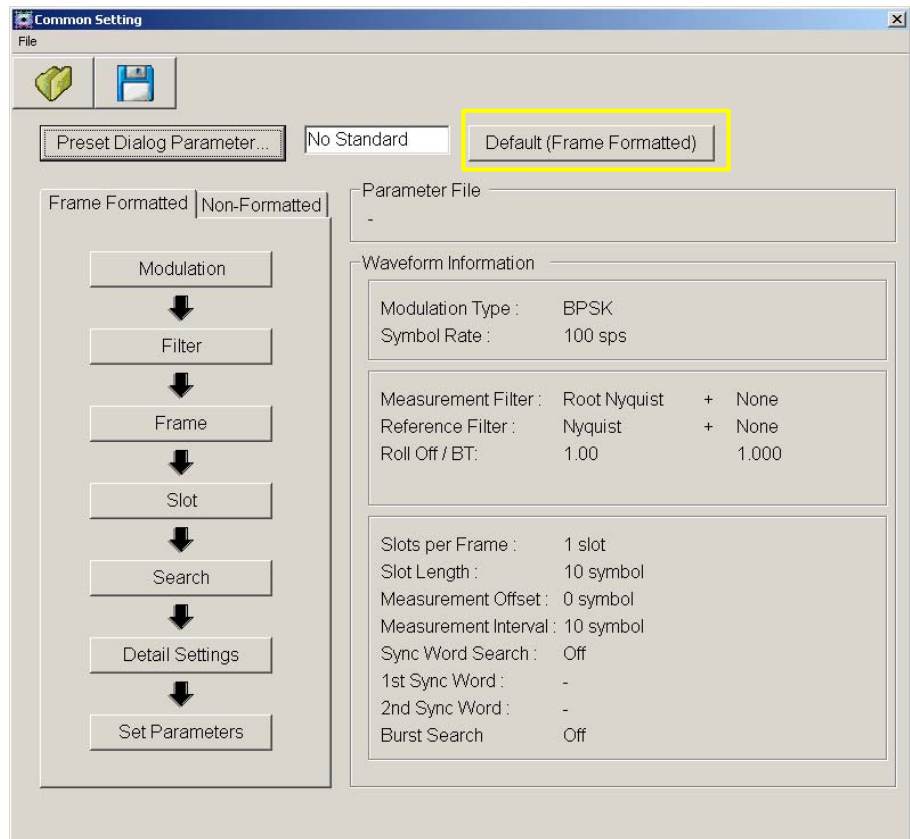
Figure 3.4.4-1   Common Setting Dialog (Default button)

3.4.5   Measuring Object

Select the format of the signal to be measured. If the signal to be measured has a frame structure, which part of the signal to analyze can be specified by setting the frame structure parameters.

■Setting options

Frame Formatted Select this tab if the measured signal has a frame structure.

Non-Formatted   Select this tab if the measured signal does not have a frame structure.

To specify the settings, click the relevant tab in the Common Setting dialog box. If **Non-Formatted** is selected, the Frame, Slot, and Search parameters are not set.
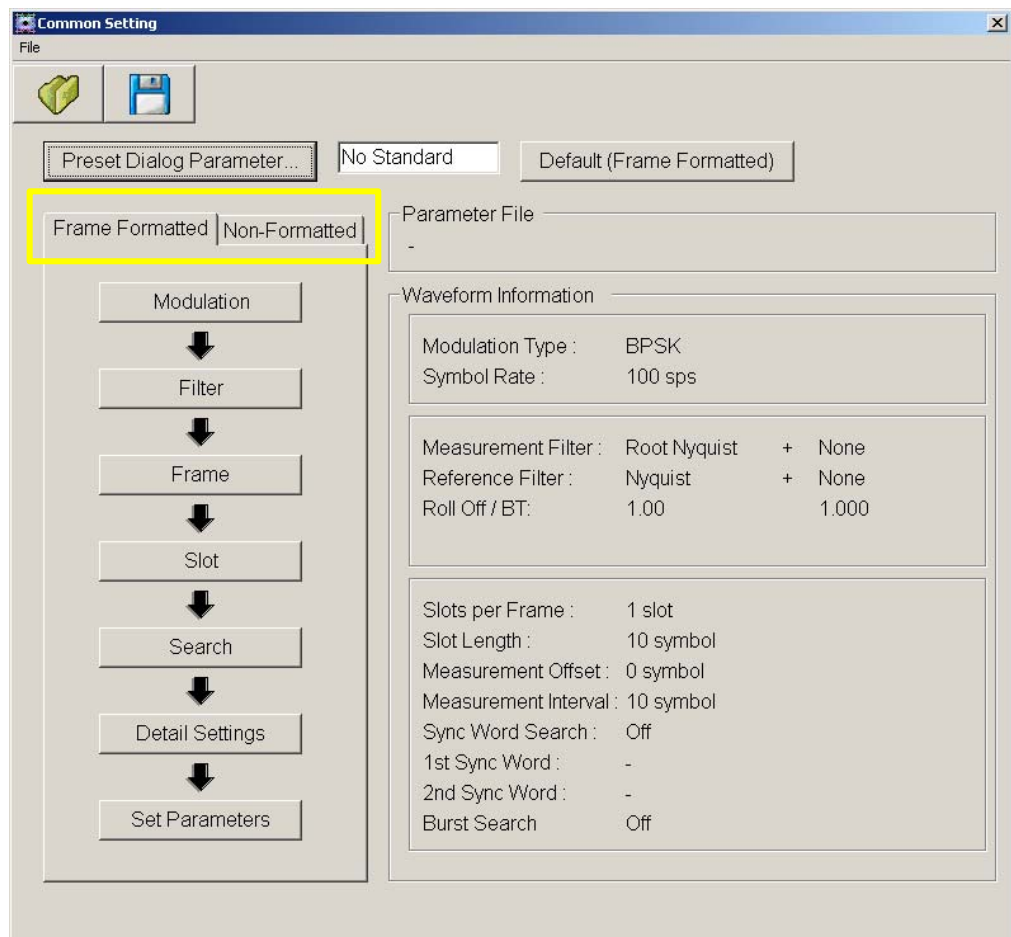
Figure 3.4.5-1   Common Setting Dialog, when Non-Formatted is selected

3.4.6   Modulation

Press the **Modulation** button in the Common Setting dialog box to display the modulation parameter setting dialog box.
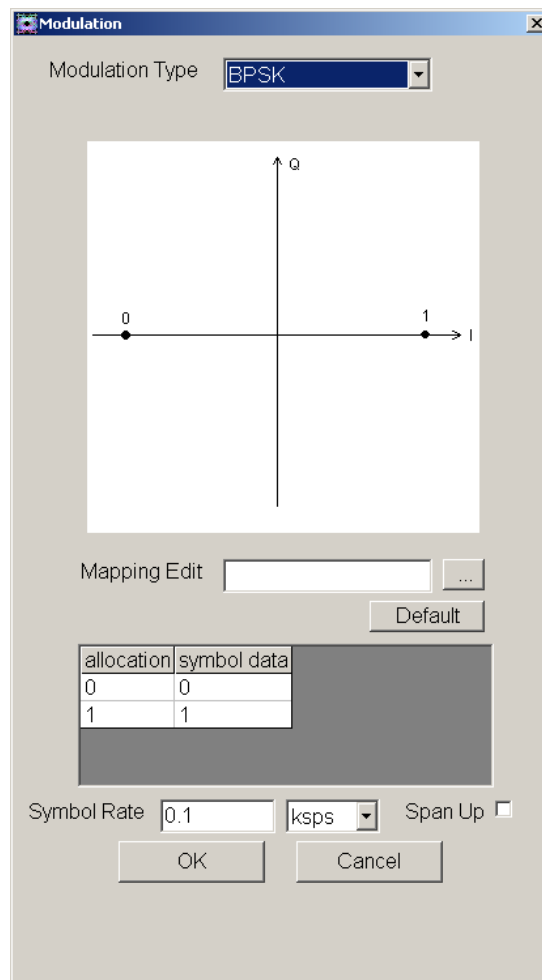
Figure 3.4.6-1   Modulation Parameter Setting Dialog

Modulation Type
■Summary

Select the modulation mode for the measured signal.

■Setting options

BPSK	Measures the signal as a BPSK-modulated signal.
QPSK	Measures the signal as a QPSK-modulated signal.
O-QPSK	Measures the signal as a Offset-QPSK-modulated signal.
PI/4DQPSK	Measures the signal as a π/4DQPSK-modulated signal.

8PSK	Measures the signal as an 8PSK-modulated signal.
16QAM	Measures the signal as a 16QAM-modulated signal.
64QAM	Measures the signal as a 64QAM-modulated signal.
256QAM	Measures the signal as a 256QAM-modulated signal.
2FSK	Measures the signal as a 2-value FSK-modulated signal.
4FSK	Measures the signal as a 4-value FSK-modulated signal.
H-CPM	Measures the signal as a H-CPM-modulated signal. (Used for Inbound measurement of APCO-P25 Phase2)
2ASK	Measures the signal as a 2-value ASK-modulated signal.
4ASK	Measures the signal as a 4-value ASK-modulated signal.

Auto (Deviation Auto Detection)
■Summary

Selects Deviation mode.

■Setting options

Selected	Detects Deviation automatically.
Cleared	Uses a user-specified value as Deviation.

Modulation Index
■Summary

Sets the modulation index for the 2FSK signal.

■Setting range

0.20 to 10.00

Maximum Frequency Deviation
■Summary

Sets the maximum frequency Deviation for the 4FSK signal.

■Setting range

120 to 300000 Hz

3

Measurement

Mapping Edit

■Summary

Mapping Edit is used to change the bit value in the symbol data column corresponding to that in the allocation column from the default setting.

The setting is changed by recalling the file that specifies the bit value in the symbol data column corresponding to that in the allocation column.

For the file format details, refer to "Appendix B.2 Mapping Edit Setting File Description Method".

Mapping Edit function is available when Frame Formatted is selected for Measuring Object.

Symbol Rate

■Summary

Sets the symbol rate of the measured signal.

■Setting range

Table 3.4.6-1 shows the setting ranges. Note the frequency range shall be limited according to the installed options.

■Resolution

0.1 sps

Table 3.4.6-1   Setting Range of Symbol Rate

Model	Options			
MS2830A	**006/106**	**005/105 /007/009**	**077**	**078**
MS2840A	**006/106**	**005/105 /009/109**	**077/177**	**078/178**
MS269xA		**Other than the following options**	**077/177**	**004/078/178**
Modulation type	**Simbol rate setting range [symbol/s]**			
BPSK QPSK π/4DQPSK 8PSK 16QAM 64QAM 256QAM 2ASK 4ASK	0.1 k to 5M	0.1 k to 35 M (Non-Formatted) 0.1 k to 12.5 M (Frame Formatted)	0.1 k to 70 M (Non-Formatted) 0.1 k to 25 M (Frame Formatted)	0.1 k to 140 M (Non-Formatted) 0.1 k to 50M (Frame Formatted)
2FSK 4FSK H-CPM	0.1 k to 2.5 M	0.1 k to 6.25 M	0.1 k to 12.5 M	0.1 k to 25 M
O-QPSK	0.1 k to 1.25 M	0.1 k to 3.125 M	0.1 k to 6.25 M	0.1 k to 12.5 M

Span Up

■Summary

Defines the span width for the symbol rate when **Modulation Type** is other than 2FSK, 4FSK, H-CPM, O-QPSK.

■Setting range

When selected: Wide span width

When not selected: Narrow span width

Span

■Summary

This value is used in the measuring instrument. This value is calculated based on the **Modulation Type** and **Symbol Rate**. It is calculated as follows:

Table 3.4.6-2   When Modulation Type is not 2FSK/4FSK/H-CPM/O-QPSK

Span [Hz]	Symbol Rate (SR) [sps]
1 k	$0.1 \text{ k} \leq \text{SR} \leq 0.5 \text{ k}$
2.5 k	$0.5 \text{ k} < \text{SR} \leq 1.25 \text{ k}$
5 k	$1.25 \text{ k} < \text{SR} \leq 2.5 \text{ k}$
10 k	$2.5 \text{ k} < \text{SR} \leq 5 \text{ k}$
25 k	$5 \text{ k} < \text{SR} \leq 12.5 \text{ k}$
50 k	$12.5 \text{ k} < \text{SR} \leq 25 \text{ k}$
100 k	$25 \text{ k} < \text{SR} \leq 50 \text{ k}$
250 k	$50 \text{ k} < \text{SR} \leq 125 \text{ k}$
500 k	$125 \text{ k} < \text{SR} \leq 250 \text{ k}$
1 M	$250 \text{ k} < \text{SR} \leq 500 \text{ k}$
2.5 M	$500 \text{ k} < \text{SR} \leq 1.25 \text{ M}$
5 M	$1.25 \text{ M} < \text{SR} \leq 2.5 \text{ M}$
10 M	$2.5 \text{ M} < \text{SR} \leq 5 \text{ M}$
25 M	$5 \text{ M} < \text{SR} \leq 12.5 \text{ M}$
31.25 M[1]	$12.5 \text{ M} < \text{SR} \leq 35 \text{ M}$
50 M[2]	$12.5 \text{ M} < \text{SR} \leq 25 \text{ M}$
62.5 M [1]	$35 \text{ M} < \text{SR} \leq 70 \text{ M}$
100 M[2]	$25 \text{ M} < \text{SR} \leq 50 \text{ M}$
125 M[1]	$70 \text{ M} < \text{SR} \leq 140 \text{ M}$

*1: Span Up = Off

*2：Span Up = On

Table 3.4.6-3 When Modulation Type is 2FSK/4FSK/H-CPM

Span [Hz]	Symbol Rate (SR) [sps]
1 k	$0.1 \text{ k} \leq \text{SR} \leq 0.25 \text{ k}$
2.5 k	$0.25 \text{ k} < \text{SR} \leq 0.625 \text{ k}$
5 k	$0.625 \text{ k} < \text{SR} \leq 1.25 \text{ k}$
10 k	$1.25 \text{ k} < \text{SR} \leq 2.5 \text{ k}$
25 k	$2.5 \text{ k} < \text{SR} \leq 6.25 \text{ k}$
50 k	$6.25 \text{ k} < \text{SR} \leq 12.5 \text{ k}$
100 k	$12.5 \text{ k} < \text{SR} \leq 25 \text{ k}$
250 k	$25 \text{ k} < \text{SR} \leq 62.5 \text{ k}$
500 k	$62.5 \text{ k} < \text{SR} \leq 125 \text{ k}$
1 M	$125 \text{ k} < \text{SR} \leq 250 \text{ k}$
2.5 M	$250 \text{ k} < \text{SR} \leq 625 \text{ k}$
5 M	$625 \text{ k} < \text{SR} \leq 1.25 \text{ M}$
10 M	$1.25 \text{ M} < \text{SR} \leq 2.5 \text{ M}$
25 M	$2.5 \text{ M} < \text{SR} \leq 6.25 \text{ M}$
50 M	$6.25 \text{ M} < \text{SR} \leq 12.5 \text{ M}$
100 M	$12.5 \text{ M} < \text{SR} \leq 25 \text{ M}$

Table 3.4.6-4 When Modulation Type is O-QPSK

Span [Hz]	Symbol Rate (SR) [sps]
1 k	$0.1 \text{ k} \leq \text{SR} \leq 0.125 \text{ k}$
2.5 k	$0.125 \text{ k} < \text{SR} \leq 0.3125 \text{ k}$
5 k	$0.3125 \text{ k} < \text{SR} \leq 0.625 \text{ k}$
10 k	$0.625 \text{ k} < \text{SR} \leq 1.25 \text{ k}$
25 k	$1.25 \text{ k} < \text{SR} \leq 3.125 \text{ k}$
50 k	$3.125 \text{ k} < \text{SR} \leq 6.25 \text{ k}$
100 k	$6.25 \text{ k} < \text{SR} \leq 12.5 \text{ k}$
250 k	$12.5 \text{ k} < \text{SR} \leq 31.25 \text{ k}$
500 k	$31.25 \text{ k} < \text{SR} \leq 62.5 \text{ k}$
1 M	$62.5 \text{ k} < \text{SR} \leq 125 \text{ k}$
2.5 M	$125 \text{ k} < \text{SR} \leq 312.5 \text{ k}$
5 M	$312.5 \text{ k} < \text{SR} \leq 625 \text{ k}$
10 M	$625 \text{ k} < \text{SR} \leq 1.25 \text{ M}$
25 M	$1.25 \text{ M} < \text{SR} \leq 3.125 \text{ M}$
50 M	$3.125 \text{ M} < \text{SR} \leq 6.25 \text{ M}$
100 M	$6.25 \text{ M} < \text{SR} \leq 12.5 \text{ M}$

If the Span is 50 MHz or more, then the setting range of the carrier frequency shall be limited as follows:

Table 3.4.6-5   Frequency range if the Span is 50 MHz or more

Model Name	Option	Frequency Range		
MS2690A	-	100 MHz	to	6 GHz
MS2691A	-			
MS2692A	-			
	067/167	100 MHz	to	26.5 GHz
MS2830A-040	-	300 MHz	to	3.6 GHz
MS2830A-041	-	300 MHz	to	6 GHz
MS2830A-043	-	300 MHz	to	13.5 GHz
MS2830A-044	-	300 MHz	to	6 GHz
	067/167	300 MHz	to	26.5 GHz
MS2830A-045	-	300 MHz	to	6 GHz
	067/167	300 MHz	to	43 GHz
MS2840A-040	-	300 MHz	to	3.6 GHz
MS2840A-041	-	300 MHz	to	6 GHz
MS2840A-044	-	300 MHz	to	6 GHz
	067/167	300 MHz	to	26.5 GHz
MS2840A-046	-	300 MHz	to	6 GHz
	067/167	300 MHz	to	44.5 GHz

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3.4.7 Filter

Press the **Filter** button in the Common Setting dialog box to display the filter parameter setting dialog box.
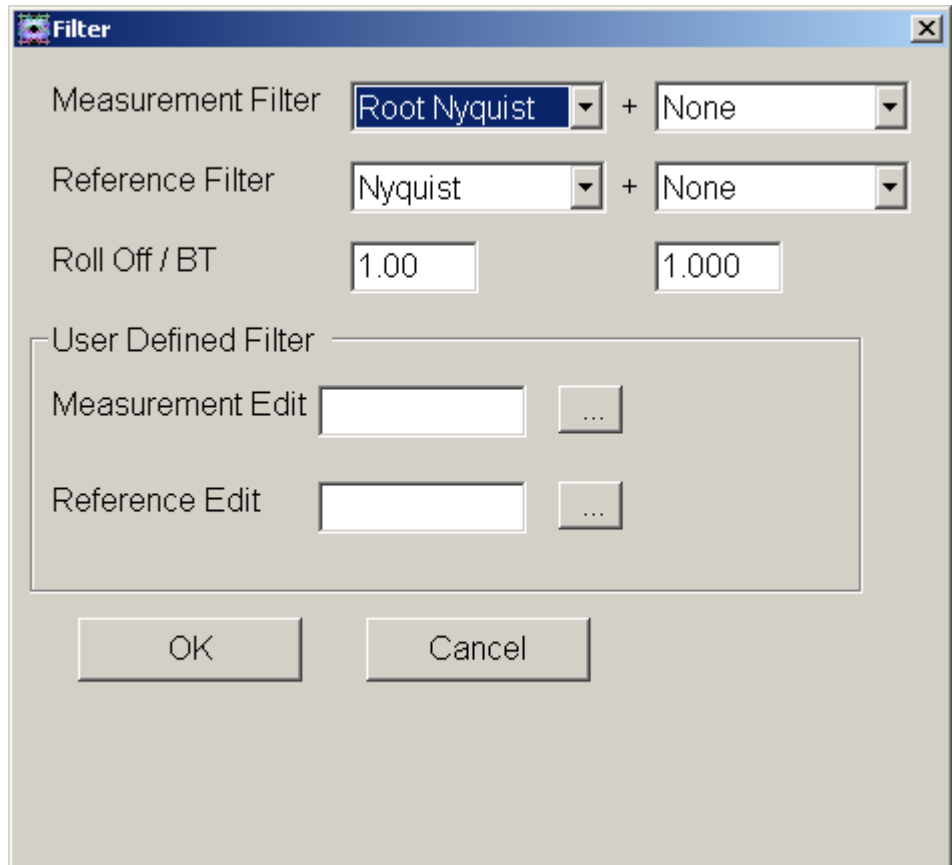
Figure 3.4.7-1   Filter Parameter Setting Dialog

Measurement Filter

■Summary

Sets the reception filter. The Filter Parameter Setting dialog shows the basic filter on the left and the 2nd filter on the right. Displayed characteristics are combined characteristics of 2 filters.

■Setting options

Table 3.4.7-1 Setting Options of Measurement Filter

Filter Type	Modulation Type					
	Other than 2FSK/4FSK /O-QPSK /2ASK/4ASK	O-QPSK	2FSK	4FSK	H-CPM	2ASK /4ASK
Root Nyquist	✓	✓	✓	✓	✓	✓
Nyquist	✓	✓	✓	✓	✓	✓
None	✓	✓	✓	✓	✓	✓
Gaussian	–	–	✓	✓	✓	–
ARIB STD-T98	–	–	–	✓	–	–
Rect	–	–	–	✓	–	–
Inverse Rect	–	–	–	✓	–	–
Inverse Gaussian	–	–	–	✓	–	–
H-CPM_P25	–	–	–	–	✓	–
User Defined	✓	✓	✓	✓	✓	✓

✓: Selectable.

–: Not selectable.

Table 3.4.7-2 Setting Options of 2nd Measurement Filter

Filter Type	Modulation Type					
	Other than 2FSK/4FSK /O-QPSK /2ASK/4ASK	O-QPSK	2FSK	4FSK	H-CPM	2ASK /4ASK
None	✓	✓	✓	✓	✓	✓
Rect	–	–	–	✓	–	–
Inverse Rect	–	–	–	✓	–	–
Inverse Gaussian	–	–	–	✓	–	–

✓: Selectable.

–: Not selectable.

Reference Filter

■Summary

Sets the filter used for the reference signal. The Filter Parameter Setting dialog shows the filter on the left and the 2nd filter on the right. Displayed characteristics are combined characteristics of 2 filters.

For details on Gaussian and Gaussian2 filter, refer to Appendix G "Filter Function".

■Setting options

Table 3.4.7-3   Setting Options of Reference Filter

Filter Type	Modulation Type					
	Other than 2FSK/4FSK /O-QPSK /2ASK/4ASK	O-QPSK	2FSK	4FSK	H-CPM	2ASK /4ASK
Root Nyquist	✓	✓	✓	✓	✓	✓
Nyquist	✓	✓	✓	✓	✓	✓
Gaussian	–	–	✓	✓	✓	✓
Gaussian2	–	–	✓	✓	✓	✓
ARIB STD-T98	–	–	–	✓	–	–
Half-sine	–	✓	–	–	–	–
Rect	–	–	✓	✓	✓	–
H-CPM_P25	–	–	–	–	✓	–
User Defined	✓	✓	✓	✓	✓	✓

✓: Selectable.

–: Not selectable.

Table 3.4.7-4   Setting Options of 2nd Reference Filter

Filter Type	Modulation Type				
	Other than 2FSK/4FSK /O-QPSK	O-QPSK	2FSK	4FSK	H-CPM
None	✓	✓	✓	✓	✓
Half-sine	–	✓	–	–	–

✓: Selectable.

–: Not selectable.

Roll Off / BT

■Summary

This sets the filter roll off ratio (Root Nyquist/Nyquist/ARIB STD-T98) or bandwidth time product. This is applied when Measurement Filter or Reference Filter setting is set to Root Nyquist, Nyquist, ARIB STD-T98, Gaussian or Inverse Gaussian.

■Setting range

0.10 to 1.00 (Filter)
0.100 to 1.000 (2nd Filter)

User Defined Filter

■Summary

When User Defined is set at Measurement Filter or Reference Filter, any filter (user filter) can be used.

For details on user filter and definition filter, refer to Appendix D "User Defined Filter".

Measurement Edit

■Summary

This selects the definition file for the user filter used as the Measurement Filter. If no file is specified, the setting is the same as **Root Nyquist**.

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Reference Edit
■Summary

> This selects the definition file for the user filter used as the Reference Filter. If no file is specified, the setting is the same as **Nyquist**.

Measurement Filter

Measurement filter is used to filter the received signal just before demodulation. Some systems split the pulse-shaping filter between the transmitter and receiver side (ex. Root Nyquist at transmitter and Root Nyquist at receiver) and in this case the filter at the receiver side is the Measurement filter.

Reference Filter

Reference filter is used to filter the reference (no error) signal. It is the total filtering used in the system (transmitter filter plus receiver filter).

Filter and 2nd Filter

For both Measurement Filter and Reference Filter, normally select the type of Filter only and select None for 2nd Filter. Then, the characteristics of Measurement Filter and Reference Filter shall be those set in the Filter Parameter Setting dialog.

If other than None is selected for both Filter and 2nd Filter, then the characteristics of Measurement Filter and Reference Filter are combined characteristics of Filter and 2nd Filter (Figure 3.4.7-2).

```
┌─────────────────────────────────────────────┐
│   ┌──────────┐        ┌──────────┐           │
──→│   Filter   │──→   │ 2nd Filter │──→
│   └──────────┘        └──────────┘           │
└─────────────────────────────────────────────┘
```
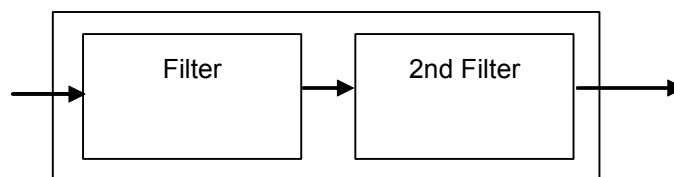
Figure 3.4.7-2   Schematic diagram of Filter and 2nd Filter

On Filter Settings and Measurement

The signal received by the measuring instrument passes through the measurement filter. Next, the signal is demodulated and the bit string of the transmission signal is generated. A symbol data string is generated through symbol mapping from the generated bit string. The symbol data string is then passed through the reference filter, and the resulting signal is used as the reference signal. The difference between the received signal that has passed through the measurement filter and the reference signal is used to calculate the modulation analysis result's EVM, Phase Error and Magnitude Error.

Table 3.4.7-5   Common Measurement and Reference Filter settings

Pulse-shaping Filter used in transmitter	Measurement Filter	Reference Filter
Root Nyquist	Root Nyquist	Nyquist
Nyquist	None	Nyquist
Gaussian	None	Gaussian
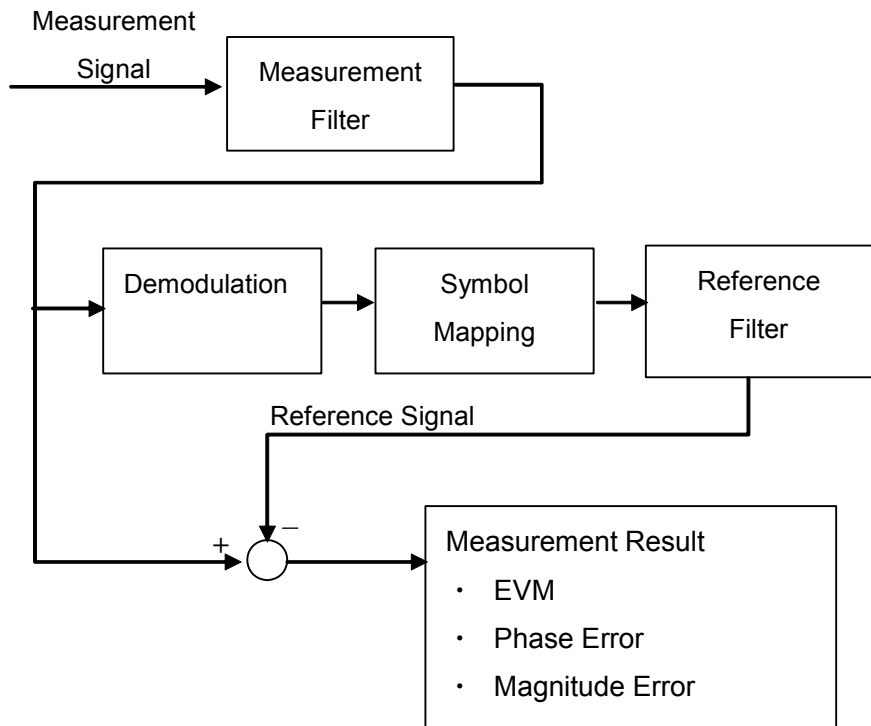
Figure 3.4.7-3   Measurement Block Diagram

3.4.8   Data

Set the interval for measurement. The Data   parameters can be set when **Non-Formatted** has been selected for Measuring Object.

Press the **Data** button in the Common Setting dialog box to display the data parameter setting dialog box.
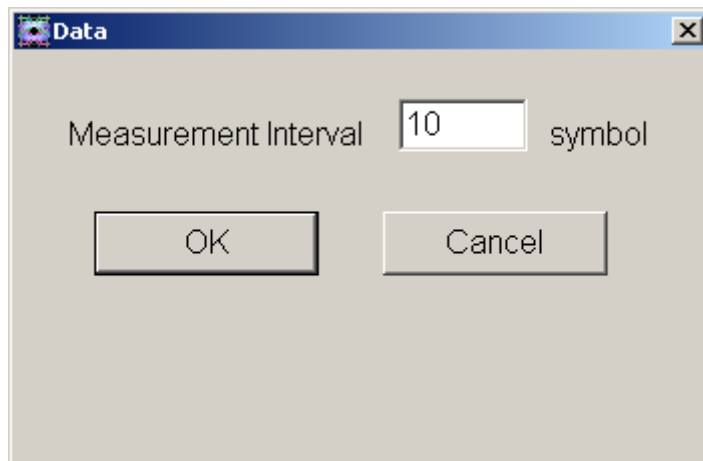
Figure 3.4.8-1   Data Parameter Setting Dialog

Measurement Interval
■Summary

Sets the measurement interval in symbols. Measurement is performed for the symbol interval specified for **Measurement Interval**.

■Setting range

10 to 4096

3.4.9　Frame

The Frame parameters can be set when **Frame Formatted** has been selected for Measuring Object.

Press the **Frame** button in the Common Setting dialog box to display the Frame parameter setting dialog box.
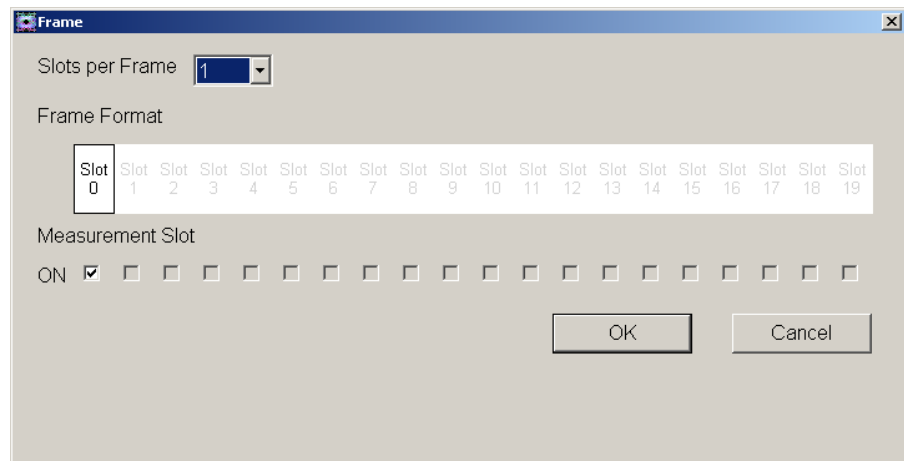
Figure 3.4.9-1　Frame Parameter Setting Dialog

Slots per Frame
■Summary

Sets the number of slots in one frame.

■Setting range

1 to 20

Measurement Slot
■Summary

This specifies the slot to analyze. Select the check box for the slot to be analyzed. If the slot is inactive, clear its check box.

■Setting range

When selected:　　　The target slot will be analyzed.
When not selected:　The target slot will not be analyzed.

3.4.10 Slot

The Slot parameters can be set when **Frame Formatted** has been selected for Measuring Object. Press the **Slot** button in the Common Setting dialog box to display the slot parameter setting dialog box.
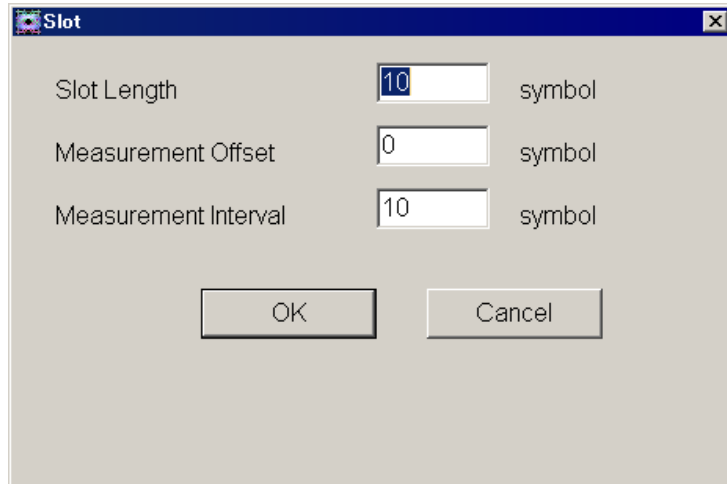
Figure 3.4.10-1   Slot Parameter Setting Dialog

Slot Length
■Summary

Sets the number of symbols in one slot.

■Setting range

10 to 4096

Measurement Offset
■Summary

Sets the start position of the measurement interval in symbols. The reference position of the measurement offset is the first symbol of the slot.

■Setting range

0 to (Slot Length – 10)

Measurement Interval
■Summary

Sets the measurement interval in symbols. The symbol interval set in **Measurement Interval** is displayed as the measurement result.

■Setting range

10 to (Slot Length – Measurement Offset)

■Setting example

When one slot includes 120 symbols and the measured interval is the 110-symbol interval starting at the third symbol.
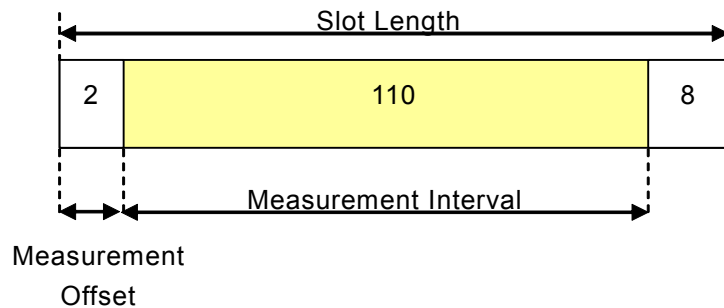
Figure 3.4.10-2   Slot Format Setting Parameter Scheme

Set the parameters in the slot parameter setting dialog box as follows:

- Slot Length = 120
- Measurement Offset = 2
- Measurement Interval = 110
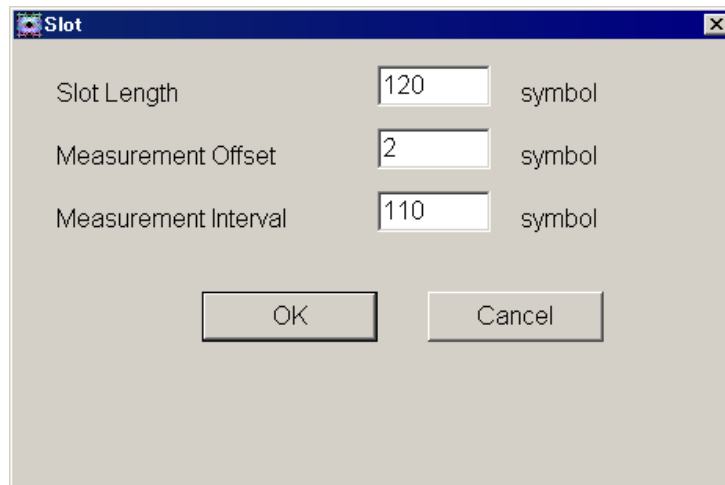
Figure 3.4.10-3   Setting example

3.4.11 Search

Set the Search parameter that determines the symbol positions in the slot. The search parameters can be set when **Frame Formatted** has been selected for Measuring Object.

Press the **Search** button in the Common Setting dialog box to display the search parameter setting dialog box.
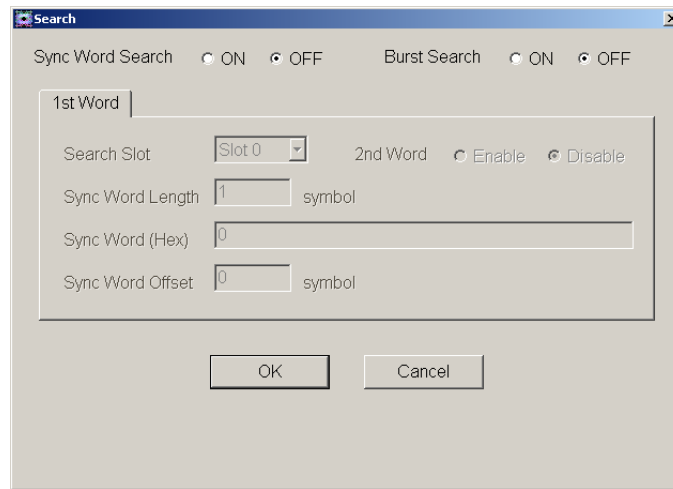
Figure 3.4.11-1   Search Parameter Setting Dialog

Sync Word Search
■Summary

Sets whether to search for a sync word consisting of a specific pattern. This setting is switched on or off by selecting a radio button.

By executing a sync word search, the position of symbols in slots can be accurately detected.

■Setting range
ON, OFF

Burst Search

■Summary

Sets whether to detect burst signals. This setting is switched on or off by selecting a radio button.

Set Burst Search to ON when a burst signal that makes up a ramp between slots is measured. Burst Search executes burst search using (Input Level – 20) dB as the level threshold.

■Setting range

ON	Conducts burst search
OFF	Does not conduct burst search

1st Word/2nd Word

■Summary

Two types of Sync word patterns can be set. The settings on the **1st Word** and **2nd Word** tabs can be switched between.

2nd Word Search

■Summary

Sets whether to detect the **2nd word**. This setting is switched on or off by selecting a radio button. 2nd word detection is executed when detection of the 1st word has failed.

■Setting range

Enable	Conducts 2nd Word search.
Disable	Does not conduct 2nd Word search

Search Slot

■Summary

Sets the number of the slot in which a sync word was detected. Detection starts from the position at which the measured signal was captured, and a slot number is set for the position at which a sync word was first detected. If the same sync word is set in multiple slots, the detected slot number might differ from the actual slot number. To detect the actual slot number, use an external trigger.

■Setting range

Slot numbers for which Measurement Slot is set to ON.

Sync Word Length

■Summary

Sets the length of the sync word in Symbols. The length varies according to the Modulation Type setting and the character number of the input sync word (HEX).

■Setting range

The value for the sync word length needs to satisfy the setting ranges of both Table 3.4.11-1 and Table 3.4.11-2.

Table 3.4.11-1   Setting Range for Sync Word Length

Modulation Type	Setting Range **[symbol]**
BPSK, 2FSK, 2ASK	1 to (128 or Slot Length, whichever smaller)
QPSK, O-QPSK, PI/4DQPSK, 4FSK, H-CPM, 4ASK	1 to (64 or Slot Length, whichever smaller)
8PSK	1 to (42 or Slot Length, whichever smaller)
16QAM	1 to (32 or Slot Length, whichever smaller)
64QAM	1 to (21 or Slot Length, whichever smaller)
256QAM	1 to (16 or Slot Length, whichever smaller)

Table 3.4.11-2   Setting Range for Sync Word Length

Item	Value [symbol]
Maximum	(Number of characters of Sync Word (HEX)) × 4 / (bits per symbol)
Minimum	{(Number of characters of Sync Word (HEX)) – 1) × 4 / (bits per symbol)} + 1

Note:

The decimal point is suppressed.

Table 3.4.11-3   Bits/symbol of Modulation Type

Modulation Type	Bits/Symbol
BPSK, 2FSK, 2ASK	1
QPSK, O-QPSK, PI/4DQPSK, 4FSK, H-CPM, 4ASK	2
8PSK	3
16QAM	4
64QAM	6
256QAM	8

Sync Word (HEX)

■Summary

Sets the sync word. Specify the sync word as a left-aligned hexadecimal value, assuming the first bit in the sync word to be the MSB.

■Setting range

Number of characters: (Sync Word Length) × (bits per symbol)/4, and round it up to the whole number.

Word: 0 to F (HEX)

Sync Word Offset

■Summary

Sets the interval between the first symbol in the slot and the first symbol in the sync word, in symbols.

■Setting range

0 to (Slot Length [Symbol] - Sync Word Length [Symbol])

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3.4.12 Detail Settings

To show Details Settings dialog box, press **Detail Settings** in the Common Setting Dialog.
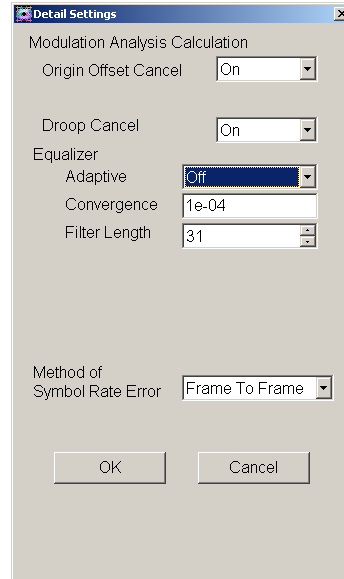
Figure 3.4.12-1   Detail Settings Dialog Box
(When Modulation Type is other than 2FSK/4FSK/H-CPM)

The parameters (Adaptive, Convergence, and Filter Length) for Equalizer can be set when Modulation Type is other than 2FSK, 4FSK, or H-CPM.

Adaptive
■Summary

    Sets Equalizer Mode.

■Setting options

On	Uses Equalizer. The filter factors of Equalizer are updated for each measurement.
Hold	Uses Equalizer. The filter factors are used, without updating from the values used before selecting **Hold**.
Off	Does not use Equalizer.

Convergence
■Summary

    Sets Convergence factor for updating the Equalizer filter.

■Setting range

    1.0e-20 to 1

Filter Length
■Summary

    Sets Filter Length for Equalizer.

■Setting range

11 to 501

Note:

Only an odd number can be set. When an even number is entered, one is added to make it odd.
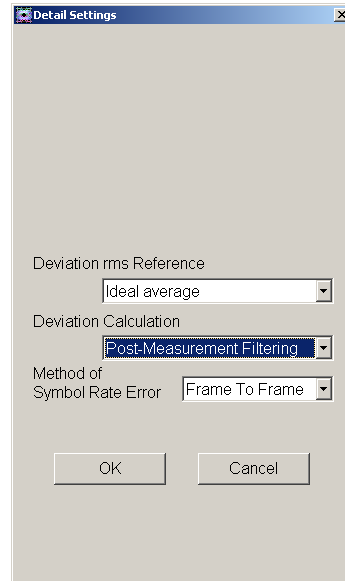
Figure 3.4.12-2   Detail Settings Dialog Box
(When Modulation Type is 2FSK/4FSK)

Deviation Calculation

The parameters for Deviation calculation can be set when Modulation Type is 2FSK or 4FSK.

■Summary

This sets the timing to calculate Deviation when Modulation Type is 2FSK or 4FSK. This parameter becomes available when Modulation Type is **2FSK** or **4FSK**.

■Options

Pre-Measurement Filtering

Calculates Deviation before applying Measurement Filter. Use for measuring frequency shift at 4FSK, based on ARIB STD-T98.

Post-Measurement Filtering

Calculates Deviation after applying Measurement Filter. Use for inputting general FSK modulation signal.

Deviation rms Reference

The parameter for calculating Deviation rms is available when 2FSK is selected as Modulation Type and Deviation Auto is OFF.

■Summary

Sets reference value to calculate Deviation rms.

■Options

Ideal average

Calculates Deviation Error with signal deviation average as reference.

Nominal settings

Calculates Nominal Deviation from Symbol Rate and Modulation Index.
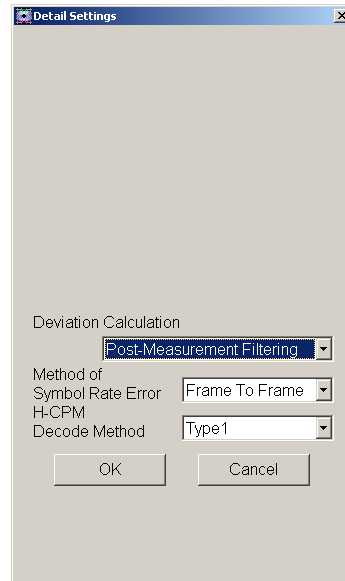
**Figure 3.4.12-3   Detail Settings Dialog Box
(When Modulation Type is H-CPM)**

H-CPM Decode Method
When H-CPM is selected as Modulation Type, the parameter for
calculating ideal signal is available.
■Summary
    Sets decode method for calculating ideal signal when Modulation
    Type is H-CPM.

■Options
    Type1

        Decodes by ISI (intersymbol interference) reduction filter.
        Reduces ISI generated by H-CPM transmission filter
        specified in TIA102.BBAA, and obtains the original signal
        information. Usable only for small error signal.
    Type2

        Decodes by Vitabi. On interval of 14 symbols is required
        before and after the analysis interval.
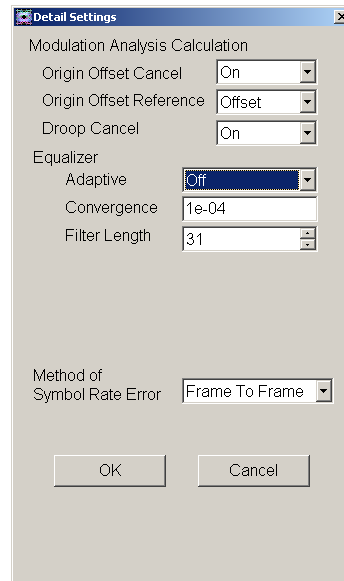
Figure 3.4.12-4   Detail Settings Dialog Box
(Origin Offset Cancel)

Origin Offset Cancel

The parameters related to Origin Offset calibration can be set.

■Summary

Sets the operation mode of Origin Offset Cancel.

■Options

On   Calibrates Origin Offset. The effect caused due to
            Origin Offset is removed from the measurement
            results.

Off   Does not calibrate Origin Offset.

Origin Offset Reference

When Modulation Type is set to O-QPSK, the parameters related to
Origin Offset calculation criteria can be set.

■Summary

Sets calculation criteria for Origin Offset measurement.

■Options

Offset   Combined power with IQ symbol time shifted by 0.5
            symbol.

Actual   IQ power of actual signals.
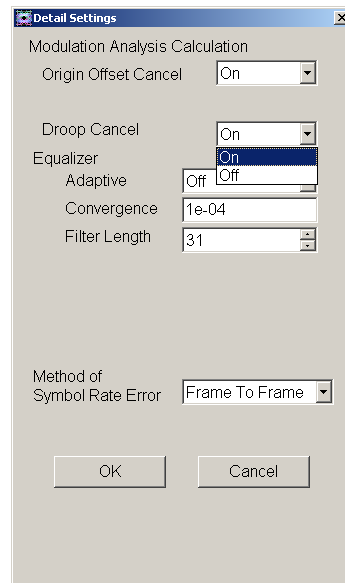
**Figure 3.4.12-5　Detail Settings Dialog Box
(Droop Cancel)**

Droop Cancel

The parameters related to Droop Cancel can be set.

■Summary

　　Sets the operation mode of Droop Cancel.

■Options

　　On　　　　Performs Droop Cancel, and removes the effect caused
　　　　　　　due to Droop from the measurement results. (Default)
　　Off　　　　Does not perform Droop Cancel.
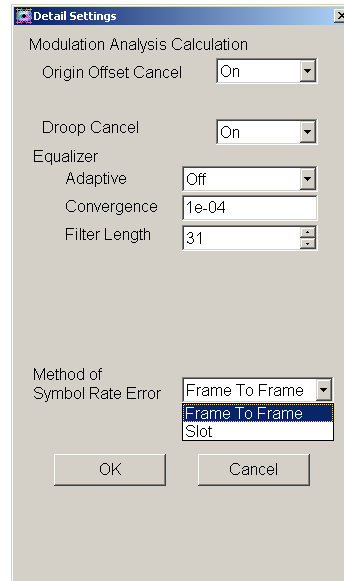
**Figure 3.4.12-6   Detail Settings Dialog Box
(Method of Symbol Rate Error)**

Method of Symbol Rate Error
The parameter related to the Symbol Rate Error measurement mode is
set.

■Summary

Sets the Symbol Rate Error measurement mode.

■Options

Frame To Frame

Searches Sync Word per frame and calculates Symbol
Rate Error from the time difference among frames.
Capture Interval should be set to 10 Frame.

Slot   Detects symbol timings within one slot and calculates
Symbol Rate Error from the temporal change of the
symbol timings. Can perform measurement without
using Sync Word.

☞ 3.9.2 Setting capture interval

3.4.13 Set Parameters

Here you confirm the parameters set so far.

To confirm the parameter change, press **Set Parameters** in the **Common Setting Dialog**. The **Common Setting Dialog** closes when **Set Parameters** is pressed.

While the Common Setting dialog box is displayed, the setting of each parameter is not applied.

To cancel the parameter change, do one of the followings:

- Press the [F8] Close key.
- Select **Close** from the **File** menu.
- Click the close button at the top right of the Common Setting dialog box.

If the parameter settings were canceled, the settings from before the Common Setting dialog box was opened are maintained.
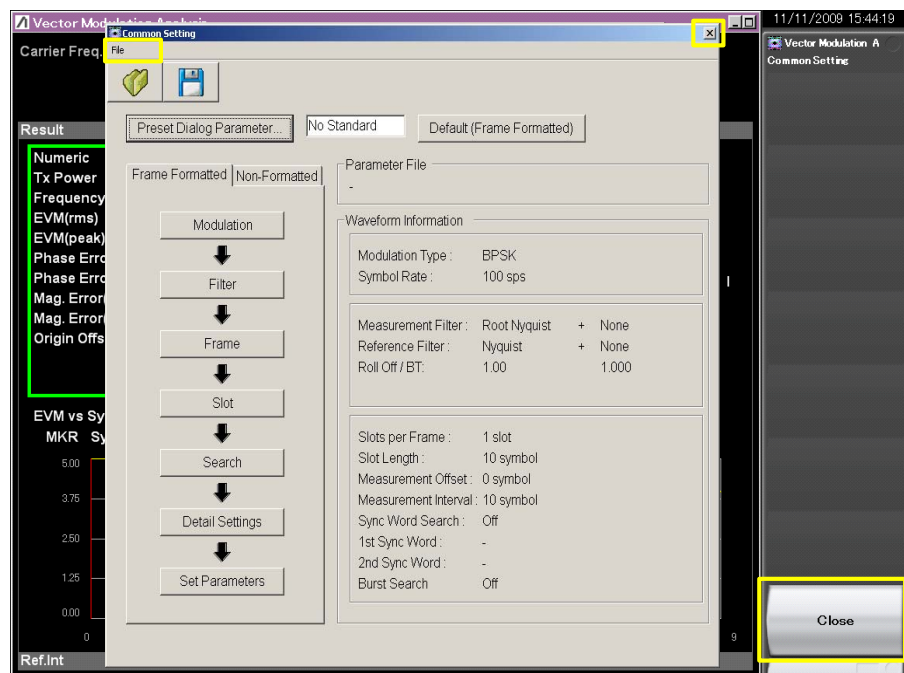
Figure 3.4.13-1   Cancelling Parameter Settings

3.5   Setting Measurement Items

Pressing [F4] (Measure) on the main function menu or [Measure] displays the Measure function menu.

3.5.1   Modulation Analysis

Pressing [F1] (Modulation Analysis) on the Measure function menu displays the Modulation Analysis function menu.

F1

F2

F3

F4

F5

F6

F7

F8
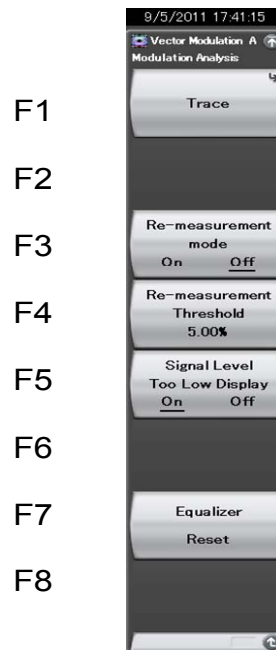
Figure 3.5.1-1 Modulation Analysis function menu

Table 3.5.1-1   Modulation Analysis Function Menu

Menu	Function
Trace	Opens the Trace menu. ☞ 3.5.1.1 Trace
Re-measurement Mode	Set the re-measurement mode. ☞ 3.5.1.2 Re-measurement mode
Re-measurement Threshold	This command sets the threshold value when the re-measurement mode is active. ☞ 3.5.1.2 Re-measurement mode
Signal Level Too Low Display	Turns on/off the Signal Level Too Low display. ☞ 3.5.1.3 Signal Level Too Low Display
Equalizer Reset	Initializes filter factors of Equalizer. ☞ 3.5.1.4 Equalizer Reset

3.5.1.1 Trace

Pressing 〔F1〕 (Trace) on the Modulation Analysis function menu or 〔Trace〕 displays the Trace function menu.

Figure 3.5.1.1-1   Trace Function Menu

Table 3.5.1.1-1   Trace Function Menu

Menu	Function
Select Trace	Sets the trace area to be manipulated.
Trace Mode	Sets the measurement result to be displayed in the trace area.
Scale	Sets the scale of the graph results.
Target Slot Number	Sets the slot number for analysis.
Storage	Sets the storage mode.
Zoom In/Zoom Out	Switches the number of trace areas to display between 1 and 4.
Next Trace	Switches the trace area to be manipulated.
Next View	If a 4-trace split screen is displayed, switches between Traces 1 to 4 and Traces 5 to 8.
(Page 2)	
Result Select	Switches the measurement items to be displayed as numeric results.
Custom Numeric Setting	Selects the items to display in the custom numeric.
Specific Word Setting	Sets the position of the specific word to analyze.
BER Setting	Sets BER.
Numeric Only	Displays numeric results only, without plotting them in a graph.

3

Measurement

Select Trace

■Summary

Sets the trace area to be manipulated. The trace area to be manipulated is enclosed in a green frame.

■Setting options

Trace 1 to Trace 8

Trace Mode

■Summary

Sets the measurement result to be displayed in the trace area to be manipulated.

☞ 3.8 Trace Mode

Scale

■Summary

Sets the scale of the graph result in the trace area to be manipulated. The scale setting for the measurement results selected in Trace Mode is displayed.

☞ 3.8 Trace Mode

Target Slot Number

■Summary

Set the slot number for displaying analysis results. This parameter can be set when **Frame Formatted** has been selected for Measuring Object.

☞ 3.4.9 Frame

■Setting options

Slot number for which Measurement Slot has been set to ON.

☞ 3.4.9 Frame

Storage

■Summary

Sets the storage mode.

■Setting options

Mode	Sets the storage mode.
Count	Sets the number of measurements.

Storage: Mode

■Summary

Sets whether to update the data at every measurement or display the average value.

■Setting options

Off	Updates the data every time it measures.
Average	Displays average every time it measures.
Average & Max	Displays average and maximum value every time it measures.

Storage: Count

■Summary

Sets the number of measurements.

■Setting range

2 to 9999

Zoom In/Zoom Out

■Summary

Sets whether to display the measurement result in four-trace split screen or one-trace screen.

■Setting options

Zoom In	Displays a one-trace screen to be manipulated.
Zoom Out	Displays a four-trace split screen to be manipulated.

Next Trace

■Summary

Switches to the next trace.

When manipulating Trace 1, executing this command switches to Trace 2. If manipulating Trace 8, Trace 1 is switched to.

Next View

■Summary

If a 4-trace split screen is displayed, the displayed traces are switched between Traces 1 to 4 and Traces 5 to 8.

■Setting options

Trace 1 - 4	Switches the displayed traces to Traces 1 to 4.
Trace 5 - 8	Switches the displayed traces to Traces 5 to 8.

3

Measurement

Result Select

■Summary

Switches measurement items to be displayed as numeric results when selecting Zoom Out.

Other than 2FSK/4FSK/O-QPSK:

Selects EVM or MER as measurement items to be displayed.

2FSK/4FSK: Selects FSK or Fidelity.*

*:   Selects either Linear or IQ to display the Constellation screen and Eye Diagram screen.

Custom Numeric Setting

■Summary

Selects the items to display in the custom numeric on the trace screen.

■Setting options

Result 1 - 7   Selects the analysis results to display in numerical values.

Bar Graph Result 1 - 2   Selects the analysis results to display in graph.

■User Name

Inputs user name when changing the item name of the analysis result to display. (Up to 16 characters)

■Min

Sets the minimum value in bar graph.

■Max

Sets the maximum value in bar graph.

■Unit

Sets the unit in bar graph.

Specific Word Setting

■Summary

Sets the position to analyze the specific word.

■Slot Number

Sets the slot number to analyze the specific word. (0 to 19)

■Top Position

Specifies the head position of the specific word in the slot to analyze. (1 to 4097 – Word Width)

■Word Width

Sets the word width of the specific word. (1 to 32)

BER Setting

■Summary

Sets the BER measurement.

Note:

- The BER function is unavailable when the Sync Word Search is Off.
- The BER function is available only when Frame Formatted is selected for Measuring Object.

☞ 3.4.5 Measuring Object

■BER

On   Sets the BER measurement to On.

Off   Sets the BER measurement to Off.

■BER Pattern

Selects a test pattern to use for the BER measurement.

For details of the test patterns, refer to Appendix E.

☞ Appendix E BER Pattern

■Slot Number

Sets the slot number to perform the BER measurement.

Numeric Only

■Summary

Displays numeric results only, without plotting them in a graph.

If a graph is not required, this helps improve the measurement speed.

■Setting options

On   Displays numeric results only.

This is available only when Trace Mode is Numeric or Custom Numeric.

Off   Displays numeric results and also plots them to a graph. (Default)

This is available, regardless of Trace Mode.

3

Measurement

3.5.1.2 Re-measurement mode

Pressing [F3] (Re-measurement mode) at the Modulation Analysis function menu sets the Re-measurement mode On and Off.
When the Re-measurement mode is On, when the next measurement exceeds the threshold value, re-measurement is performed automatically once only.

Table 3.5.1.2-1 Measurement result used for judgement

Modulation	Measurement Result
Other than 2FSK/4FSK	EVM (peak)
2FSK/4FSK	FSK Error (peak)

The threshold value is set by pressing [F4] (Re-measurement Threshold).

3.5.1.3 Signal Level Too Low Display

Pressing [F5] (Signal Level Too Low Display) at the Modulation Analysis function menu sets the warning display when the signal is too low either On or Off.

This display indicates that the signal level is either too low or not present; it does indicate the measurement validity.

3.5.1.4   Equalizer Reset

Pressing [F7] (Equalizer Reset) on the Modulation Analysis function menu initializes filter factors of Equalizer.

In the following cases, Equalizer may malfunction and may not provide a correct measurement result:
- When the quality of input signal is degraded, or no signal is input
- When filter factors of Equalizer, which are updated and used for measurement, are different from the setting of input signals

To recover this to the normal operation, initialize Equalizer filter factors after inputting appropriate signals or setting them correctly.

3.5.2   Power vs Time Measurement (Power vs Time)

This section describes how to set the Power vs Time measurement.

3.5.2.1   Setting Averaging Display Method (Storage Mode)

This section describes how to set the averaging display method.

■Procedure

1.   Press **Measure** on the main function menu to display the **Measure** function menu.

2.   Press **Power vs Time** to display the **Power vs Time** function menu.

3.   Press **Trace** to display the **Trace** function menu.

4.   Press **Storage** to display the **Storage** function menu.

5.   Press **Mode** to display the **Mode** dialog box.

6.   Set the display mode, and then press **Set**.

■Setting options

Table 3.5.2.1-1   Storage Mode Setting Options

Settings	Description
Off	Average not displayed
On	Average displayed

3

Measurement

3.5.2.2 Setting Average Storage Count (Storage Count)

This section describes how to set the average storage count.

Note:

This setting is only enabled when On is selected at Storage Mode.

☞ 3.5.2.1 Setting Averaging Display Method (Storage Mode)

■Procedure

1.   Press **Measure** on the main function menu to display the **Measure** function menu.

2.   Press **Power vs Time** to display the **Power vs Time** function menu.

3.   Press **Trace** to display the **Trace** function menu.

4.   Press **Storage** to display the **Storage** function menu.

5.   Press **Count** to display the **Storage Count** dialog box.

6.   Input the average storage count, and then press **Set**.

■Setting options

Table 3.5.2.2-1   Storage Count Setting Options

Item	Settings
Maximum Value	9999
Minimum Value	2

3.5.2.3　Setting Averaging Calculation Method (Average Type)

This section describes how to set the type of averaging calculation method.

■Procedure

1. Press **Measure** on the main function menu to display the **Measure** function menu.

2. Press **Power vs Time** to display the **Power vs Time** function menu.

3. Press **Trace** to display the **Trace** function menu.

4. Press **Storage** to display the **Storage** function menu.

5. Press **Average Type** and switch to **Pwr** or **Log-Pwr**.

■Setting options

Table 3.5.2.3-1　Average Type Setting Options

Settings	Description
Pwr	Performs RMS averaging
Log-Pwr	Performs log base 10 mean averaging

3.5.2.4 Setting Measurement Results Type (Trace Mode)

This section describes how to set the type of results displayed on the screen.

■Procedure

1.   Press **Measure** on the main function menu to display the **Measure** function menu.

2.   Press **Power vs Time** to display the **Power vs Time** function menu.

3.   Press **Trace** to display the **Trace** function menu.

4.   Press **Trace Mode** to display the **Trace Mode** function menu.

5.   Select the type of measurement results.

■Setting options

Table 3.5.2.4-1   Trace Mode Setting Options

Settings	Description
Rise and Fall	Displays Slot Rise and Fall
Slot	Displays all Slot segments
Frame	Displays 1 Frame

3.5.2.5 Setting Graph Vertical Axis Units (Unit)

This section describes how to set the units of the graph vertical axis.

■Procedure

1.   Press **Measure** on the main function menu to display the **Measure** function menu.

2.   Press **Power vs Time** to display the **Power vs Time** function menu.

3.   Press **Trace** to display the **Trace** function menu.

4.   Press **Unit**, and switch to **dB** or **dBm**.

■Setting options

Table 3.5.2.5-1   Unit Setting Options

Settings	Description
dB	Displays vertical axis in dB units
dBm	Displays vertical axis in dBm units

3

Measurement

3.5.2.6 Setting Measurement Displayed on Graph (Display Item)

This section describes how to set the type of measurement results displayed on the graph.

■Procedure

1. Press **Measure** on the main function menu to display the **Measure** function menu.

2. Press **Power vs Time** to display the **Power vs Time** function menu.

3. Press **Trace** to display the **Trace** function menu.

4. Press **Display Item**, and switch to **Average** or **All**.

■Setting options

Table 3.5.2.6-1   Display Item Setting Options

Settings	Description
Average	Displays average for each point
All	Displays average, min., and max. for each point

3.5.2.7 Setting Slot (Slot)

This section describes how to set a slot number for graph while **Rise and Fall** or **Slot** is selected in the Trace Mode.

■Procedure
1. Press **Measure** on the main function menu to display the **Measure** function menu.
2. Press **Power vs Time** to display the **Power vs Time** function menu.
3. Press **Trace** to display the **Trace** function menu.
4. Press **Slot** to display the **Slot** dialog box.
5. Input the slot number, and then press **Set**.

■Setting options

Table 3.5.2.7-1　Slot Setting Options

Item	Settings
Maximum Value	19
Minimum Value	0

3.5.2.8 Setting Upper Limit Line Segment Separator

(Mask Setup-Upper Limit-Time Point/Segment)

This section describes how to set the Upper Limit Line Segment separator.

Note:

Mask user settings are not initialized by Preset.

■Procedure

1. Press **Measure** on the main function menu to display the **Measure** function menu.

2. Press **Power vs Time** to display the **Power vs Time** function menu.

3. Press **Mask Setup** to display the **Power vs Time Mask Setup** dialog box.

4. Switch to **Rise Upper Limits** or **Fall Upper Limits** on the **Mask Setup** function menu.

5. Input Time Point value.

6. Press **Set** to input the input value.

Note:

The default **Power vs Time Mask Setup** dialog box is Rise Upper Limits.

■Setting options

Table 3.5.2.8-1   Time Point Setting Options (at Rise Upper Limits)

Item	Settings
Maximum Value	$999.99 \times k$*
Minimum Value	$-999.99 \times k$*
Resolution	0.01

*: k is automatically set when setting the Symbol Rate. For the relation of the Symbol Rate setting and k, refer to Table 3.5.2.8-3.

Table 3.5.2.8-2   Time Point Setting Options (at Fall Upper Limits)

Item	Settings
Maximum Value	$999.99 \times k$*
Minimum Value	$-999.99 \times k$*
Resolution	0.01

*: k is automatically set when setting the Symbol Rate. For the relation of the Symbol Rate setting and k, refer to Table 3.5.2.8-3.

Table 3.5.2.8-3 Relation of Symbol Rate Setting and *k*

Symbol Rate	*k*
100 sps ≤ Symbol Rate < 1 ksps	10 ms
1 ksps ≤ Symbol Rate < 10 ksps	1 ms
10 ksps ≤ Symbol Rate < 100 ksps	100 µs
100 ksps ≤ Symbol Rate < 1 Msps	10 µs
1 Msps ≤ Symbol Rate < 10 Msps	1 µs
10 Msps ≤ Symbol Rate < 100 Msps	100 ns
100 Msps ≤ Symbol Rate ≤ 140 Msps	10 ns

3

Measurement

3.5.2.9 Setting Upper Limit Line Upper Limit and Evaluation Standard (Mask Setup-Upper Limit-Limit Setup)

This section describes how to set the upper limit and evaluation standard for the Upper Limit Line.

Note:

Mask user settings are not initialized by Preset.

■Procedure

1. Press **Measure** on the main function menu to display the **Measure** function menu.

2. Press **Power vs Time** to display the **Power vs Time** function menu.

3. Press **Mask Setup** to display the **Power vs Time Mask Setup** dialog box.

4. Switch to **Rise Upper Limits** or **Fall Upper Limits** on the **Mask Setup** function menu.

5. Input REL Limit value, and press the unit button **dB**.

6. Input ABS Limit value, and press the unit button **dBm**.

7. Select the Fail Logic setting.

8. Press **Set** to input the input value.

Note:

The default **Power vs Time Mask Setup** dialog box is Rise Upper Limits.

■Setting options

Table 3.5.2.9-1 REL Limit Setting Options

Item	Settings
Maximum Value	99.99 dB
Minimum Value	−99.99 dB
Resolution	0.01

Table 3.5.2.9-2 ABS Limit Setting Options

Item	Settings
Maximum Value	99.99 dBm
Minimum Value	−99.99 dBm
Resolution	0.01

Table 3.5.2.9-3   Fail Logic Setting Options

Settings	Description
ABS	Performs Pass/Fail evaluation using ABS Limit [dBm] setting
REL	Performs Pass/Fail judgment using REL Limit [dB] setting
ABS or REL	Judges as Pass if the evaluation is Pass either in ABS Limit (dBm) or in REL Limit (dB).
Off	Disables Pass/Fail evaluation

3

Measurement

3.5.2.10 Setting Lower Limit Line Segment Separator

(Mask Setup-Lower Limit-Time Point/Segment)

This section describes how to set the Lower Limit Line Segment separator.

Note:

Mask user settings are not initialized by Preset.

■Procedure

1. Press **Measure** on the main function menu to display the **Measure** function menu.

2. Press **Power vs Time** to display the **Power vs Time** function menu.

3. Press **Mask Setup** to display the **Power vs Time Mask Setup** dialog box.

4. Switch to **Rise Upper Limits** or **Fall Upper Limits** on the **Mask Setup** function menu.

5. Input Time Point value, and press the unit button.

6. Press **Set** to input the input value.

Note:

The default **Power vs Time Mask Setup** dialog box is Rise Upper Limits.

■Setting options

Table 3.5.2.10-1 Time Point Setting Options (at Rise Lower Limits)

Item	Settings
Maximum Value	$999.99 \times k$*
Minimum Value	$-999.99 \times k$*
Resolution	0.01

*: k is automatically set when setting the Symbol Rate. For the relation of the Symbol Rate setting and k, refer to Table 3.5.2.8-3.

Table 3.5.2.10-2 Time Point Setting Options (at Fall Lower Limits)

Item	Settings
Maximum Value	$999.99 \times k$*
Minimum Value	$-999.99 \times k$*
Resolution	0.01

*: k is automatically set when setting the Symbol Rate. For the relation of the Symbol Rate setting and k, refer to Table 3.5.2.8-3.

3.5.2.11 Setting Lower Limit Line Lower Limit and Evaluation Standard

(Mask Setup-Lower Limit-Limit Setup)

This section describes how to set the lower limit and evaluation standard for the Lower Limit Line.

Note:

Mask user settings are not initialized by Preset.

■Procedure

1.   Press **Measure** on the main function menu to display the **Measure** function menu.

2.   Press **Power vs Time** on the **Measure** function menu to display the **Power vs Time** function menu.

3.   Press **Mask Setup** to display the **Power vs Time Mask Setup** dialog box.

4.   Switch to **Rise Upper Limits** or **Fall Upper Limits** on the **Mask Setup** function menu.

5.   Input REL Limit value, and press the unit button **dB**.

6.   Input ABS Limit value, and press the unit button **dBm**.

7.   Select the Fail Logic setting.

8.   Press **Set** to input the input value.

Note:

The default **Power vs Time Mask Setup** dialog box is Rise Upper Limits.

■Setting options

Table 3.5.2.11-1   REL Limit Setting Options

Item	Settings
Maximum Value	99.99 dB
Minimum Value	−99.99 dB
Resolution	0.01

Table 3.5.2.11-2   ABS Limit Setting Options

Item	Settings
Maximum Value	99.99 dBm
Minimum Value	−99.99 dBm
Resolution	0.01

3

Measurement

Table 3.5.2.11-3   Fail Logic Setting Options

Settings	Description
ABS	Performs Pass/Fail evaluation using ABS Limit [dBm] setting
REL	Conducts Pass/Fail judgment using the REL Limit [dB] setting.
ABS or REL	Judges as Pass if the evaluation is Pass either in ABS Limit (dBm) or in REL Limit (dB).
Off	Disables Pass/Fail evaluation

3.5.2.12 Load Mask Setting-Standard Mask Table

Change the mask setting by loading the mask for Preset.

For the list of Preset with details, refer to Appendix F.

☞ Appendix F Mask for Power vs Time

■Procedure
1. Press **Measure** on the main function menu to display the **Measure** function menu.

2. Press **Power vs Time** to display the **Power vs Time** function menu.

3. Press **Load Mask Setting** to display the **Load Mask Setting** function menu.

4. Press **Standard Mask Table** to display the **Standard Mask Table** function menu.

5. Select the desired Preset setting from the list and press **Recall** to determine it as Mask setting value.

3

Measurement

3.5.2.13 Mask Evaluation

This section shows an example of the limit line setting. How to set the upper limit lines as in Figure 3.5.2.13-1 is explained below. The setting values corresponding to Figure 3.5.2.13-1 are in Table 3.5.2.13-1. In this case, the lines actually used for judgment are shown in thick lines. If the measured value enters the shaded part, it is judged as Fail.
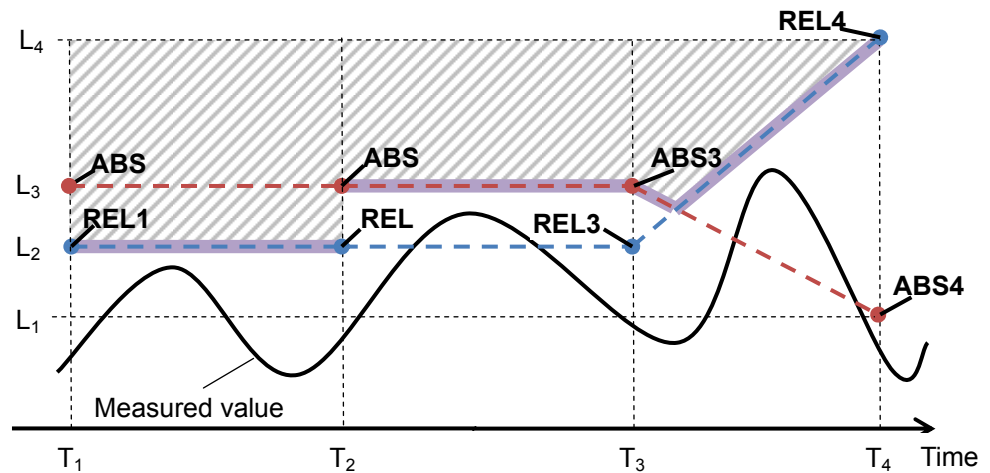
Figure 3.5.2.13-1   Mask Judgment Example

Table 3.5.2.13-1   Example of Limit Line Setting

No.	Time	REL [dB]	ABS [dBm]	Fail Logic
0	T1	L2 (REL1)	L3 (ABS1)	REL
1	T2	L2 (REL2)	L3 (ABS2)	ABS
2	T3	L2 (REL3)	L3 (ABS3)	ABS or REL
3	T4	L4 (REL4)	L1 (ABS4)	

In limit line setting, set Time, REL, ABS, and Fail Logic for each No. in the table.

First of all, define the line connecting REL1 to REL4 and the line connecting ABS1 to ABS4 as in Figure 3.5.2.13-1. REL[dB] specifies relative power to average power and ABS[dBm] specifies absolute power in ON interval.

Next, specify judgment method in each interval for the two lines by Fail Logic and make the limit line.

Fail Logic specifies if the line connecting one No. and the next No. is used as REL line or ABS line for judgment. ABS or REL, whichever has more margin, is used for judgment at each time. If set to Off, the interval is not judged.

3.5.2.14 Setting filter Type

The filter type used for Power vs Time measurement can be set.

■Procedure

1. Press **Measure** on the main function menu to display the **Measure** function menu.

2. Press **Power vs Time** to display the **Power vs Time** function menu.

3. Press **Filter** to display the **Filter** function menu.

4. Press **Type,** and then select the filter type.

■Setting options

Gaussian, Low Pass, Nyquist, Root Nyquist, Off

3

Measurement

3.5.2.15 Setting filter Bandwidth(BW)

The filter bandwidth used for Power vs Time measurement can be set. The filter bandwidth is available when the filter type is **Gaussian**, **Low Pass**, **Nyquist**, or **Root Nyquist**.

The bandwidth is defined as follows, depending on the filter type:

Gaussian:	Equivalent noise bandwidth
Low Pass or **Nyquist**:	6-dB attenuation point
Root Nyquist:	3-dB attenuation point

■Procedure

1. Press **Measure** on the main function menu to display the **Measure** function menu.

2. Press **Power vs Time** to display the **Power vs Time** function menu.

3. Press **Filter** to display the **Filter** function menu.

4. Press **BW**, and then set the filter bandwidth.

■Setting range

Table 3.5.2.15-1   Filter bandwidth (BW) Setting Options [Hz]

SPAN	Minimum Value	Maximum Value
1 kHz	100 Hz	4 kHz
2.5 kHz	100 Hz	10 kHz
5 kHz	1.001 kHz	20 kHz
10 kHz	2.001 kHz	40 kHz
25 kHz	4.001 kHz	100 kHz
50 kHz	10.001 kHz	200 kHz
100 kHz	20.001 kHz	400 kHz
250 kHz	40.001 kHz	1 MHz
500 kHz	100.001 kHz	2 MHz
1 MHz	200.001 kHz	4 MHz
2.5 MHz	400.001 kHz	10 MHz
5 MHz	1.000001 MHz	12.5 MHz
10 MHz	2.000001 MHz	20 MHz
25 MHz	4.000001 MHz	25 MHz
31.25 MHz	1.000001 MHz	40 MHz
50 MHz	12.500001 MHz	50 MHz
62.5 MHz	20.000001 MHz	50 MHz
100 MHz	25.000001 MHz	50 MHz
125 MHz	40.000001 MHz	50 MHz

Note:

The maximum value is limited depending on hardware option.

3.5.2.16 Setting filter Roll-off factor

The filter Roll-off factor used for Power vs Time measurement can be set. The filter Roll-off factor is available when the filter type is **Nyquist** or **Root Nyquist**.

■Procedure

1. Press **Measure** on the main function menu to display the **Measure** function menu.

2. Press **Power vs Time** to display the **Power vs Time** function menu.

3. Press **Filter** to display the **Filter** function menu.

4. Press **Roll-off Factor,** and then set the roll-off factor.

■Setting range

0.10 to 1.00

■Resolution

0.01

3

Measurement

3.5.3   Power Meter Measurement

Start the application (Power Meter Function first. Select ⟨F2⟩ (Power Meter) in the Measure function menu to invoke the Power Meter function.

Settings of Carrier Frequency, Offset, and Offset Value are automatically reflected on the corresponding parameters. When these parameters are being recalled, you cannot execute Recall Current Application in Section 3.6.2 "Recalling parameters" of *MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual Mainframe Operation*, *MS2830A Signal Analyzer Operation Manual Mainframe Operation* or *MS2840A Signal Analyzer Operation Manual Mainframe Operation*.

For operations when invoking the function, refer to *MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual Mainframe Operation*, *MS2830A Signal Analyzer Operation Manual Mainframe Operation* or *MS2840A Signal Analyzer Operation Manual Mainframe Operation*.

3.6 Setting Markers

3.6.1 Modulation Analysis

Pressing [F5] (Marker) on the main function menu or [Marker] displays the page 1 one of the Marker function menu.

 The marker setting and whether to display the marker change depending on the Trace Mode setting for the trace to be manipulated.

☞ 3.8 Trace Mode

3.6.2 Power vs Time

This section describes how to set the parameters related to markers displayed at Power vs Time of the Measurement items (Measure).

☞ 3.5.2 Setting Power vs Time (Power vs Time)

3.6.2.1 Displaying/Hiding Markers (Marker)

This section describes how to display or hide markers at the top and bottom of the graph window.

■Procedure

1.   Press **Marker** on the main function menu to display the **Marker** function menu.

2.   Enable or disable by pressing **Marker**.

■Setting range

Table 3.6.2.1-1   Marker Setting Options

Settings	Description
On	Enables marker function
Off	Disables marker function

3.6.2.2 Setting Graph Marker Position (Point)

This section describes how to set the positions of Marker 1 and Marker 2 in graph display.

■Procedure [Changing Marker 1 position]

1. Press **Marker** on the main function menu to display the **Marker** function menu.

2. Select **Marker Number 1** from the **Marker** function menu.

3. Sets the Marker position by rotary knob, cursor keys, or ten keys.

■Setting range

Table 3.6.2.2-1 Point Setting Range

Item	Settings [symbol]
Maximum value	(Slot Length×All Slot Number) + 20
Minimum value	−20

3.6.2.3 Displaying the Modulation Analysis Area (Marker to Modana Area)

The area that is currently under the modulation analysis is indicated by Marker 1 and Marker 2 in the graph.(Modana: Modulation Analysis)

Marker 1 and Marker 2 indicate the points below.
Marker 1: Measurement Offset [Symbol]
Marker 2: Measurement Offset + Measurement Interval [Symbol]

■Procedure

1. Press **Marker** on the main function menu to display the **Marker** function menu.

2. Select **Marker to Modana** (Modulation Analysis) **Area**.

Note:

To hide the markers, set Marker to Off.

3

Measurement

3.7 Setting Trigger

Pressing [F6] (Trigger) on the main function menu or [Trigger/Gate] displays the Trigger function menu.

Trigger Switch
■Summary
> This sets the trigger synchronization On/Off.

■Setting options
> On, Off

Trigger Source
■Summary
> This sets the trigger source.

■Setting options

Video	The Capture starts in synchronization with the rise or fall of the waveform.
Wide IF Video	An IF signal with a wide passing band of about 50 MHz is detected, and measurement starts in synchronization with the rise or fall of the detected signal.
External	Measurement starts with external trigger signal input.
SG Marker	Starts measurement by the timing of the Vector Signal Generator option.

Trigger Slope
■Summary
> Sets the trigger polarity.

■Setting options

Rise	Synchronizes with rising edge of the trigger.
Fall	Synchronizes with falling edge of the trigger.

Video Trigger Level

■Summary

Sets the level threshold for detecting the slot.

■Setting options

(–150 + Level Offset Value) to (+50 + Level Offset Value) dBm

■Resolution

1 dBm

Wide IF Video Trigger Level

■Summary

This sets the level threshold value for slot detection.

■Setting range

(–60 + Level Offset Value) to (+50 + Level Offset Value) dBm

■Resolution

1 dBm

Trigger Delay

■Summary

Sets the trigger delay.

■Setting range

–2.00000000 to +2.00000000 s

3.8 Trace Mode

The Trace Mode setting specifies the type of the measurement result displayed on the Trace screen.

3.8.1 Modulation Analysis

When the measurement item (Measure) is set to Modulation Analysis, selectable Trace Mode types are as in Table 3.8.1-1.

Table 3.8.1-1 Trace Mode Type

Trace Mode	Function
Constellation	Displays the waveform of the analysis interval on IQ coordinate or frequency axis graph.
EVM vs Symbol	Displays the EVM of each symbol on a graph.
Magnitude Error vs Symbol	Displays the amplitude error of each symbol on a graph.
Phase Error vs Symbol	Displays the phase error of each symbol on a graph.
Frequency vs Symbol	Displays the FM frequency deviation of the waveform in the analysis interval on a graph.
Trellis	Displays the phase transition of the waveform in the analysis interval on a graph.
Eye Diagram	Displays the amplitude of the I phase and Q phase of the waveform in the analysis interval on a graph.
Numeric	Displays the numeric results.
I and Q vs Symbol	Displays the amplitude of the I phase and Q phase of the waveform in the analysis interval on a graph.
Magnitude vs Symbol	Displays the amplitude of the waveform in the analysis interval on a graph.
Phase vs Symbol	Displays the phase of the waveform in the analysis interval on a graph.
Signal Monitor	Displays the spectrum of the waveform in the analysis interval on a graph.
Symbol Table	Displays the demodulation bit for each symbol.
EqualizerAmplitude	Displays the equalizer amplitude characteristics.
Equalizer Phase	Displays the equalizer phase characteristics.
Equalizer Group Delay	Displays the equalizer group delay characteristics.
Equalizer Impulse Response	Displays the equalizer impulse response.
FSK Error vs Symbol	Displays the FSK error of each symbol on a graph.
Fidelity vs Symbol	Displays the analysis results of Modulation Fidelity vs Symbol.
Histogram	Displays the appearance frequency of each symbol.
Custom Numeric	Displays the numerical results that the user has specified in numerical values and bars.

Whether the measurement result is displayed depends on the Modulation Type setting. The relationship between Modulation Type and the result display are described in Table 3.8.1-2. If the measurement result is not displayed, 'Not Supported' is displayed in the trace area.

Table 3.8.1-2   Modulation Type and Result Display

Trace Mode	Modulation Type		
	BPSK QPSK O-QPSK PI/4DQPSK 8PSK 2ASK 4ASK	16QAM 64QAM 256QAM	2FSK 4FSK H-CPM
Constellation	✓	✓	✓
EVM vs Symbol	✓	✓	✓
Magnitude Error vs Symbol	✓	✓	✓
Phase Error vs Symbol	✓	✓	✓
Frequency vs Symbol	−	−	✓
Trellis	✓	✓	✓
Eye Diagram	✓	✓	✓
Numeric	✓	✓	✓
I and Q vs Symbol	✓	✓	✓
Magnitude vs Symbol	✓	✓	✓
Phase vs Symbol	✓	✓	✓
Signal Monitor	✓	✓	✓
Symbol Table	✓	✓	✓
Equalizer Amplitude	✓	✓	−
Equalizer Phase	✓	✓	−
Equalizer Group Delay	✓	✓	−
Equalizer Impulse Response	✓	✓	−
FSK Error vs Symbol	−	−	✓
Fidelity vs Symbol	−	−	✓*
Histogram	−	−	✓
Custom Numeric	✓	✓	✓

✓: Displays measured results.

−: Does not display measured results.

*: Available only when Modulation Type is set to 2FSK, 4FSK, H-CPM.

The measurement result display format and marker setting conditions differ for each Trace Mode. For details, refer to the following sections:

3

Measurement

3.8.1.1 Constellation

Displays the Constellation analysis result in the trace area. The result of each such analysis is displayed, regardless of the storage mode.
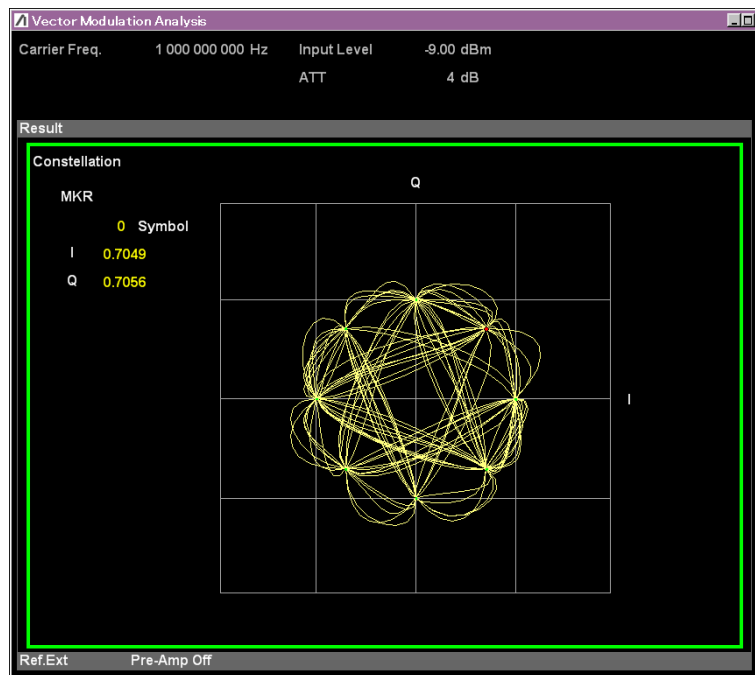
Figure 3.8.1.1-1   Constellation Result (Interpolation On)

Graph display result
■Summary

> Displays the waveform in the analysis interval on the IQ axis. The IQ waveform is normalized and displayed with the vector of the outermost symbol position. When the modulation is set to 2FSK, 4FSK, or H-CPM, the frequency deviation of each symbol can be displayed with the horizontal axis as normalized frequency.

Scale
■Summary

> Sets the interpolation between the symbols displayed on the graph.

Scale: Interpolation

■Summary

Sets the data interpolation between the symbols displayed on the graph and the display complementation. On the interpolation display, data is interpolated by using the number of splits between symbols specified in Points/Symbol and a graph is displayed with each data connected with straight lines.

■Setting options

On   Performs interpolation display.

Off   Does not perform interpolation display.

Scale: Points/Symbol

■Summary

Sets how many splits are allowed when the data interpolation between symbols is executed.

■Setting options

1point   Does not split the symbol interval (Used for connecting the symbols with straight lines).

8points   Splits the symbol interval into 8.

Marker

■Summary

Selects marker function between On and Off.

■Setting options

On, Off

Marker Number (Constellation)

■Summary

Sets marker target in Constellation results display.

■Setting range

(Measurement Offset) to (Measurement Interval-1)

■Resolution

1symbol   When Interpolation is set to Off, or Interpolation is set to On and Points/Symbol is set to 1point

0.125symbol When Interpolation is set to On and Points/Symbol is set to 8points

0.5symbol   When Interpolation is set to On and Points/Symbol is set to 4points

Marker Link

■Summary

Selects whether to turn On or Off the synchronization of markers in separate traces.

■Setting options

On, Off

Result Select

■Summary

Sets Constellation and Eye Diagram to display in frequency or in IQ. This can be set only when 2FSK or 4FSK is selected for Modulation.

■Setting options

| Linear | Displays Constellation in frequency. (This is available only when Modulation Type is 2FSK or 4FSK.) |
| IQ | Displays Constellation in IQ. |

3.8.1.2 EVM vs Symbol

Displays EVM vs Symbol analysis result in the Trace. The result of each such analysis is displayed, regardless of the storage mode.
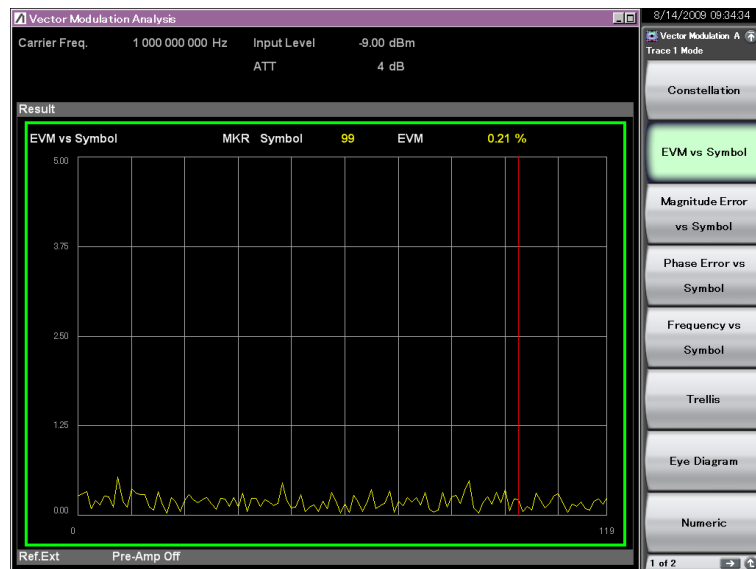
Figure 3.8.1.2-1   EVM vs Symbol Result

Graph result display

■Summary

> Displays EVM of each symbol in the analysis interval as a percentage.

Scale

■Summary

> Sets vertical scale of a graphical result.

Scale: Vertical

■Summary

> Sets the upper limit of the vertical axis scale of the graph result.

■Setting range

> 5%, 10%, 20%, 50%

Marker

■Summary

> Selects marker function between On and Off.

■Setting options

> On, Off

Marker Number (EVM vs Symbol)

■Summary

Sets the target of the marker on the EVM vs Symbol result display.

■Setting range

(Measurement Offset) to (Measurement Interval – 1)

☞ 3.4.8 Data

☞ 3.4.10 Slot

Marker Link

■Summary

Selects whether to turn On or Off the synchronization of markers in separate traces.

■Setting options

On, Off

3.8.1.3 Magnitude Error vs Symbol

Displays Magnitude Error vs Symbol analysis result in the Trace. The result of each such analysis is displayed, regardless of the storage mode.

Figure 3.8.1.3-1   Magnitude Error vs Symbol Result

Graph display result
■Summary

Displays the amplitude error of each symbol in the analysis interval as a percentage.

Scale
■Summary

Sets vertical scale of a graphical result.

Scale: Vertical
■Summary

Sets the upper and lower limits of the vertical axis scale of the graph result.

■Setting range

±5%, ±10%, ±20%, ±50%

Marker
■Summary
Selects marker function between On and Off.
■Setting options
On, Off

Marker Number (Magnitude Error vs Symbol)
■Summary
Sets the marker target in the Magnitude Error vs Symbol result display.
■Setting range
(Measurement Offset) to (Measurement Interval-1)

Marker Link
■Summary
Selects whether to turn On or Off the synchronization of markers in separate traces.
■Setting options
On, Off

3.8.1.4 Phase Error vs Symbol

Displays Phase Error vs Symbol analysis result in the Trace. The result of each such analysis is displayed, regardless of the storage mode.

Figure 3.8.1.4-1   Phase Error vs Symbol Result

Graph display result
■Summary

Displays the phase error of each symbol in the analysis interval in degrees.

Scale
■Summary

Sets vertical scale of a graphical result.

Scale: Vertical
■Summary

Sets the upper and lower limits of the vertical axis scale of the graph result.

■Setting range

±5 degree, ±10 degree, ±20 degree, ±50 degree

Marker
■Summary

Selects marker function between On and Off.

■Setting options

On, Off

Marker Number (Phase Error vs Symbol)

■Summary

Sets the marker target in the Phase Error vs Symbol result display.

■Setting range

(Measurement Offset) to (Measurement Interval – 1)

☞ 3.4.8 Data

☞ 3.4.10 Slot

Marker Link

■Summary

Selects whether to turn On or Off the synchronization of markers in separate traces.

■Setting options

On, Off

3.8.1.5 Frequency vs Symbol

Displays Frequency vs Symbol analysis result in the trace area. The result of each such analysis is displayed, regardless of the storage mode.
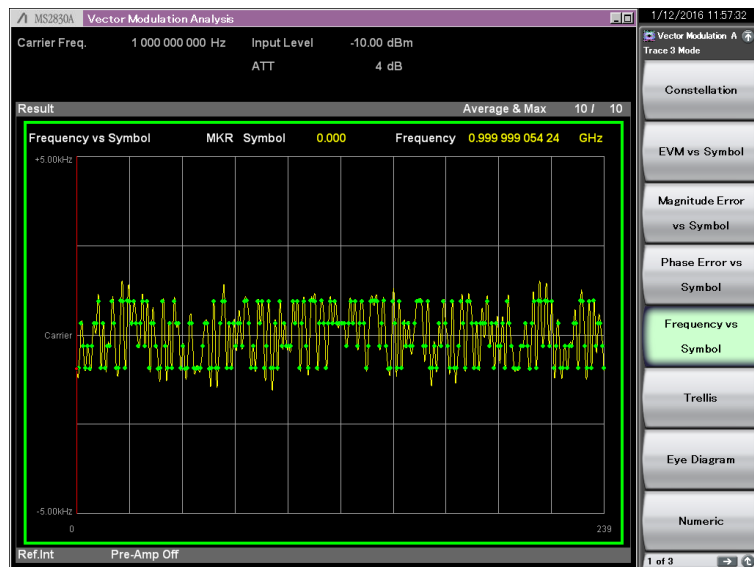
Figure 3.8.1.5-1   Frequency vs Symbol Result

Graph display result
■Summary

Displays the frequency deviation of each 1/8th of the symbol interval in the analysis interval in Hz units.

Scale
■Summary

Sets vertical scale of a graphical result.
■Setting range

The graph scale is calculated from the Span value, which is calculated from the value of the setting parameter. The upper and lower limits of the graph are calculated by using the following formula:

Graph's upper/lower limits = ±(Span/ 2) Hz

Marker
■Summary

Selects marker function between On and Off.
■Setting options

On, Off

Marker Number (Frequency vs Symbol)

■Summary

Sets the marker target in the Frequency vs Symbol result display.

■Setting range

(Measurement Offset) to (Measurement Interval − 1)

☞ 3.4.8 Data
☞ 3.4.10 Slot

Marker Link

■Summary

Selects whether to turn On or Off the synchronization of markers in separate traces.

■Setting options

On, Off

Highlight Symbols

■Summary

Selects whether to highlight symbols.

■Setting options

On, Off

3.8.1.6 Trellis

Displays the analysis result of the phase transition in the trace area. The result of each such analysis is displayed, regardless of the storage mode.
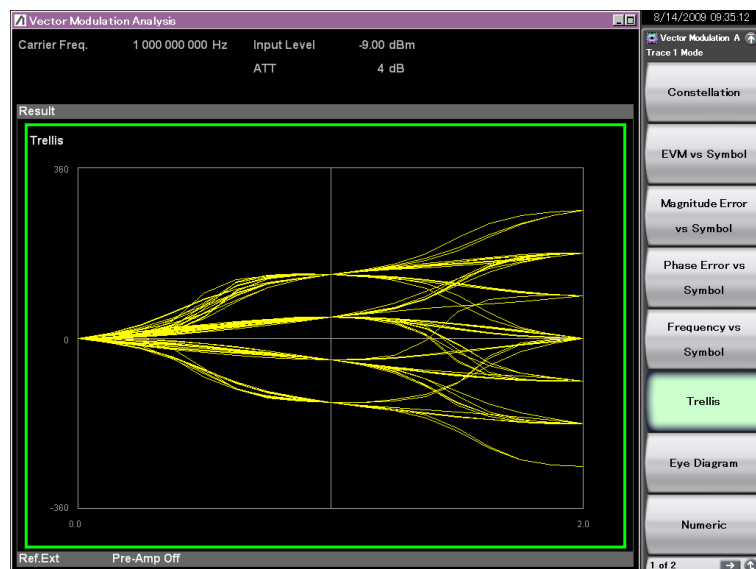
Figure 3.8.1.6-1   Trellis Result

Graph display result
■Summary

Displays the phase transition for each 1/8th of the symbol in the analysis interval, in degrees.
The graph's horizontal axis is displayed in intervals of 2 symbols.

Scale
■Summary

The graph's vertical axis scale is fixed to ±360 degrees.

Marker
■Summary

There is no marker function.

3.8.1.7 Eye Diagram

Displays the amplitude analysis result of the I phase and Q phase, in the trace area. The result of each such analysis is displayed, regardless of the storage mode.
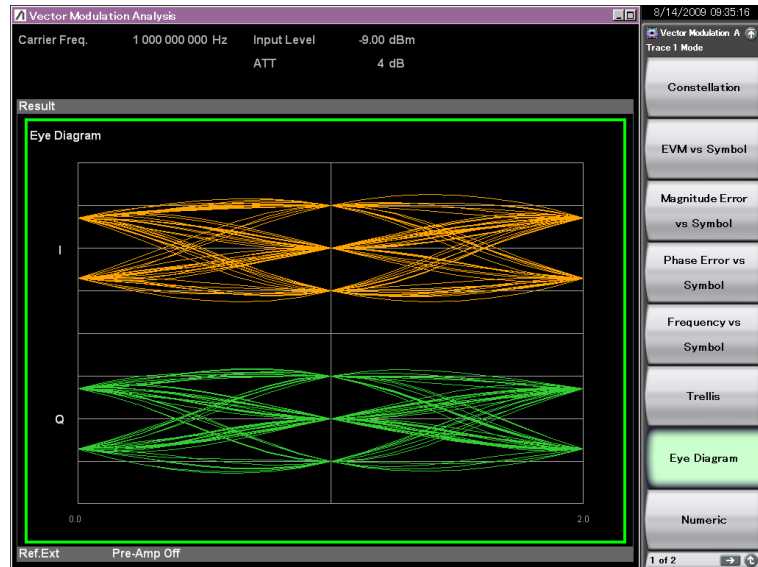
Figure 3.8.1.7-1   Eye Diagram Result

Graph display result
■Summary

> Displays the normalized amplitude of the I phase and Q phase for each 1/8th of the symbol in the analysis interval.
> When modulation is set to 2FSK, 4FSK, or H-CPM, the frequency deviation of each symbol can be displayed with the horizontal axis as normalized frequency.
> The graph's horizontal axis is displayed in 2-symbol intervals.

Scale
■Summary

> Sets the vertical scale for the graphical plot of results.

Scale: Zoom
■Summary

> Sets the vertical scale for the graphical waveform of results.

■Setting range

> 0.01 to 5.00

■Default

> 1.00

Scale: Offset

■Summary

Sets the vertical-scale offset for the graphical plot of results. This is added to the reference scale. This is available only when Modulation Type is 2FSK, 4FSK or H-CPM.

■Setting range

±(Symbol Rate) Hz

■Default

0 [Hz]

Marker

■Summary

No marker function is available.

Result Select

■Summary

Sets Constellation and Eye Diagram to display in frequency or in IQ.

■Setting options

Linear	Displays Eye Diagram in frequency. When the Modulation Type is 2ASK or 4ASK, the waveform given by $\sqrt{I^2+Q^2}$ is plotted.
IQ	Displays Eye Diagram in IQ.

3

Measurement

3.8.1.8 Numeric

Displays the numeric result of modulation analysis in the trace area. According to the storage mode specified, the results in a single measurement are displayed for Off, the averages of the results in the specified number of measurements for Average, and the averages and the maximums of the results in the specified number of measurements for Average & Max, respectively.

☞ 3.5.1.1 Trace

The measured items vary depending on the Modulation Type setting. If a 4-trace split screen is displayed, Filtered Power, Frequency Error (ppm), Droop Factor, MER (rms, peak), or Deviation at Ts/2 is not displayed on the screen.
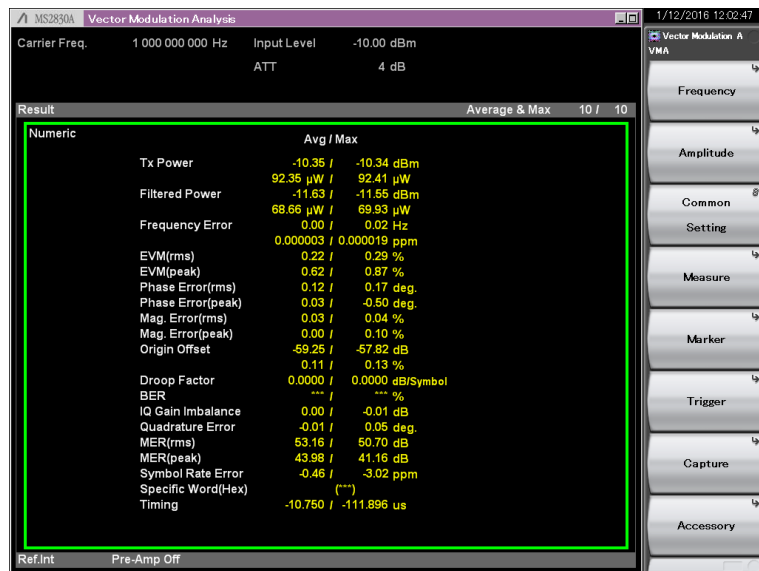
Figure 3.8.1.8-1   Numeric Result (When Modulation Type is PI/4DQPSK)
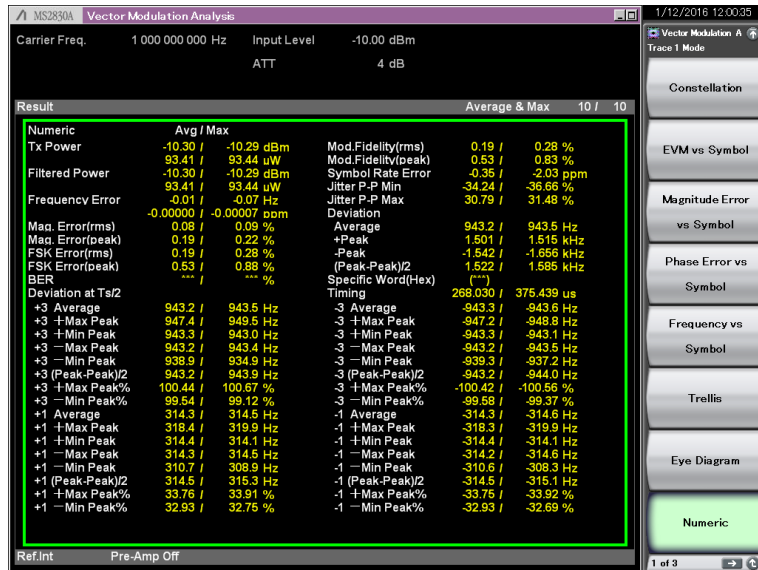
Figure 3.8.1.8-2　Numeric Result (When Modulation Type is 4FSK)
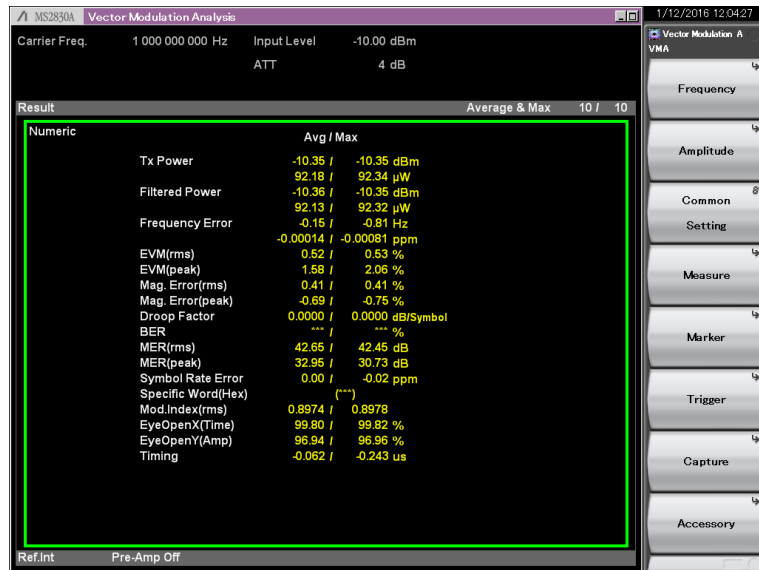
**Figure 3.8.1.8-3   Numeric Result (When Modulation Type is
2ASK/4ASK)**

Scale – [Power]

■Summary

Toggles between [dBm] and [W] for the unit of measurement result.
Select the Unit menu by pressing F5 (Unit) at Scale menu, select
Unit-Power menu by pressing F1 (Power), and select either F1
(dBm) or F5 (W).

Scale – [Symbol Rate]

■Summary

Sets the unit of numeric results, selecting one from [ppm], [mHz]
and [Hz]. On the Scale menu F5 (Unit), select the Unit menu,
select F2 (Symbol Rate), select the Unit-Symbol Rate menu, and
then select F1 (ppm), F2 (mHz) or F3 (Hz).

Table 3.8.1.8-1 Measured Items

Measured Items	Modulation Type					
	BPSK	**QPSK** **O-QPSK**	**PI/4DPQSK** **8PSK**	**16QAM** **64QAM** **256QAM**	**2FSK** **4FSK** **H-CPM**	**2ASK** **4ASK**
Tx Power	✓	✓	✓	✓	✓	✓
Filtered Power	✓	✓	✓	✓	✓	✓
Frequency Error	✓	✓	✓	✓	✓	✓
EVM (rms)	✓	✓	✓	✓		✓
EVM (peak)	✓	✓	✓	✓		✓
Phase Error (rms)	✓	✓	✓	✓		
Phase Error (peak)	✓	✓	✓	✓		
Magnitude Error (rms)	✓	✓	✓	✓	✓	✓
Magnitude Error (peak)	✓	✓	✓	✓	✓	✓
FSK Error (rms)					✓	
FSK Error (peak)					✓	
Modulation Fidelity (rms)					✓*4	
Modulation Fidelity (peak)					✓*4	
Symbol Rate Error	✓	✓	✓	✓	✓	✓
Jitter P-P Min					✓	
Jitter P-P Max					✓	
Deviation					✓	
Deviation rms (%)					✓*2	
Deviation at Ts/2					✓*3	
BER	✓*5	✓*5	✓*5	✓*5	✓*5	✓*5
Specific Word (Hex)	✓	✓	✓	✓	✓	✓
Origin Offset	✓	✓	✓	✓		
Droop Factor	✓		✓			✓
IQ Gain Imbalance		✓	✓	✓		
Quadrature Error		✓	✓	✓		
MER (rms)	✓	✓	✓	✓		✓
MER (peak)	✓	✓	✓	✓		✓
Offset EVM (rms)		✓*1				
Offset EVM (peak)		✓*1				
Modulation Index (rms)						✓*6
Eye Opening (X-Time)						✓*6
Eye Opening (Y-Amplitude)						✓*6
Timing Offset	✓	✓	✓	✓	✓	✓

✓: Displays measured results.

Blank: Does not display measured results.

*1: Only O-QPSK

*2: Only 2FSK

*3: Only 2FSK and 4FSK

*4: Only 2FSK, 4FSK and H-CPM

*5: Only BER = On

*6: Only 2ASK/4ASK

Tx Power
■Summary
　Displays the average RF level before the signal has passed through the measurement filter

Filtered Power
■Summary
　Displays the average RF level after the signal has passed through the measurement filter.

Frequency Error
■Summary
　Displays the frequency error.

EVM (rms)
■Summary
　Displays rms value of EVM.

EVM (peak)
■Summary
　Displays the EVM Peak value and the number of the symbol for which the peak value was detected.

Phase Error (rms)
■Summary
　Displays rms value of Phase Error.

Phase Error (peak)
■Summary
　Displays the Phase Error Peak value and the number of the symbol for which the peak value was detected.

Magnitude Error (rms)

■Summary

   Displays rms value of Magnitude Error.

Magnitude Error (peak)

■Summary

   Displays the Magnitude Error Peak value and the number of the symbol for which the peak value was detected.

FSK Error (rms)

■Summary

   Displays rms value of FSK Error.

FSK Error (peak)

■Summary

   Displays the FSK Error Peak value and the number of the symbol for which the peak value was detected.

Modulation Fidelity (rms)

■Summary

   Displays rms value of Modulation Fidelity.

Modulation Fidelity (peak)

■Summary

   Displays the Modulation Fidelity Peak value and the number of the symbol for which the peak value was detected.

Symbol Rate Error

■Summary

   Displays Symbol Rate Error. Select a measurement mode with Method of Symbol Rate Error.

   ☞ 3.4.12 Detail Settings

Jitter P-P Min

■Summary

   Displays the minimum peak-to-peak value for jitter.

Jitter P-P Max

■Summary

   Displays the maximum peak-to-peak value for jitter.

3

Measurement

Deviation
■Summary

> Displays the average value, peak value, and peak-to-peak value of the frequency deviation.

Deviation rms (%)
■Summary

> Displays rms value of Deviation in %.

Deviation at Ts/2
■Summary

> Displays the average value, the maximum + frequency peak value, the minimum + frequency peak value, the maximum – frequency peak value, the minimum – frequency peak value, and peak-to-peak value of the frequency deviation.

BER
■Summary

> Displays the Bit Error Rate.

Specific Word
■Summary

> Displays an extracted part of specific bits.

Origin Offset
■Summary

> Displays origin offset value.

Droop Factor
■Summary

> Displays droop factor.

IQ Gain Imbalance
■Summary

> Displays the amplitude difference between the I phase and the Q phase.

Quadrature Error
■Summary

> Displays how perpendicular the I phase is to the Q phase.

MER (rms)
■Summary

> Displays rms value of MER.

MER (peak)

■Summary

Displays the MER peak value and the number of the symbol for which the peak value was detected.

Offset EVM (rms)

■Summary

Displays rms value of Offset EVM.

Offset EVM (peak)

■Summary

Displays the Offset EVM peak value and the number of the symbol for which the peak value was detected.

Modulation Index (rms)

■Summary

Displays the Modulation Index in ratio (no unit).

Eye Opening (X-Time)

■Summary

Displays the Eye Opening (X-Time) in %.

Eye Opening (Y-Amplitude)

■Summary

Displays the Eye Opening (Y-Amplitude) in %.

Timing Offset

■Summary

Displays the time difference between external trigger and Symbol [0], in units of μs.
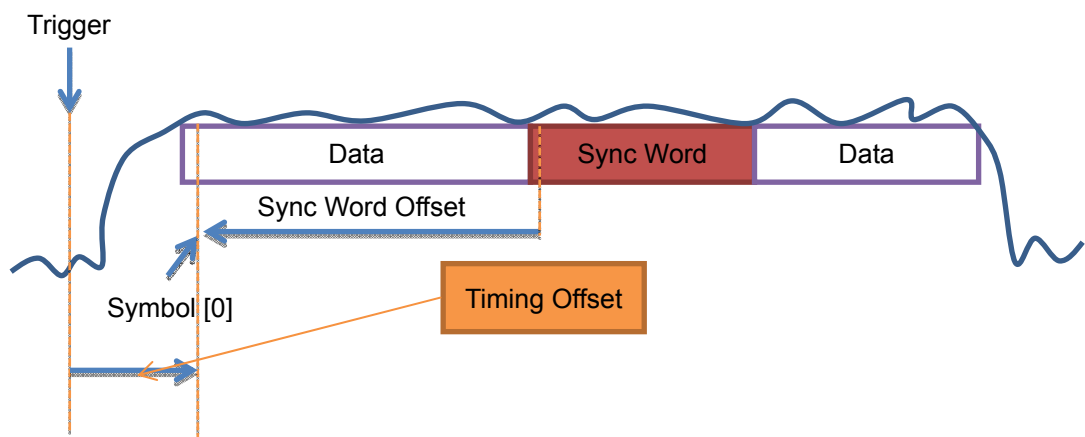
Figure 3.8.1.8-1   Timing Offset Measurement Mode

3.8.1.9 I and Q vs Symbol

Displays the amplitude analysis results of the I phase and the Q phase, in the trace area. The result of each such analysis is displayed, regardless of the storage mode.

Figure 3.8.1.9-1   I and Q vs Symbol Result

Graph display result
■Summary

Displays the normalized amplitude of the I phase and Q phase for each 1/8th of the symbol in the analysis interval.

Scale
■Summary

The graph's vertical axis scale is fixed to ±2.0.

Marker
■Summary

Selects marker function between On and Off.

■Setting options

On, Off

Marker Number (I and Q vs Symbol)

■Summary

Sets the marker target in the I and Q vs Symbol result display.

■Setting range

(Measurement Offset) to (Measurement Interval − 1)

☞ 3.4.8 Data

☞ 3.4.10 Slot

Marker Link

■Summary

Selects whether to turn On or Off the synchronization of markers in separate traces.

■Setting options

On, Off

3

Measurement

3.8.1.10 Magnitude vs Symbol

Displays Magnitude vs Symbol analysis result in the Trace. The result of each such analysis is displayed, regardless of the storage mode.
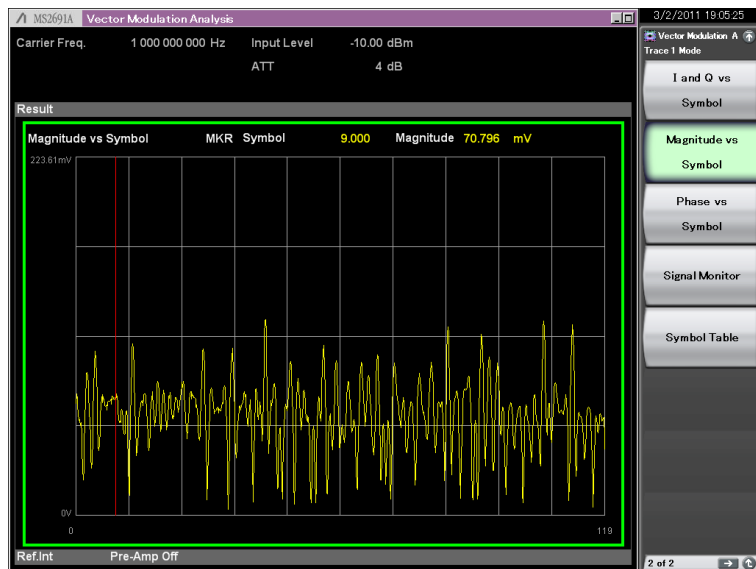
Figure 3.8.1.10-1   Magnitude vs Symbol Result

Graph display result
■Summary

Displays the amplitude for each 1/8th of the symbol in the analysis interval in volts.

Scale
■Summary

The graph's vertical axis scale is fixed according to the Input Level setting.

$$0 \text{ to } \sqrt{50 \times 1000 \times 10^{(InputLevel+10)/10}} \quad \text{mV}$$

Marker
■Summary

Selects marker function between On and Off.
■Setting options

On, Off

Marker Number (Magnitude vs Symbol)

■Summary

Sets the marker target in the Magnitude vs Symbol result display.

■Setting range

(Measurement Offset) to (Measurement Interval – 1)

☞ 3.4.8 Data

☞ 3.4.10 Slot

Marker Link

■Summary

Selects whether to turn On or Off the synchronization of markers in separate traces.

■Setting options

On, Off

3

Measurement

3.8.1.11 Phase vs Symbol

Displays the analysis result of Phase vs Symbol in the trace area. The result of each such analysis is displayed, regardless of the storage mode.


Figure 3.8.1.11-1   Phase vs Symbol Result

Graph display result
■Summary

Displays the phase for each 1/8th of the symbol in the analysis interval, in degrees.

Scale
■Summary

Sets vertical scale of a graphical result.
■Setting range

The graph's vertical axis scale is up to ±180 degrees.

Marker
■Summary

Selects marker function between On and Off.
■Setting options

On, Off

Marker Number (Phase vs Symbol)

■Summary

Sets the marker target in the Phase vs Symbol result display.

■Setting range

(Measurement Offset) to (Measurement Interval – 1)

☞ 3.4.8 Data

☞ 3.4.10 Slot

Marker Link

■Summary

Selects whether to turn On or Off the synchronization of markers in separate traces.

■Setting options

On, Off

3

Measurement

3.8.1.12 Signal Monitor

Displays the spectrum in the trace area. The result of each such analysis is displayed, regardless of the storage mode.
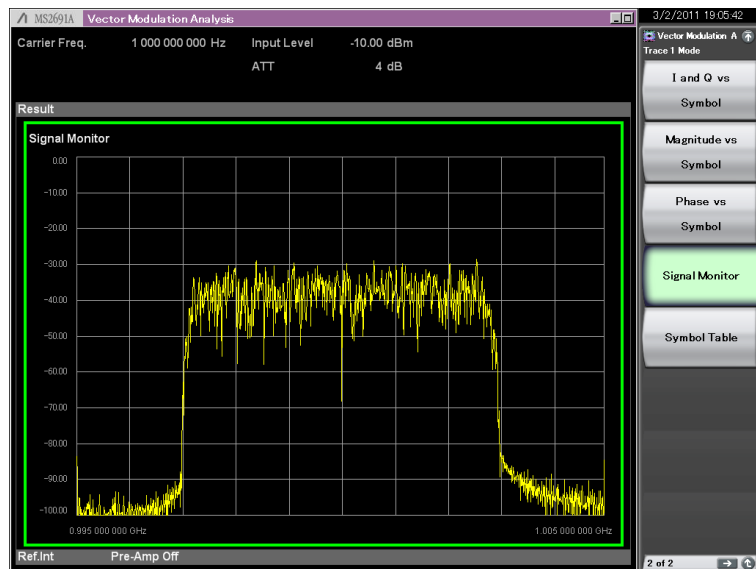
Figure 3.8.1.12-1   Signal Monitor Result

Graph display result
■Summary

Displays the spectrum in the analysis interval.

The range of the graph's horizontal axis is fixed to ±(Span/2) [Hz].

The value of Span is calculated from the Modulation setting and the Symbol Rate setting.

☞ 3.4.6 Modulation

Scale
■Summary

Sets vertical scale of a graphical result.

■Setting range

−10 to −100 dB (in 0.1 dB steps)

Reference level (0 dB) shall be +10 dB from the Input Level setting.

Marker
■Summary

No marker function is available.

3.8.1.13 Symbol Table

Displays the analysis result of Symbol Table in the trace area. The result of each such analysis is displayed, regardless of the storage mode setting.
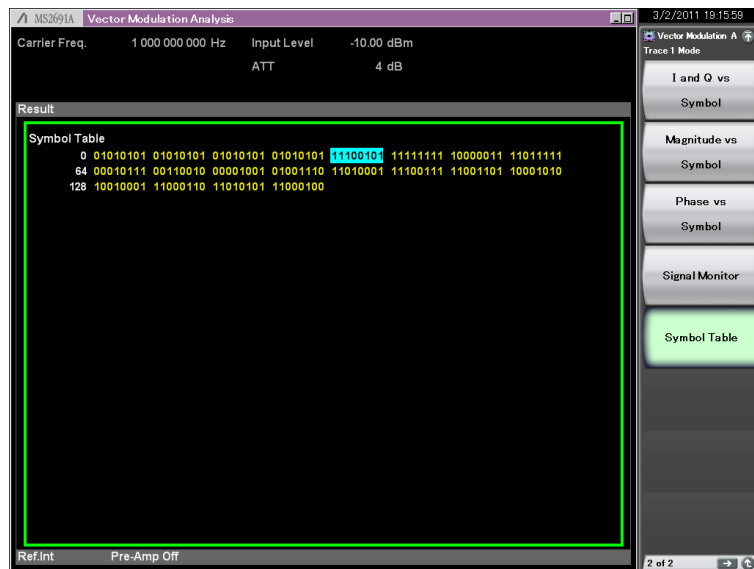
Figure 3.8.1.13-1   Symbol Table Result

Graph display result
■Summary

     Displays the demodulation result for each symbol.

Scale
■Summary

     Switches the measurement unit of numeric result between **Binary** and **Hex**. On the Scale menu, select F5 (Unit) to select the Unit menu, select F4 (Symbol) to select the Symbol menu, and specify F1 (Binary) or F2 (Hex).

3.8.1.14 Equalizer Amplitude

This function displays the Equalizer Amplitude analysis results at Trace. The analysis results are displayed each time irrespective of the Storage mode setting.

The analysis results are displayed when either On or Hold is selected at the Adaptive setting of Equalizer.

Figure 3.8.1.14-1   Equalizer Amplitude Result

Graph display result
■Summary

    Displays the equalizer amplitude characteristics in dB.

Scale
■Summary

    Sets vertical scale of a graphical result.

Scale: Vertical
■Summary

    Sets the upper and lower limits of the vertical axis scale of the graph result.

■Setting options

    +0.1 dB to +50 dB

3.8.1.15 Equalizer Phase

This displays the Equalizer Phase analysis results at Trace. The analysis results are displayed each time irrespective of the Storage mode setting. The analysis results are displayed when either On or Hold is selected at the Adaptive setting of Equalizer.
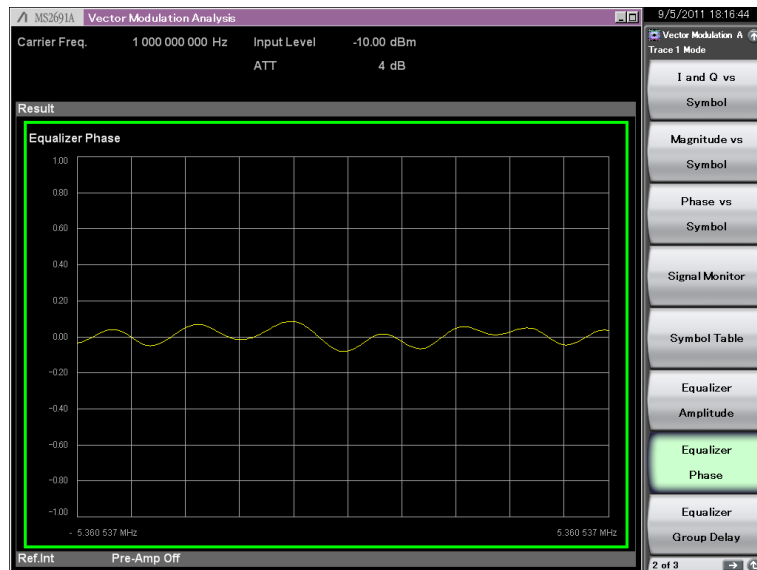
Figure 3.8.1.15-1　Equalizer Phase Result

Graph display result
■Summary

    Displays the equalizer phase characteristics in degree.

Scale
■Summary

    Sets vertical scale of a graphical result.

Scale: Vertical
■Summary

    Sets the upper and lower limits of the vertical axis scale of the graph result.

■Setting options

    +1 Degree to +180 degree

3.8.1.16 Equalizer Group Delay

This displays the Equalizer Group Delay analysis results at Trace. The analysis results are displayed each time irrespective of the Storage mode setting.

The analysis results are displayed when either On or Hold is selected at the Adaptive setting of Equalizer.

Figure 3.8.1.16-1   Equalizer Group Delay Result

Graph display result
■Summary
   Displays the equalizer group delay characteristics in s.

Scale
■Summary
   Sets vertical scale of a graphical result.

Scale: Vertical
■Summary
   Sets the upper and lower limits of the vertical axis scale of the graph result.
■Setting options
   +100 ns to +1 ms

3.8.1.17 Equalizer Impulse Response

This displays the Equalizer Impulse Response analysis results at Trace. The analysis results are displayed each time irrespective of the Storage mode setting.

The analysis results are displayed when either On or Hold is selected at the Adaptive setting of Equalizer.
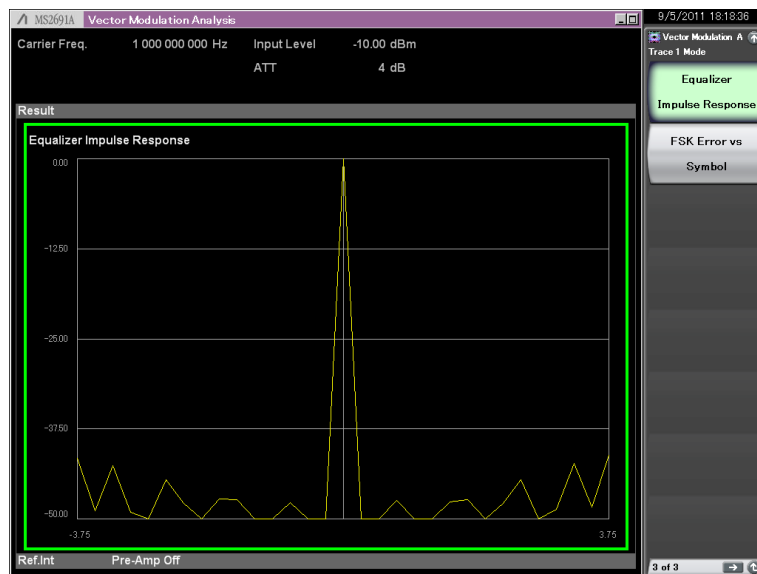
Figure 3.8.1.17-1 Equalizer Impulse Response Result

Graph display result
■Summary

Displays the equalizer impulse response in dB.

Scale
■Summary

Sets vertical scale of a graphical result.

Scale: Vertical
■Summary

Sets the upper and lower limits of the vertical axis scale of the graph result.
■Setting options

20 dB, 50 dB, 100 dB

3.8.1.18 FSK Error vs Symbol

Displays FSK Error vs Symbol analysis result in the Trace. The result of each such analysis is displayed, regardless of the storage mode setting.
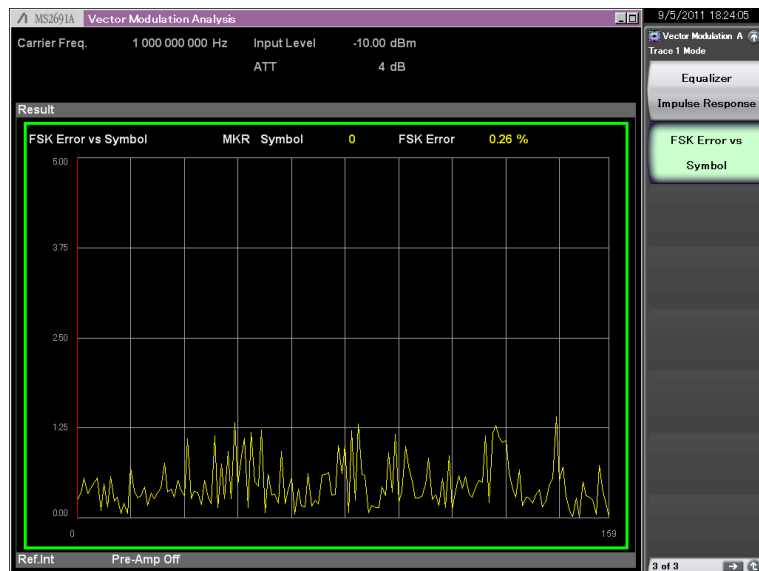
Figure 3.8.1.18-1   FSK Error vs Symbol Result

Graph display result
■Summary

This displays the FSK Error for each symbol in the analysis segment in % units.

Scale
■Summary

Sets vertical scale of a graphical result.

Scale: Vertical
■Summary

Sets the upper limit of the vertical axis scale of the graph result.

■Setting options

5%, 10%, 20%, 50%

Marker
■Summary

Selects marker function between On and Off.

■Setting options

On, Off

Marker Number (FSK Error vs Symbol)

■Summary

Sets the marker target in the FSK Error vs Symbol result display.

■Setting range

(Measurement Offset) to (Measurement Interval – 1)

☞ 3.4.8 Data

☞ 3.4.10 Slot

Marker Link

■Summary

Selects whether to turn On or Off the synchronization of markers in separate traces.

■Setting options

On, Off

3

Measurement

3.8.1.19 Fidelity vs Symbol

Displays the analysis results of Modulation Fidelity vs Symbol in Trace. The results are displayed only when the modulation is set to 2FSK, 4FSK, or H-CPM. The result of each analysis is displayed, regardless of the storage mode setting.
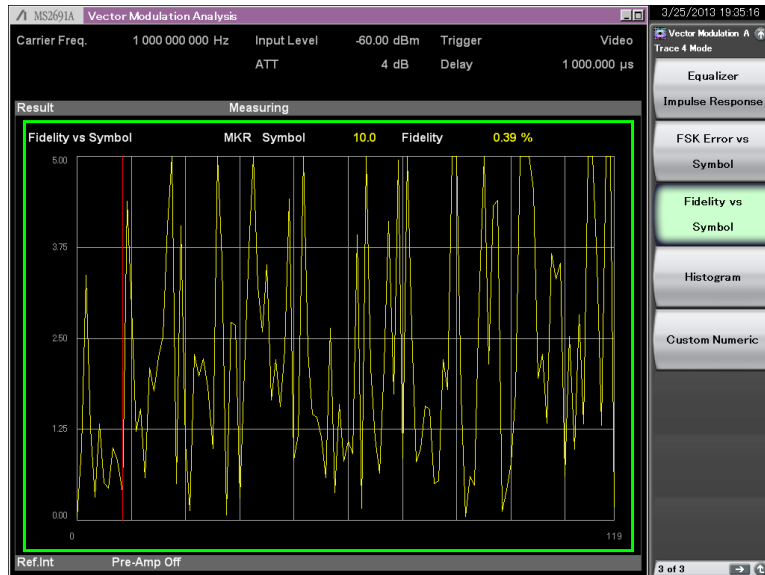
Figure 3.8.1.19-1   Modulation Fidelity vs Symbol Result

Graph display result
■Summary

Displays Modulation Fidelity of each symbol in the analysis interval in percentage.

Scale
■Summary

Sets the vertical axis scale of the graph result.

Scale: Vertical
■Summary

Sets the upper limit of the vertical axis scale of the graph result.
■Setting options

5%, 10%, 20%, 50%

Marker
■Summary

Selects marker function between On and Off.
■Setting options

On, Off

Marker Link

■Summary

Selects whether to turn On or Off the synchronization of markers in separate traces.

■Setting options

On, Off

3

Measurement

3.8.1.20 Histogram

Displays the appearance frequency of each symbol in Trace. The results are displayed only when the modulation is set to 2FSK, 4FSK, or H-CPM.
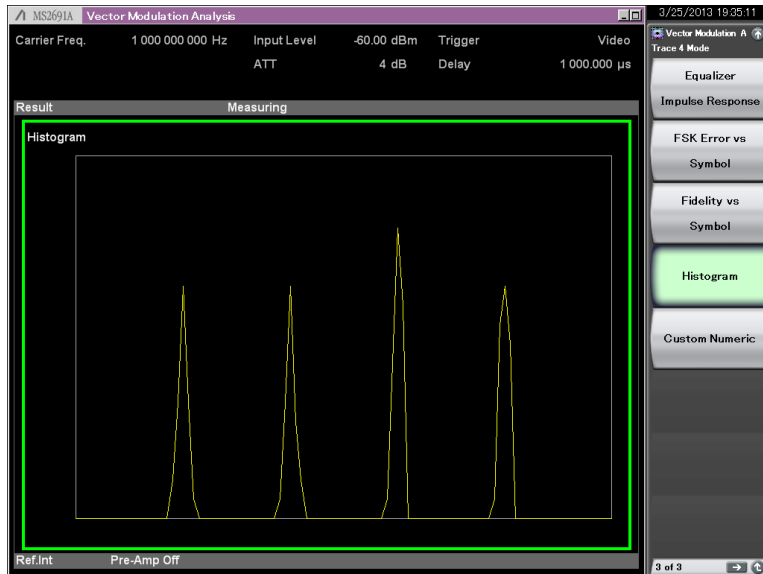
Figure 3.8.1.20-1   Histogram Result

Graph display result
■Summary

Displays the frequency elements of each symbol. The horizontal axis represents normalized frequency and the vertical axis represents appearance frequency.

Scale
■Summary

The graph's vertical axis scale is fixed to 0 to 1.

3.8.1.21 Custom Numeric

Displays the numeric result of modulation analysis in figures and bars in the trace area. The items to display can be selected from numeric result items arbitrarily.

If the Storage Mode is set to Off, the analysis result of each measurement is displayed. If set to Average, the average analysis result of plural measurements is displayed. If set to Average & Max, the average and maximum of the analysis results are displayed.

Note:

The custom numeric cannot be enlarged in display.

Figure 3.8.1.21-1   Custom Numeric Result

Display result

Refer to 3.8.1.8 "Numeric" for detail.

3.8.2 Power vs Time

Displays the numeric result of power vs time in figures and bars in the trace area. The items to display can be selected from numeric result items arbitrarily.

Table 3.8.2-1 Trace Mode Type

Trace Mode	Function
Rise and Fall	Displays Rise and Fall of Slot.
Slot	Displays all the intervals of Slot.
Frame	Displays one frame.

3.8.2.1 Rise and Fall

Displays the analysis result of Rise and Fall in the trace area.
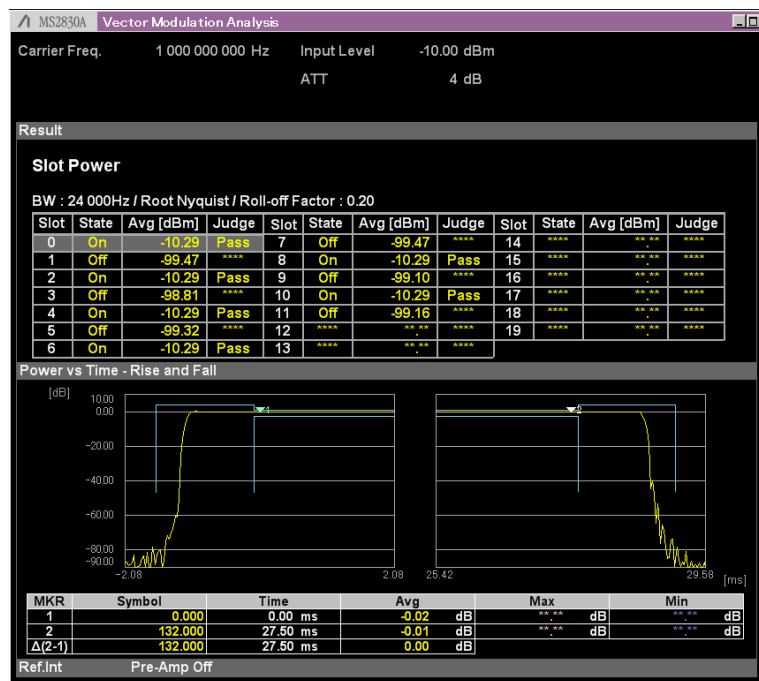
Figure 3.8.2.1-1 Rise and Fall Result

Numeric results
■Summary

Displays analysis results of each slot.

BW…
■Summary

Displays filter bandwidth, type, and Roll-off factor at measurement.

Slot
■Summary

Displays the slot number.

State
■Summary

Displays On/Off state of the slot.

Avg[dBm]
■Summary

Displays the power after filtering of the slot.

When the level offset is On, the level offset value is added.

Judge
■Summary

Displays the Template judgment result of the slot.

Graph display result
■Summary

Displays Power vs Time at rise and fall of the slot.

Slot
■Summary

Sets the slot number to display graph result. (0 to 19)

Unit
■Summary

Selects a unit for the vertical axis of the graph.

■Setting options

dB, dBm

Display Item
■Summary

Selects the analysis results to display in the graph.

■Setting options

Average	Displays only the average value.
All	Displays the average, minimum, and maximum values.

3

Measurement

Marker Display Results

■Summary

Displays markers in the graph of Power vs Time.

MKR

■Summary

Sets the position of each marker.(Marker1, Marker2)

Symbol

■Summary

Displays marker position information in symbols.
Reference for position information is the starting point of the
analysis interval.

Time

■Summary

Displays marker position information in time.
Reference for position information is the starting point of the
analysis interval.

Avg

■Summary

Displays the average of the analysis results at the position where
the marker is selected.

Max

■Summary

Displays the maximum value of the analysis results at the position
where the marker is selected.

Min

■Summary

Displays the minimum value of the analysis results at the position
where the marker is selected.

3.8.2.2 Slot

Displays the analysis result of the slot in the trace area.
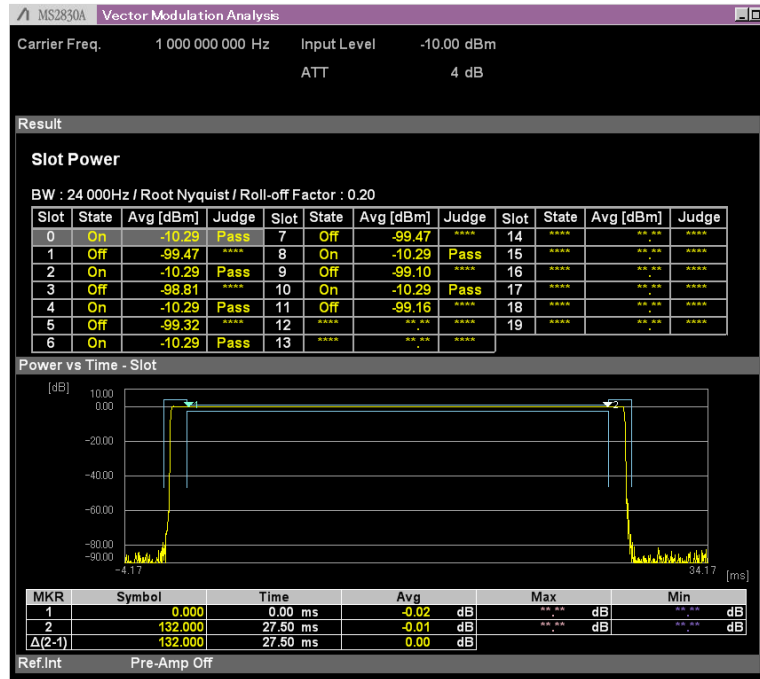
Figure 3.8.2.2-1   Slot Result

Numeric results

See Section 3.8.2.1 "Rise and Fall".

Graph display result

See Section 3.8.2.1 "Rise and Fall".

3

Measurement

3.8.2.3 Frame

Displays the analysis result of the frame in the trace area.
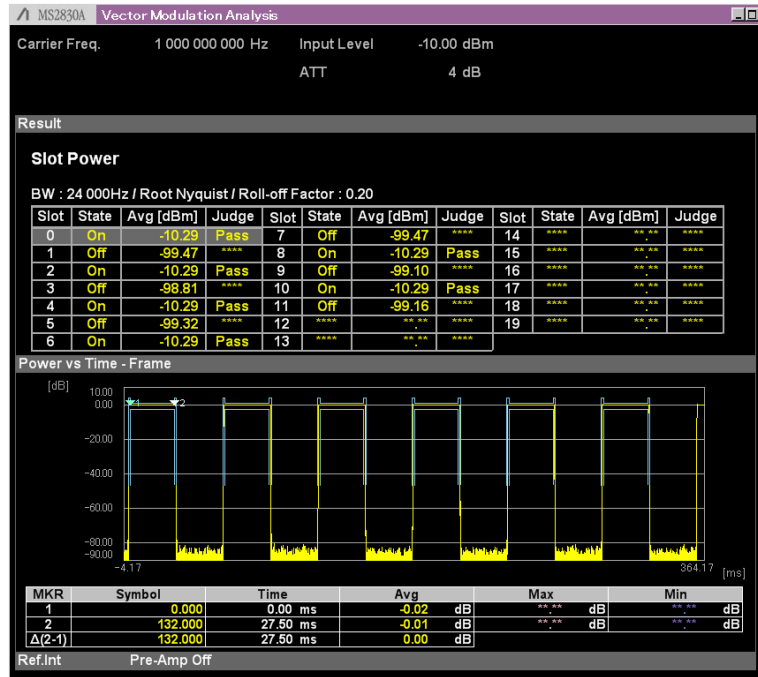
Figure 3.8.2.3-1   Frame Result

Numeric results

See Section 3.8.2.1 "Rise and Fall".

Graph display result

See Section 3.8.2.1 "Rise and Fall".

3.9 Setting Capture

This section describes the settings of IQ data capture. Pressing [F7] (Capture) on the main function menu displays the Capture function menu.

Note:

The Capture function is unavailable for the Power vs Time measurement.

Table 3.9-1 Capture Function Menu

Menu	Function
Capture Time Auto Manual	Selects Auto (default) or Manual for IQ data capture mode. This is not available when the Replay function is executed. ☞ 3.9.1 Setting capture time
Capture Time Length *.*** *** ***s	Sets the capture time length of IQ data. This is not available when the Replay function is executed. ☞ 3.9.1 Setting capture time
Save Captured Data	Recalls the Save Captured Data function menu. ☞ Chapter 4 Digitize Function
Replay	Recalls the Replay function menu. ☞ Chapter 4 Digitize Function
Stop Replaying	Stops the Replay function. This is available only when the Replay function is executed. ☞ Chapter 4 Digitize Function
Analysis Offset Time	Tunes the analysis start position during replay. This is available only when the Replay function is executed. ☞ Chapter 4 Digitize Function
Capture Interval Frame	Selects 1 Frame (default) or 10 Frame for capture interval of IQ data to use for one analysis. This is not available when the Replay function is executed. ☞ 3.9.2 Setting capture interval

3

Measurement

3.9.1   Setting capture time

Sets the capture mode from Capture Time and the capture time length from Capture Time Length.

- Auto

This captures the required data at each measurement in accordance with the Common Setting Dialog settings.

- Manual

This mode specifies the capture time for each measurement. The capture time is set at Capture Time Length. The Capture Time Length setting range changes according to the Span. (The Span is determined by the Symbol Rate at the Common Setting Dialog. Refer to section 3.4.6 Modulation.) When Capture Time Length is set, the mode becomes Manual automatically.

Table 3.9.1-1   Maximum Capture Time

Span [Hz]	Maximum Capture Time [s]
1 k	2000
2.5 k	2000
5 k	2000
10 k	2000
25 k	2000
50 k	1000
100 k	500
250 k	200
500 k	100
1 M	50
2.5 M	20
5 M	10
10 M	5
25 M	2
31.25 M	2
50 M	0.5
62.5 M	0.5
100 M	0.5
125 M	0.5

3.9.2 Setting capture interval

Sets capture interval (frame number to capture) for one measurement. This setting is available only when Frame Formatted is selected for Measuring Object. It is set to "1 Frame" when No Formatted is selected.

■Summary

Sets capture length of measurement data for analysis.

■Setting options

1 Frame, 10 Frame

■Default

1 Frame: Except the below

10 Frame: When Frame Formatted is selected for Measuring Object and Sync Word Search is On.

3.9.3 Automatically saving Common Setting parameters

By capturing IQ data, the Common Setting parameter file is automatically saved to the same folder as the Waveform folder. The saved Common Setting parameters are automatically loaded when replaying the captured IQ data.

The Common Setting parameter file is automatically saved as:

"[File name same as waveform (without extension)]_VMA.xml"

3

Measurement

3.10 Saving Measurement Results

This section describes how to save measurement results to the internal memory or USB memory stick. Press [Save] when the VMA screen is displayed, and the Save function menu appears.

Note:

Use the supplied USB memory stick. Other USB memory stick may cause malfunction due to incompatibilities.
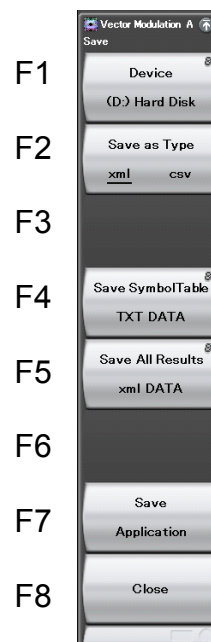
Figure 3.10-1   Save Function Menu

Table 3.10-1   Save Function Menu

Menu	Function
Device	Sets the save destination drive.
Save as Type	Sets the type of the file to be saved.
Save All Results	Saves all results measured by the MX269017A.
Save Application	Sets measurement parameters. ☞ *MS2690A/MS2691A/MS2692A Signal Analyzer operation manual* or *MS2830A Signal Analyzer operation manual*
Save SymbolTable	Saves symbol demodulation results.
Close	Closes the Save function menu.

Device
■Summary

Sets the save destination drive.

■Setting options

D, E, F, …
All available drives except drive C

Save as Type
■Summary

Sets the type of the file to be saved.

■Setting options

xml   Saves in xml format.
csv   Saves in csv format.

Save All Results
■Summary

This saves the measurement results. The measurement results that can be read by the `:FETCh:EVM[n]?`, `:READ:EVM[n]?`, and `:MEASure:EVM[n]?` remote commands are saved. For details on measurement results, refer to Table 2.7-2 "Responses of Modulation Analysis Result" in the *MX269017A Vector Modulation Analysis Software Operation Manual (Remote Control)*.

The saved file is output under the name format of "VMA*date_sequence number*.xml". When measurement results are saved several times on the same date, the sequence number starting from "00" is suffixed to each file name, like "VMA*date*_00.xml," "VMA*date*_01.xml," "VMA*date*_02.xml," …, up to "VMA*date*_99.xml."

The sequential numbers suffixed to a file name are 0 to 99. Since the file number returns to 00 after 99, files with the same name are overwritten.

Files are saved to the following directory of the target drive specified using ⌗F1⌗ (Device).

/Anritsu Corporation/Signal Analyzer/User Data/Measurement Results/Vector Modulation Analysis

There can be up to 100 XML files and 100 CSV files among the files.

3

Measurement

Save SymbolTable

■Summary

Saves demodulation result for each symbol.
The data displayed in Symbol Table is saved, even if Trace Mode is not currently set to Symbol Table.

The saved file is output under the name format of "SymbolTable*date_sequence number*.xml". When measurement results are saved several times on the same date, the sequence number starting from "00" is suffixed to each file name, like "SymbolTable*date*_00.xml," "SymbolTable*date*_01.xml," "SymbolTable*date*_02.xml," …, up to "SymbolTable*date*_99.xml."

The sequential numbers suffixed to a file name are 0 to 99. Since the file number returns to 00 after 99, files with the same name are overwritten.

Files are saved to the following directory of the target drive specified using [F1] (Device).

/Anritsu Corporation/Signal Analyzer/User Data/Trace Data
/Vector Modulation Analysis

Figure 3.10-2 shows the save format for SymbolTable file.
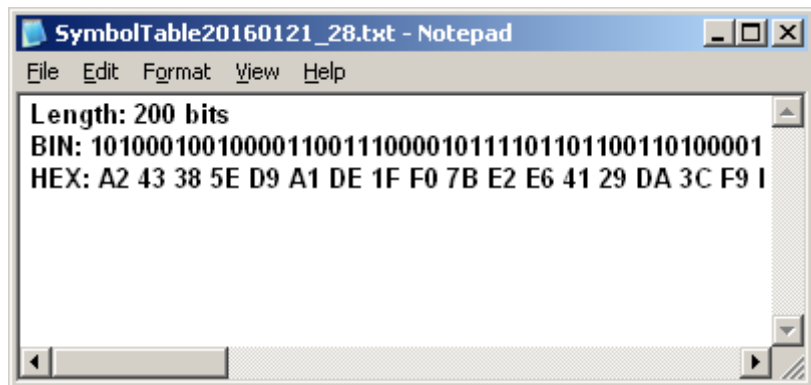
Figure 3.10-2　Save format for SymbolTable

Close

■Summary

Closes the Save function menu.

Chapter 4 Digitize Function

This chapter describes how to save IQ data to an external memory and replay the stored IQ data.
The Digitize function is available only when Measure is set to Modulation Analysis.

4

Digitize Function

4.1 Saving IQ Data

After pressing [F7] (Capture) on the Main function menu, press [F3] (Save Captured Data) to display the Save Captured Data function menu.
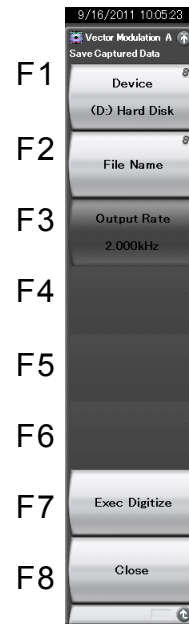
Figure 4.1-1   Save Captured Data function menu

Table 4.1-1   Save Captured Data function menu

Menu Display	Function
Device	Selects the location of the file to be saved.
File Name	Sets the name of the file to be saved.
Output Rate	Displays the output data rate (this setting cannot be configured).
Exec Digitize	Executes saving.
Close	Closes the Save Captured Data function menu.

The IQ data stored in the internal memory at the time of execution of this function is saved to the external memory.

Example: To save IQ data
<Procedure>
1. Press [F7] (Capture) on the main function menu.
2. Press [F3] (Save Captured Data).
3. Press [F1] (Device) on the Save Captured Data function menu to select a data file for saving the IQ data.
4. Press [F2] (File Name) to set the file name.
5. Press [F7] (Exec Digitize) to save the IQ data.

When save processing is executed, the following files are created.

- "[File Name].dgz"   Data file (binary format)
- "[File Name].xml" Data information file (XML format)

The IQ data row is saved to the data file. The information on the saved data is saved to the data information file.

If a file name was not specified, the file is automatically named "Digitize *date_sequential number*". The sequential number range is from 000 to 999.

Files are saved to the following directory of the target drive specified using [F1] (Device).
¥Anritsu Corporation¥Signal Analyzer¥User Data¥Digitized Data¥Vector Modulation Analysis
Up to 1000 files can be saved in a folder.

4

Digitize Function

4.1.1 Format of data information file

The information on the saved IQ data is recorded in the data information file. Table 4.1.1-1 shows the details of the recorded parameters.

Table 4.1.1-1 Format of data information file

Item	Descriptions
CaptureDate	Day/Month/Year of the captured data in the "DD/MM/YYYY" format.
CaptureTime	Data captured time in "HH/MM/SS" format
FileName	Data file name
Format	Data format, fixed to "Float"
CaptureSample	Number of samples of the recorded data [Sample]
Condition	Error status of the recorded data "Normal": No error "OverLoad": Level over
TriggerPosition	Trigger occurrence position [Sample] The start point of the recorded data is 0.
CenterFrequency	Center frequency [Hz]
SpanFrequency	Frequency span [Hz]
SamplingClock	Sampling rate [Hz]
PreselectorBandMode	Frequency band switch mode "Normal": Normal mode "Spurious": Spurious mode
ReferenceLevel	Reference level [dBm] Note that this value does not include the reference level offset.
AttenuatorLevel	Attenuator value [dB]
InternalGain	Internal gain value [dB] This is an internal parameter.
PreAmp	Gain value obtained by PreAmp [dB]
IQReverse	IQ reverse setting, fixed to "Normal"
TriggerSwitch	Trigger On/Off setting "FreeRun":Trigger is not used "Triggered":Trigger is used

Table 4.1.1-1 Format of data information file (Cont'd)

Item	Descriptions
TriggerSource	Trigger source "External": External trigger "SGMarker": SG marker trigger
TriggerLevel	Trigger level [dBm] Note that this value does not include the reference level offset. It is in dBm units, even if the scale mode is Lin.
TriggerDelay	Trigger delay time [s] It is the relative time from the trigger input position to the start point of the recorded data.
IQReference0dBm	Reference IQ amplitude value that indicates 0 dB Fixed to "1".
ExternalReferenceDisp	Reference signal information "Ref.Int":Internal reference signal "Ref.Ext":External reference signal "Ref.Int Unlock":Internal reference signal is unlocked. "Ref.Ext Unlock":External reference signal is unlocked.
Correction Factor	Correction value of correction function [dB] The correction factor is added to the IQ data in a data file. 0.000 is automatically set when the Correction function is set to Off.
Terminal	Signal input terminal "RF": RF terminal
ReferencePosition	0-second reference position Indicates the 0-second reference position using the digitized data point position. During Replay function execution, the reference position is displayed as 0 s.
Trigger Slope	Selects the edge where the trigger is generated (rise or fall). "Rise": Rising edge "Fall": Falling edge

4

Digitize Function

4.1.2   Format of data file

The data file is created in binary format. From the beginning of the file, I-phase data and Q-phase data are recorded by 4 bytes. The I-phase data and Q-phase data are recorded as a float type (IEEE real*4).

Beginning of file →

I-phase data 1   (4Byte)
Q-phase data 1   (4Byte)
I-phase data 2   (4Byte)
Q-phase data 2   (4Byte)
I-phase data 3   (4Byte)
Q-phase data 3   (4Byte)
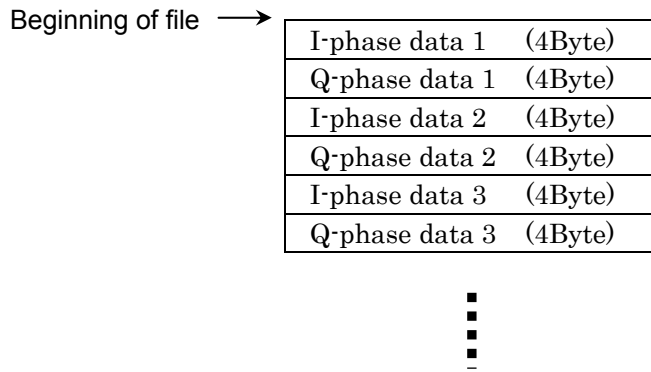
Figure 4.1.2-1   Format of data file

The IQ data can be converted to power based on the following formula:

$$P = 10 Log_{10} \left(I^2 + Q^2 \right)$$

P: Power [dBm]
I: I-phase data
Q: Q-phase data

4.2   Replay Function

The Replay function enables the saved IQ data to be reanalyzed .After pressing ⬛ (Capture) on the main function menu, press ⬛ (Replay) to display the Replay function menu.
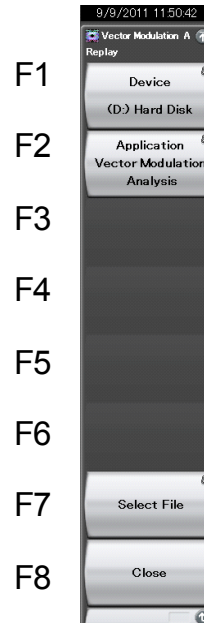
Figure 4.2-1   Replay Function Menu

Table 4.2-1   Replay Function Menu

Menu Display	Function
Device	Selects the drive in which the target file is stored.
Application	Selects the name of the application used to save the target file.
Select File	Selects the target file. After selecting the file, the Replay function is executed.
Close	Closes the Replay function menu.

4.2.1   Starting Replay Function

Start the Replay function using the following procedure:

<Procedure>

1.   Press [F7] (Capture) on the main function menu.

2.   Press [F4] (Replay) on the Capture function menu.

3.   Press [F1] (Device) on the Replay function menu and select the drive in which the target file is stored.

4.   Press [F2] (Application) and select the application used to save the target file.

5.   Press [F7] (Select File) to display the file selection dialog box. The Replay function starts after a file is selected. Then, **Replaying** is displayed on the screen.

Note:

  • Depending on the file type which is replayed, restriction applies to the range of symbol rate.

For details about the settings while Replay function is being executed, refer to the following:

☞ 4.2.5 "Characteristics of Replayable IQ Data Files"

  • When starting the Replay function, the settings are restored to those saved in the Common Setting values in the Common Setting parameter file if the file is in the same folder. If the file is not in the same folder, the settings are initialized except for the parameters specified in Table 4.1.1-1.

☞ 3.9.2 "Automatically saving Common Setting parameters"

4.2.2   Display During Replay Function Execution

Replay Error Info. is displayed if the target IQ data file meets the following conditions:

  • Frequency reference is Unlocked when IQ data is saved.
  • Level Over occurs when IQ data is saved.

4.2.3   Restriction During Replay Function Execution

The functions shown in Table 4.2.3-1 are disabled when Replay is executed.

Table 4.2.3-1   Functions Restricted During Replay

Function
Center Frequency
Frequency Band Mode
Input Level
Pre Amp
Storage Mode
Storage Count
Average Mode
Trigger Switch
Trigger Source
Trigger Slope
Trigger Delay
Continuous Measurement
Single Measurement
Capture Time Auto/Manual
Capture Time Length
Pre-selector Auto Tune
Pre-selector Tune (Manual)
Pre-selector Tune Preset
Erase Warm Up Message

4

Digitize Function

4.2.4   Tuning the Analysis Start Position During Replay

This section describes how to tune the analysis start position while the Replay function is being executed.

<Procedure>

1.   Press ⬚ F7 (Capture) on the main function menu.

2.   Press ⬚ F6 (Analysis Offset Time) on the Capture function menu to display the Analysis Offset Time setting dialog box.

3.   Inputs the Analysis Offset Time.

4.   Press **Set** to set the input value. The analysis start position is changed by the specified time length.

This function is available only when a long-time IQ data file is subject to the replay function. Refer to the following for how to set the time to capture an IQ data file.

☞ 3.9.1   "Setting capture time"

Analysis Offset Time
■Summary

This function sets the position to start analysis during replay, by the offset from the reference position.

■Setting range

Lower limit: 0
Upper limit: The range depends on the size of the replayed file, Common Setting parameters, Capture Time Length, Storage Count, etc.

■Resolution

1 / Sampling Rate [Hz]

Sampling Rate [Hz] is twice as large as Span calculated from Modulation Type and Symbol Rate. For more information about "Span", refer to Section 3.4.6 "Modulation".

If the value set for the offset doesn't match the resolution, the set value is rounded up.

■Default

0.000000000 s

4.2.5   Conditions for IQ Data Files That Can Be Replayed

Table 4.2.5-1 shows the conditions for IQ data files for which replay analysis can be performed.

Table 4.2.5-1   IQ data file that can be replayed

Name	Value
Format	I, Q (32-bit Float Binary format) Only for IQ data saved with MX269017A.
Sample numbers	Dependent on the common setting value.

Under certain condition, measurement may not be executed. Note the following.

- While replaying, parameter included in Common Setting is restricted.
- The items to be restricted varies according to file type that is replayed.

If the message "Current Common Setting cannot measure IQ data file." is displayed, measurement may become possible by changing the following parameters.

- Decrease the setting value for:
  - Slot per Frame

  - Slot Length

  - Measurement Offset

  - Measurement Interval

- Increase the setting value for:
  - Symbol Rate

- Turn off the setting for:
  - Sync Word Search

  - Burst Search

  - Equalizer Adaptive

The measurement results during IQ data save and during replay may sometimes be different under the following conditions.

- When a different value is set at the Common Setting value at IQ data save and at replay.

4

Digitize Function

4.2.6   Stopping Replay

Stop the Replay function using the following procedure:

\<Procedure\>

1.   Press [F7] (Capture) on the main function menu.

2.   Press [F5] (Stop Replaying) to stop the Replay function.

Chapter 5   Performance Test

This chapter describes the measuring instruments, setup methods, and performance test procedures required for testing the performance of the MS269xA, MS2830A or MS2840A in which the MX269017A is installed.

5

Performance Test

5.1 Overview of Performance Test

5.1.1 Performance test

Performance tests are performed as part of preventive maintenance in order to prevent the performance of the MS269xA, MS2830A or MS2840A from being degraded before it occurs.

Use performance tests when required for acceptance inspection, routine inspection and performance verification after repairs. Perform items deemed critical at regular intervals as preventive maintenance. Perform the following performance tests for acceptance inspection, routine inspection and performance verification after repairs of the MS269xA, MS2830A or MS2840A.

- Carrier frequency accuracy
- Residual vector error
- Symbol rate error

Perform items deemed critical at regular intervals as preventive maintenance. A recommended cycle for routine tests of once or twice a year is desirable.

If items that do not meet the required level are detected during performance testing, contact an Anritsu Service and Sales office. Contact information is available in a separate file (for the PDF version), and on the last page of this manual (for the printed version).

5.1.2 Performance test items and instruments used

Table 5.1.2-1 lists measuring instruments used or performance tests.

Table 5.1.2-1   List of measuring instruments for performance test

Item	Model Name
MS2690A/MS2691A/MS2692A	MS2690A/MS2691A/MS2692A, MS2830A or MS2840A
Vector signal generator with TDMA signal generation function	MG3710A + MX370102A
Power meter + Power sensor	ML2487B + MA2470D series
3 dB attenuator × 2	41KC-3

5.1.3 Setting of signal used for performance test

Use the MX370102A TDMA IQproducer to create signals used for performance testing. Ten types of signals are used for performance testing. Specify the settings described in the following table for the TDMA IQproducer to create waveform files for each signal.

Table 5.1.3-1   Setting Parameters for Testsignal000 Signal

Item	Value
Parameter setting sheet	No Format
Modulation Type	4FSK
Maximum frequency deviation	945 Hz
Symbol Rate	2.4 ksps
Over Sampling	16
Data	PN9
Filter	ARIB STD-T98
Roll Off	0.20
RMS	1634
Package	TDMA_IQproducer
Pattern Name	TestSignal000

Table 5.1.3-2   Setting Parameters for Testsignal001 Signal

Item	Value
Parameter setting sheet	No Format
Modulation Type	π/4DQPSK
Symbol Rate	4 ksps
Over Sampling	32
Data	PN9
Filter	Root Nyquist
Roll Off	1
RMS	1634
Package	TDMA_IQproducer
Pattern Name	TestSignal001

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Table 5.1.3-3   Setting Parameters for Testsignal002 Signal

Item	Value
Parameter setting sheet	No Format
Modulation Type	64QAM
Symbol Rate	4 ksps
Over Sampling	32
Data	PN9
Filter	Root Nyquist
Roll Off	1
RMS	1634
Package	TDMA_IQproducer
Pattern Name	TestSignal002

Table 5.1.3-4   Setting Parameters for Testsignal003 Signal

Item	Value
Parameter setting sheet	No Format
Modulation Type	$\pi/4$DQPSK
Symbol Rate	500 ksps
Over Sampling	32
Data	PN9
Filter	Root Nyquist
Roll Off	1
RMS	1634
Package	TDMA_IQproducer
Pattern Name	TestSignal003

Table 5.1.3-5   Setting Parameters for Testsignal004 Signal

Item	Value
Parameter setting sheet	No Format
Modulation Type	64QAM
Symbol Rate	500 ksps
Over Sampling	32
Data	PN9
Filter	Root Nyquist
Roll Off	1
RMS	1634
Package	TDMA_IQproducer
Pattern Name	TestSignal004

Table 5.1.3-6   Setting Parameters for Testsignal005 Signal

Item	Value
Parameter setting sheet	No Format
Modulation Type	$\pi/4$DQPSK
Symbol Rate	5 Msps
Over Sampling	32
Data	PN9
Filter	Root Nyquist
Roll Off	1
RMS	1634
Package	TDMA_IQproducer
Pattern Name	TestSignal005

Table 5.1.3-7   Setting Parameters for Testsignal006 Signal

Item	Value
Parameter setting sheet	No Format
Modulation Type	64QAM
Symbol Rate	5 Msps
Over Sampling	32
Data	PN9
Filter	Root Nyquist
Roll Off	1
RMS	1634
Package	TDMA_IQproducer
Pattern Name	TestSignal006

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Table 5.1.3-8   Setting Parameters for Testsignal007 Signal

Item	Value
Parameter setting sheet	No Format
Modulation Type	256QAM
Symbol Rate	5 Msps
Over Sampling	4
Data	PN15
Filter	Root Nyquist
Roll Off	1
RMS	1634
Package	TDMA_IQproducer
Pattern Name	TestSignal007

Table 5.1.3-9   Setting Parameters for Testsignal008 Signal

Item	Value
Parameter setting sheet	Burst
Modulation Type	2FSK
Modulation Index	1
Symbol Rate	100 ksps
Over Sampling	8
The Number of Frames	1
The Number of Slots per Frame	2
Frame Format	1st Slot:On, 2nd Slot:Off
Data	PN9
1st Field	Ramp, 1 bit
2nd Field	Fixed, 2 bit, 1(Hex)
3rd Field	Fixed, 32 bit, 55555555(Hex)
4th Field	Fixed, 8 bit, E5(Hex)
5th Field	Data, 120 bit
6th Field	Fixed, 2 bit, 1(Hex)
7th Field	Ramp, 1 bit
8th Field	Guard 2 bit
Filter	Gaussian
Roll Off	0.5
RMS	1634
Package	TDMA_IQproducer
Pattern Name	TestSignal008

Table 5.1.3-10   Setting Parameters for Testsignal009 Signal

Item	Value
Parameter setting sheet	No Format
Modulation Type	2ASK
Modulation Index	1
Manchester Code	On
Symbol Rate	1.024 Msps
Over Sampling	4
Data	PN9
Filter	Gaussian2
Roll Off	0.5
RMS	1634
Package	TDMA_IQproducer
Pattern Name	TestSignal009

Table 5.1.3-11   Setting Parameters for Testsignal010 Signal

Item	Value
Parameter setting sheet	No Format
Modulation Type	4ASK
Modulation Index	1
Symbol Rate	500 ksps
Over Sampling	8
Data	PN9
Filter	Gaussian2
Roll Off/BT	0.5
RMS	1157
Package	TDMA_IQproducer
Pattern Name	TestSignal010

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5.2 Performance Test Items

Warm up the device to be tested and the measuring instruments for at least 30 minutes except if specified otherwise, in order to stabilize them sufficiently before running performance tests. Maximum measurement accuracy requires, in addition to the above, conducting performance tests under ambient temperatures and with little AC power supply voltage fluctuations, as well as the absence of noise, vibrations, dust, humidity and other problems.

5.2.1 Testing Methods – Carrier Frequency Accuracy

(1) Test target standards

- Carrier frequency accuracy

(2) Measuring instrument for test

- Vector signal generator: MG3710A + MX370102A
- Power meter
- 3-dB attenuator × 2

(3) Setup

Figure 5.2.1-1　Setup

(4)   Test procedure

Use the default values (value following preset execution) for parameters whose values are not indicated in the following procedure.

<Procedure>

1.   Set the MG3710A as follows:

- Frequency   :30.0 MHz
- Level   :–15 dBm
- Base Band Pattern   :TestSignal001
- Mod On/Off   :On
- Output   :On

2.   Set as follows for the MS2690A/MS2691A/MS2692A.

- Center Frequency   :30.0 MHz
- Input Level   :–15 dBm
- Reference Signal   :Auto
- Common Setting
    Measuring Object   :Non-Formatted
    Modulation   :PI/4DQPSK
    Symbol Rate   :4 ksps
    Measurement Filter   :Root Nyquist+None
    Reference Filter   :Nyquist+None
    Roll Off   :1.0
    Measurement Interval :200 symbol

3.   Select the Modulation Analysis screen.

4.   Input the output signal from the MG3710A to the power meter and adjust this output level so that the power reading is –15 dBm ±0.1 dB.

5.   Input the output signal from the MG3710A to the MX269017A.

6.   Press ⌒Single⌒ to perform measurement.

7.   Confirm whether the measured carrier frequency error (carrier frequency accuracy)is within specifications.

8.   Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 2 GHz, and repeat Steps 4 through 7.

9.   Set the frequency of the MG3710A and the main unit to 6 GHz (MS269xA) or 3.5 GHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

10.   Specify TestSignal002 as the MG3710A pattern.

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11. Set as follows for the MS2690A/MS2691A/MS2692A.

    - Common Setting
      Measuring Object   :Non-Formatted
      Modulation   :64QAM
      Symbol Rate   :4 ksps
      Measurement Filter :Root Nyquist+None
      Reference Filter   :Nyquist+None
      Roll Off   :1.0
      Measurement Interval :200 symbol

12. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 30 GHz, and repeat Steps 4 through 7.

13. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 2 GHz, and repeat Steps 4 through 7.

14. Set the frequency of the MG3710A and the main unit to 6 GHz (MS269xA) or 3.5 GHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

15. Specify TestSignal003 as the MG3710A pattern.

16. Set as follows for the MS2690A/MS2691A/MS2692A.

    - Common Setting
      Measuring Object   :Non-Formatted
      Modulation   :PI/4DQPSK
      Symbol Rate   :500 ksps
      Measurement Filter :Root Nyquist+None
      Reference Filter   :Nyquist+None
      Roll Off   :1.0
      Measurement Interval :4096 symbol

17. Set the frequency of the MG3710A and MS2690A/MS2691A/ MS2692A to 30 GHz, and repeat Steps 4 through 7.

18. Set the frequency of the MG3710A and MS2690A/MS2691A/ MS2692A to 2 GHz, and repeat Steps 4 through 7.

19. Set the frequency of the MG3710A and the main unit to 6 GHz (MS269xA) or 3.5 GHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

20. Specify TestSignal004 as the MG3710A pattern.

21. Set as follows for the MS2690A/MS2691A/MS2692A.
    - Common Setting
      Measuring Object   :Non-Formatted
      Modulation   :64QAM
      Symbol Rate   :500 ksps
      Measurement Filter :Root Nyquist+None
      Reference Filter   :Nyquist+None
      Roll Off   :1.0
      Measurement Interval :4096 symbol

22. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 30 GHz, and repeat Steps 4 through 7.

23. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 2 GHz, and repeat Steps 4 through 7.

24. Set the frequency of the MG3710A and the main unit to 6 GHz (MS269xA) or 3.5 GHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

25. Specify TestSignal005 as the MG3710A pattern.

26. Set as follows for the MS2690A/MS2691A/MS2692A.
    - Common Setting
      Measuring Object   :Non-Formatted
      Modulation   :PI/4DQPSK
      Symbol Rate   :5 Msps
      Measurement Filter :Root Nyquist+None
      Reference Filter   :Nyquist+None
      Roll Off   :1.0
      Measurement Interval :4096 symbol

27. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 30 GHz, and repeat Steps 4 through 7.

28. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 2 GHz, and repeat Steps 4 through 7.

29. Set the frequency of the MG3710A and the main unit to 6 GHz (MS269xA) or 3.5 GHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

30. Specify TestSignal006 as the MG3710A pattern.

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31. Set as follows for the MS2690A/MS2691A/MS2692A.

- Common Setting

    Measuring Object   :Non-Formatted
    Modulation   :64QAM
    Symbol Rate   :5 Msps
    Measurement Filter :Root Nyquist+None
    Reference Filter   :Nyquist+None
    Roll Off   :1.0
    Measurement Interval :4096 symbol

32. Set the frequency of the MG3710A and MS2690A/MS2691A/ MS2692A to 30 GHz, and repeat Steps 4 through 7.

33. Set the frequency of the MG3710A and MS2690A/MS2691A/ MS2692A to 2 GHz, and repeat Steps 4 through 7.

34. Set the frequency of the MG3710A and the main unit to 6 GHz (MS269xA) or 3.5 GHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

35. Specify TestSignal007 as the MG3710A pattern.

36. Set as follows for the MS2690A/MS2691A/MS2692A.

- Common Setting

    Measuring Object   :Non-Formatted
    Modulation   :256QAM
    Symbol Rate   :5 Msps
    Measurement Filter :Root Nyquist+None
    Reference Filter   :Nyquist+None
    Roll Off   :1.0
    Measurement Interval: 4096 symbol

37. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 30 GHz, and repeat Steps 4 through 7.

38. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 2 GHz, and repeat Steps 4 through 7.

39. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 6 GHz (MS269xA) or 3.5 GHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

40. Specify TestSignal000 as the MG3710A pattern.

41. Set as follows for the MS2690A/MS2691A/MS2692A.

- Common Setting

      Measuring Object   :Non-Formatted
      Modulation   :4FSK
      Symbol Rate   :2.4 ksps
      Measurement Filter :ARIB STD-T98+None
      Reference Filter   :ARIB STD-T98+None
      Roll Off   :0.20
      Measurement Interval :240 symbol

42. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 30 GHz, and repeat Steps 4 through 7.

43. Set the frequency of the MG3710A and MS2690A/MS2691A/ MS2692A to 2 GHz, and repeat Steps 4 through 7.

44. Set the frequency of the MG3710A and the main unit to 6 GHz (MS269xA) or 3.5 GHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

45. Specify TestSignal009 as the MG3710A pattern.

46. Set as follows for the MS2690A/MS2691A/MS2692A.

- Common Setting

      Measuring Object   :Non-Formatted
      Modulation   :2ASK
      Symbol Rate   :2.048 Msps
      Measurement Filter :None
      Reference Filter   :Gausian
      Roll Off   :0.5
      Measurement Interval :1600 symbol

47. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 30 GHz, and repeat Steps 4 through 7.

48. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 2 GHz, and repeat Steps 4 through 7.

49. Set the frequency of the MG3710A and the main unit to 6 GHz (MS269xA) or 3.5 GHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

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50. Specify TestSignal010 as the MG3710A pattern.

51. Set as follows for the MS2690A/MS2691A/MS2692A.
     - Common Setting
         Measuring Object   :Non-Formatted
         Modulation   :4ASK
         Symbol Rate   :500 ksps
         Measurement Filter   :None
         Reference Filter   :Gaussian
         Roll Off   :0.5
         Measurement Interval: 1600 symbol

52. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 30 GHz, and repeat Steps 4 through 7.

53. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 2 GHz, and repeat Steps 4 through 7.

54. Set the frequency of the MG3710A and the main unit to 6 GHz (MS269xA) or 3.5 GHz (MS2830A), and repeat Steps 4 through 7.

(5) Test results

Table 5.2.1-1   Carrier frequency accuracy

Signal Name	Modulation Method	Symbol Rate	Frequency	Min. Value	Deviation (Hz)	Max. Value	Uncer-tainty	Pass /Fail
TestSignal 001	π/4DQPSK	4 ksps	30 MHz					
			2 GHz					
			6 GHz*					
TestSignal 002	64QAM	4 ksps	30 MHz					
			2 GHz					
			6 GHz*					
TestSignal 003	π/4DQPSK	500 ksps	30 MHz					
			2 GHz					
			6 GHz*					
TestSignal 004	64QAM	500 ksps	30 MHz					
			2 GHz					
			6 GHz*					
TestSignal 005	π/4DQPSK	5 Msps	30 MHz					
			2 GHz					
			6 GHz*					
TestSignal 006	64QAM	5 Msps	30 MHz	−10 Hz		+10 Hz	±1 Hz	
			2 GHz					
			6 GHz*					
TestSignal 007	256QAM	5 Msps	30 MHz					
			2 GHz					
			6 GHz*					
TestSignal 000	4FSK	2.4ksps	30 MHz					
			2 GHz					
			6 GHz*					
TestSignal 009	2ASK	2.048 Msps	30 MHz					
			2 GHz					
			6 GHz*					
TestSignal 010	4ASK	500 ksps	30 MHz					
			2 GHz					
			6 GHz					

*:   6 GHz：MS2690A/MS2691A/MS2692A
3.5 GHz：MS2830A, MS2840A

5.2.2 Testing Methods – Residual Vector Error

(1) Test target standards

- Residual EVM

(2) Measuring instrument for tests

- Vector signal generator: MG3710A + MX370102A

- Power meter

- 3-dB attenuator
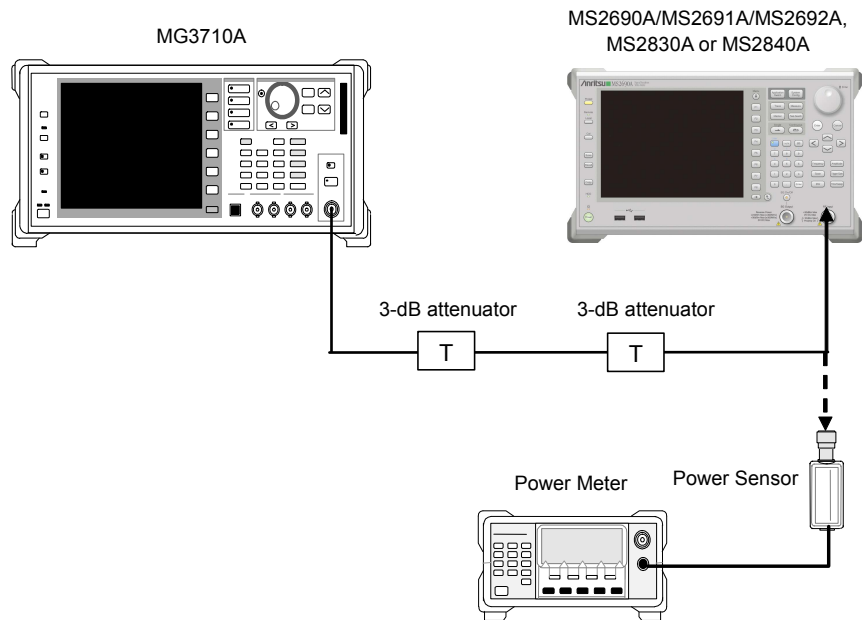
(3) Setup

Figure 5.2.2-1 Setup

(4) Test Procedure

Use the default values (value following preset execution) for parameters whose values are not indicated in the following procedure.

<Procedure>

1. Set the MG3710A as follows:

    - Frequency   :49.996 MHz
    - Level   :–15 dBm
    - Base Band
      Pattern Combination ： Edit
      Pattern (Memory A)   :TestSignal001
      Pattern (Memory B)   :Does not set
      Freq Offset   :4 kHz
    - Mod On/Off   :On
    - Output   :On

2. Set as follows for the MS2690A/MS2691A/MS2692A.

    - Center Frequency   :50.0 MHz
    - Input Level   :–15 dBm
    - Reference Signal   :Fixed to Internal
    - Trace
      Storage Mode   :Average
      Storage Count   :20
    - Common Setting
      Measuring Object   :Non-Formatted
      Modulation   :PI/4DQPSK
      Symbol Rate   :4 ksps
      Measurement Filter :Root Nyquist+None
      Reference Filter   :Nyquist+None
      Roll Off   :1.0
      Measurement Interval:200 symbol

3. Select the Modulation Analysis screen.

4. Input the output signal from the MG3710A to the power meter and adjust this output level so that the power reading is –15 dBm ±0.1 dB.

5. Input the output signal from the MG3710A to the MX269017A.

6. Press ⏩(Single) to perform measurement.

7. Confirm that the measured EVM (rms) (Residual Vector Error) results satisfy the specifications.

8. Set the frequency of the MS2690A/MS2691A/MS2692A to 500 MHz.

9. Set the frequency of the MG3710A to 499.996 GHz, and repeat Steps 4 through 7.

10. Set the MG3710A as follows:

    - Frequency   :49.996 MHz
    - Base Band
      Pattern (Memory A)   :TestSignal002
      Freq Offset   :4 kHz

11. Set the MS2690A/MS2691A/MS2692A as follows:

    - Center Frequency   :50.0 MHz
    - Common Setting
         Measuring Object   :Non-Formatted
         Modulation   :64QAM
         Symbol Rate   :4 ksps
         Measurement Filter :Root Nyquist+None
         Reference Filter   :Nyquist+None
         Roll Off   :1.0
         Measurement Interval:200 symbol

12. Repeat Steps 4 to 7.

13. Set the frequency of the MS2690A/MS2691A/MS2692A to 500 MHz.

14. Set the frequency of the MG3710A to 499.996 GHz, and repeat Steps 4 through 7.

15. Set the MG3710A as follows:

    - Frequency   :49.5 MHz
    - Base Band
      Pattern (Memory A)   :TestSignal003
      Freq Offset   :500 kHz

16. Set the MS2690A/MS2691A/MS2692A as follows:

    - Center Frequency   :50.0 MHz
    - Common Setting
         Measuring Object   :Non-Formatted
         Modulation   :PI/4DQPSK
         Symbol Rate   :500 ksps
         Measurement Filter :Root Nyquist+None
         Reference Filter   :Nyquist+None
         Roll Off   :1.0
         Measurement Interval: 4096 symbol

17. Repeat Steps 4 to 7.

18. Set the frequency of the MS2690A/MS2691A/MS2692A to 500 MHz.

19. Set the frequency of the MG3710A to 499.5 GHz, and repeat Steps 4 through 7.

20. Set the frequency of the main unit to 6000 MHz (MS269xA) or 3500 MHz (MS2830A, MS2840A).

21. Set the frequency of the MG3710A to 5999.5 MHz (MS269xA) or 3499.5 MHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

22. Set the MG3710A as follows:

    - Frequency   :49.5 MHz
    - Base Band
      Pattern(Memory A)   :TestSignal004

23. Set the MS2690A/MS2691A/MS2692A as follows:

    - Center Frequency   :50.0 MHz
    - Common Setting
      Measuring Object   :Non-Formatted
      Modulation   :64QAM
      Symbol Rate   :500 ksps
      Measurement Filter :Root Nyquist+None
      Reference Filter   :Nyquist+None
      Roll Off   :1.0
      Measurement Interval :4096 symbol

24. Repeat steps 4 to 7.

25. Set the frequency of the MS2690A/MS2691A/MS2692A to 500 MHz.

26. Set the frequency of the MG3710A to 499.5 GHz, and repeat Steps 4 through 7.

27. Set the frequency of the main unit to 6000 MHz (MS269xA) or 3500 MHz (MS2830A, MS2840A).

28. Set the frequency of the MG3710A to 5999.5 MHz (MS269xA) or 3499.5 MHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

29. Set the MG3710A as follows:

    - Frequency   :45 MHz
    - Base Band
      Pattern (Memory A)   :TestSignal005
      Freq Offset   :5 MHz

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30. Set the MS2690A/MS2691A/MS2692A as follows:

- Center Frequency   :50.0 MHz
- Common Setting
  Measuring Object   :Non-Formatted
  Modulation   :PI/4DQPSK
  Symbol Rate   :5 Msps
  Measurement Filter   :Root Nyquist+None
  Reference Filter   :Nyquist+None
  Roll Off   :1.0
  Measurement Interval: 4096 symbol

31. Repeat Steps 4 to 7.

32. Set the frequency of the main unit to 6000 MHz (MS269xA) or 3500 MHz (MS2830A, MS2840A).

33. Set the frequency of the MG3710A to 5995 MHz (MS269xA) or 3495 MHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

34. Set the MG3710A as follows:

- Frequency   :45 MHz
- Base Band
  Pattern (Memory A)   :TestSignal006

35. Set the MS2690A/MS2691A/MS2692A as follows:

- Center Frequency   :50.0 MHz
- Common Setting
  Measuring Object   :Non-Formatted
  Modulation   :64QAM
  Symbol Rate   :5 Msps
  Measurement Filter   :Root Nyquist+None
  Reference Filter   :Nyquist+None
  Roll Off   :1.0
  Measurement Interval:4096 symbol

36. Repeat Steps 4 to 7.

37. Set the frequency of the main unit to 6000 MHz (MS269xA) or 3500 MHz (MS2830A, MS2840A).

38. Set the frequency of the MG3710A to 5995 MHz (MS269xA) or 3495 MHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

39. Set the MG3710A as follows:

- Frequency   :45 MHz
- Base Band
  Pattern (Memory A)   :TestSignal007

40. Set the MS2690A/MS2691A/MS2692A as follows:

- Center Frequency   :50.0 MHz
- Common Setting
    Measuring Object   :Non-Formatted
    Modulation   :256QAM
    Symbol Rate   :5 Msps
    Measurement Filter :Root Nyquist+None
    Reference Filter   :Nyquist+None
    Roll Off   :1.0
    Measurement Interval:4096 symbol

41. Repeat steps 4 to 7.

42. Set the frequency of the MS2690A/MS2691A/MS2692A to 6000 MHz (MS269xA) or 3500 MHz (MS2830A, MS2840A).

43. Set the frequency of the MG3710A to 5995 MHz (MS269xA) or 3495 MHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

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Table 5.2.2-1   Residual Vector Error

Signal Name	Modulation Method	Symbol Rate	Frequency	Measured Value [% (rms)]	Max. Value	Uncer- tainty	Pass /Fail
TestSignal 001	π/4DQPSK	4 ksps	50 MHz		MS269xA 0.5%		
			500 MHz				
TestSignal 002	64QAM	4 ksps	50 MHz		MS2830A 1.0%		
			500 MHz				
TestSignal 003	π/4DQPSK	500 ksps	50 MHz		MS2840A 1.0%		
			500 MHz				
			6000 MHz*		MS269xA 1.0% MS2830A 1.5% MS2840A 1.5%	MS269xA 0.1% MS2830A 0.1% MS2840A 0.1%	
TestSignal 004	64QAM	500 ksps	50 MHz		MS269xA 0.5% MS2830A 1.0% MS2840A 1.0%		
			500 MHz				
			6000 MH*z				
TestSignal 005	π/4DQPSK	5 Msps	50 MHz		MS269xA 1.0% MS2830A 1.5% MS2840A 1.5%		
			6000 MHz*				
TestSignal 006	64QAM	5 Msps	50 MHz				
			6000 MHz*				
TestSignal 007	256QAM	5 Msps	50 MHz				
			6000 MHz*				

*:   6000 MHz：MS2690A/MS2691A/MS2692A
3500 MHz：MS2830A, MS2840A

5.2.3   Testing Methods - Symbol Rate Error

(1) Test target standards

- Symbol rate error

(2) Measuring instrument for tests

- Vector signal generator: MG3710A + MX370102A

- Power meter

- 3-dB attenuator

(3) Setup

Figure 5.2.3-1   Setup

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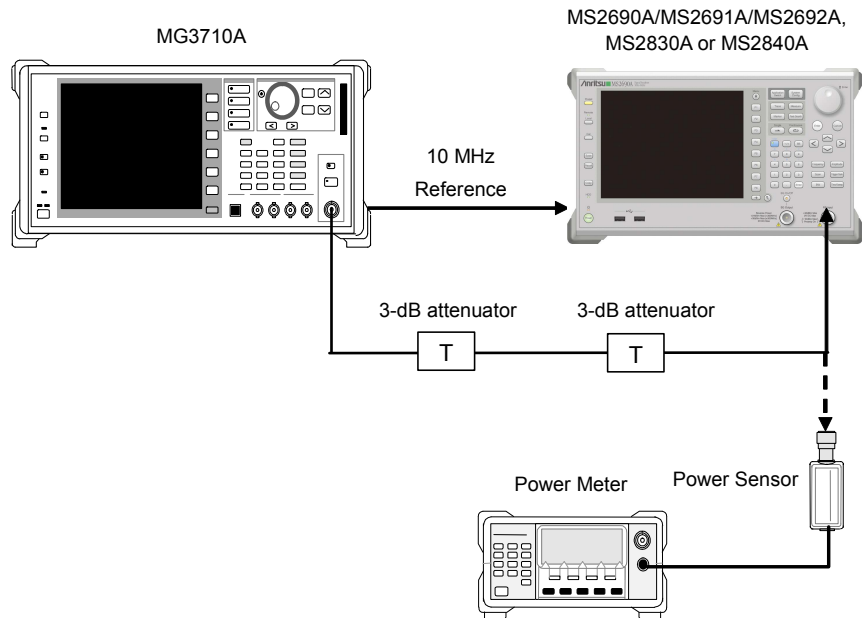
(4)   Test Procedure

Use the default values (value following preset execution) for parameters whose values are not indicated in the following procedure.

\<Procedure\>
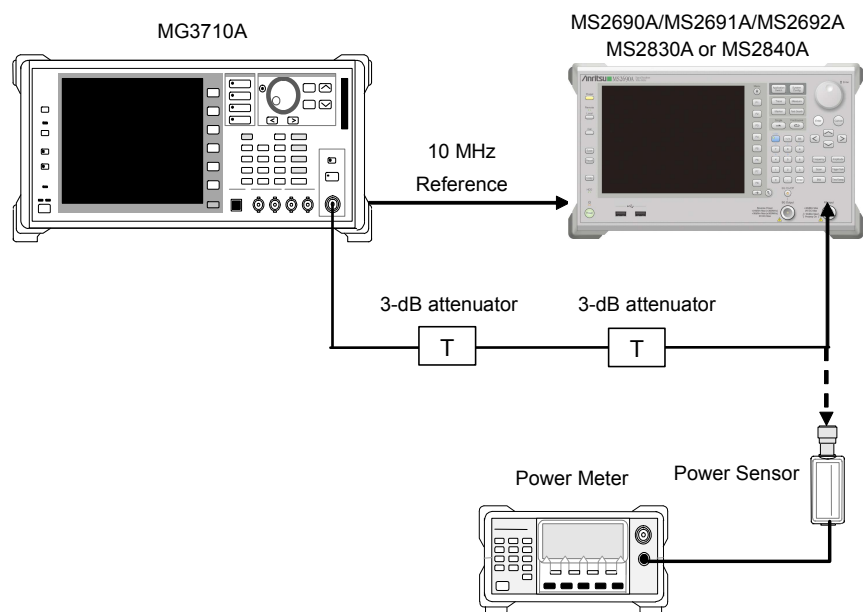
1.   Set the MG3710A as follows:

- Frequency   : 30.0 MHz
- Level   :–15 dBm
- Base Band Pattern   : TestSignal008
- Mod On/Off   : On
- Output   : On

2.   Set as follows for the MS2690A/MS2691A/MS2692A.

- Center Frequency   : 30.0 MHz
- Input Level   :–15 dBm
- Reference Signal   : Auto
- Trace
  - Storage Mode   :Average
  - Storage Count   :10
- Common Setting
  - Measuring Object   :Frame-Formatted
  - Modulation   :2FSK
  - Auto   :Off
  - Modulation Index   :1
  - Symbol Rate   :100 ksps
  - Measurement Filter   :None+None
  - Reference Filter   :Gaussian+None
  - Roll Off   :0.50
  - Slots per Frame   :2
  - Measurement Slot   :Slot0:ON, Slot1:OFF
  - Slot Length   :168 symbol
  - Measurement Offset   :0 symbol
  - Measurement Interval   :160 symbol
  - Sync Word Search   :ON
  - Burst Search   :ON
  - 1st Word Search Slot   :Slot 0
  - 2nd Word   :Disable
  - Sync Word Length   :8
  - Sync Word (Hex)   :E5
  - Sync Word Offset   :32 symbol
  - Deviation Calculation   :Post-Measurement Filtering

3. Select the Modulation Analysis screen.

4. Input the output signal from the MG3710A to the power meter and adjust this output level so that the power reading is –15 dBm + Correction value (–3.09 dB) ± 0.1 dB.

5. Input the output signal from the MG3710A to the MX269017A.

6. Press ⬤ to perform measurement.

7. Confirm that the measured Symbol Rate Error results satisfy the specifications.

8. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 2 GHz, and repeat Steps 4 through 7.

9. Set the frequency of the MG3710A and MS2690A/MS2691A/MS2692A to 6 GHz (MS269xA) or 3.5 GHz (MS2830A, MS2840A), and repeat Steps 4 through 7.

(5) Test results

Table 5.2.3-1   Symbol Rate Error

Signal name	Modulation scheme	Symbol Rate	Frequency	Min. value	Deviation (Hz)	Max. value	Uncertainty	Pass /Fail
TestSignal 008	2FSK	100 ksps	30 MHz	–1 ppm		+1 ppm	±0.1 ppm	
			2 GHz					
			6 GHz*					

*:   6 GHz : MS2690A/MS2691A/MS2692A
3.5 GHz : MS2830A, MS2840A

5

Performance Test

Chapter 6   Other Functions

This chapter describes other functions of this application.

6

Other Functions

6.1   Selecting Other Functions

Pressing [F8] (Accessory) on the main function menu displays the Accessory function menu.

Table 6.1-1   Accessory function menu

Function Keys	Menu Display	Function
F1	Title	Sets the title character string.
F2	Title (On/Off)	Displays (On) or hides (Off) the title character string.
F4	Erase Warm Up Message	Hides Warm-up Message display.
F7	Preselector	Opens the Preselector function menu. Only available for MS2691A/MS2692A, MS2830A-044/045 or MS2840A-044/046. ☞3.2.2 "Preselector function menu"

6.2   Setting Title

A title of up to 32 characters can be displayed on the screen. (Character strings of up to 17 characters can be displayed on a function menu. The maximum number of characters to be displayed on the top of the function menu varies according to character string.)

<Procedure>

1.   Press [F8] (Accessory) on the main function menu.

2.   Press [F1] (Title) to display the character string input screen. Select a character using the rotary knob, and enter it by pressing (Enter). Enter the title by repeating this operation. When the title is entered, press [F7] (Set).

3.   Press [F2] (Title) and then select "Off" to hide the title.

6.3   Erasing Warmup Message

The warmup message (⧗ Warm Up), which is displayed upon power-on and indicates that the level and frequency are not stable, can be deleted.

<Procedure>

1.   Press [F8] (Accessory) on the main function menu.

2.   Press [F4] (Erase Warm Up Message) to erase the warmup message.

Appendix A   Default Value List

Frequency

Carrier Frequency	1.000 GHz
RF Spectrum	Off
Frequency Band Mode	Normal

    (When MS2691A/MS2692A-003, MS2830A-041/043/044/045
    or MS2840A-041/044/046 is installed)

Signal Level Too Low Display	On
Micro Wave Preselector Bypass	On

    (When MS2692A-067/167 or MS2830A-007/067/167 or
    MS2840A-067/167 is installed)

Amplitude

Input Level	–10.00 dBm
Pre-Amp	Off
Offset	Off
Offset Value	0.00 dB

Common Setting

Preset Dialog Parameter	No Standard
Measuring Object	Frame Formatted
Modulation Type	BPSK
Symbol Rate	100 sps
Span Up (Frame Formatted)	Off
Measurement Filter	Root Nyquist
2nd Measurement Filter	None
Reference Filter	Nyquist
2nd Reference Filter	None
Roll Off / BT	1.00
2nd Roll Off / BT	1.00
Slots per Frame	1 slot
Slot length	10 symbol
Measurement Offset	0 symbol
Measurement Interval	10 symbol
Sync Word Search	OFF
Burst Search	OFF
1st Word Search Slot	Slot 0
1st Word Sync Word Length	1 symbol
1st Word Sync Word	0
1st Word Sync Word Offset	0 symbol

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2nd Word Search	Disable
2nd Word Search Slot	Slot 0
2nd Word Sync Word Length	1 symbol
2nd Word Sync Word	0
2nd Word Sync Word Offset	0 symbol
Origin Offset Cancel	On
Origin Offset Reference	Offset
Droop Cancel	On
Method of Symbol Rate Error	Frame To Frame

Modulation Analysis

Re-measurement mode	Off
Re-measurement Threshold	5%
Signal Level Too Low Display	On

Power vs Time

Type	Gaussian
Bandwidth	400 Hz
Roll-off Factor	1.00

Capture

Capture Time	Auto
Capture Interval	1Frame

Trace (Modulation Analysis)

Select Trace	Trace 1
Trace Mode of Trace 1	Numeric
Trace Mode of Trace 2	Constellation
Trace Mode of Trace 3	EVM vs Symbol
Trace Mode of Trace 4	Magnitude Error vs Symbol
Trace Mode of Trace 5	Signal Monitor
Trace Mode of Trace 6	I and Q vs Symbol
Trace Mode of Trace 7	Eye Diagram
Trace Mode of Trace 8	Trellis
Target Slot Number	0
Storage	
Mode	Off
Count	10
Zoom In/Zoom Out	Zoom Out
Next View	Trace 1 - 4
Result Select	EVM
Numeric Only	Off

Custom Numeric Setting

Result1	Tx Power dBm
Result2	Frequency Error Hz
Result3	Mod. Fidelity (rms)
Result4	Deviation Average
Result5	Specific Word(Hex)
Result6	BER
Result7	Symbol Rate Error
Bar Graph Result1	Tx Power dBm
Min	−50
Max	0
Unit	dBm
Bar Graph Result2	Mod. Fidelity (rms)
Min	0
Max	10
Unit	%

Specific Word Setting

Slot Number	0
Top Position	1 bit
Word Width	8 bit

BER Setting

BER	Off
Slot Number	0

Trace (Power vs Time)

Trace Mode	Slot
Slot	0
Unit	dB
Display Item	All

Power vs Time Mask Setup

Marker

Marker Number 1	0
Marker Number 2	0
Maker Link	Off

Trigger

    Trigger Switch   Off

    Trigger Source   External

    Trigger Slope   Rise

    Wide IF Video Trigger Level   −20 dBm

    Trigger Delay   0 s

Accessory

    Title   On,

                                    "Vector Modulation Analysis"

Appendix B   Symbol Mapping

The following lists the initial symbol data (symbol mapping) values that correspond to the symbol allocation values for each modulation method and describes the file specification method for changing the symbol mapping.

B.1 Symbol Mapping Defaults

■ BPSK
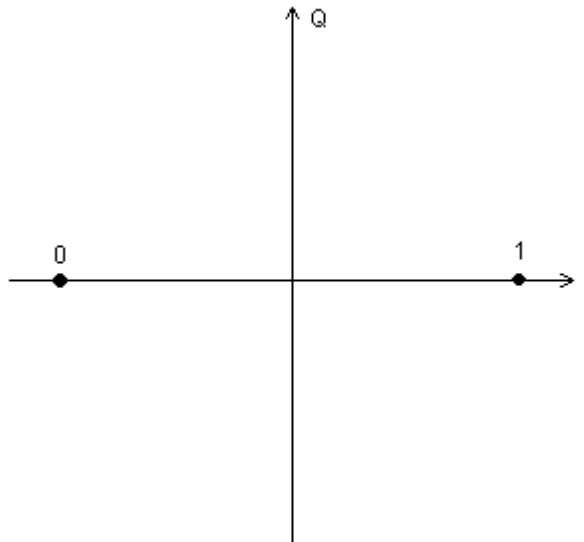
Figure B.1-1   BPSK Symbol Allocation

Table B.1-1   BPSK Symbol data

Allocation	Symbol data
0	0
1	1

■ QPSK
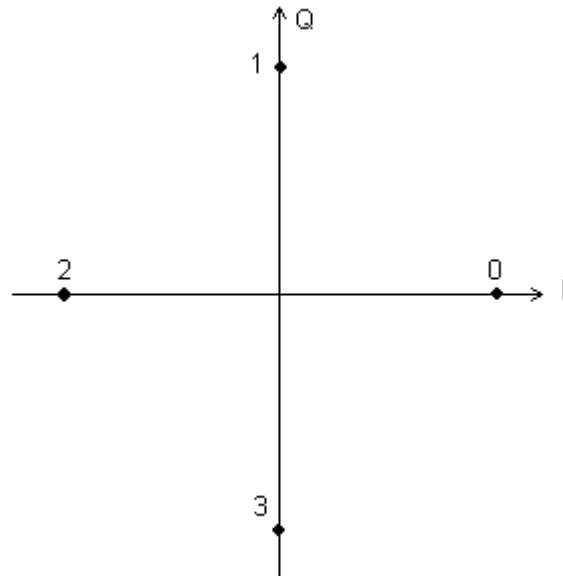
Figure B.1-2   QPSK Symbol Allocation

Table B.1-2   QPSK Symbol data

Allocation	Symbol data
0	11
1	01
2	00
3	10

■ O-QPSK
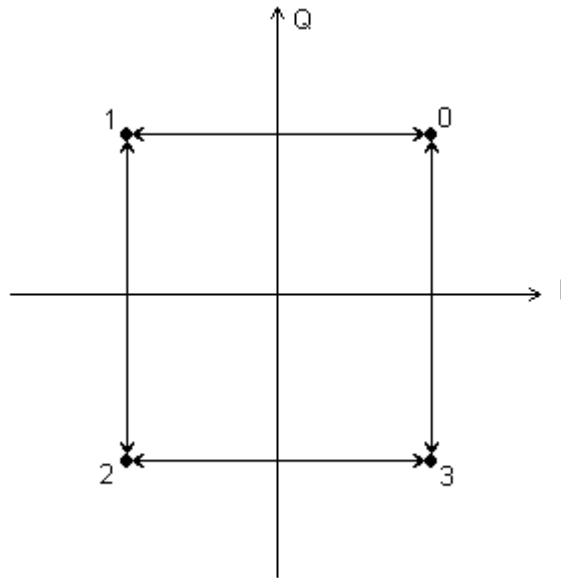
Figure B.1-3   O-QPSK Symbol Allocation

Table B.1-3   O-QPSK Symbol data

Allocation	Symbol data
0	11
1	01
2	00
3	10
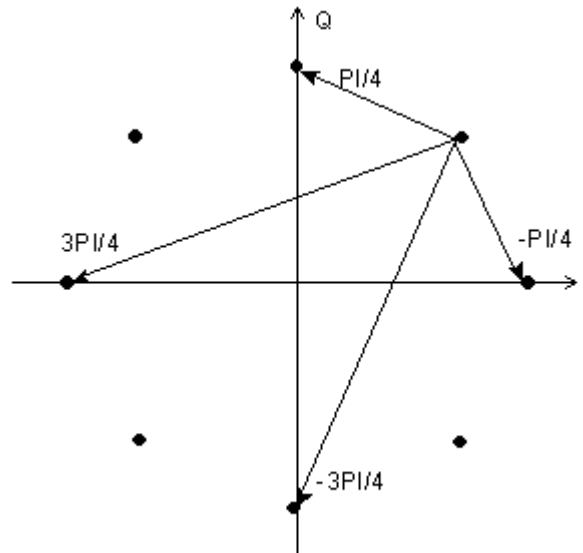
■ π/4DQPSK

Figure B.1-4   π/4DQPSK Symbol Allocation

Table B.1-4   π/4QPSK Symbol data

Differential	Symbol data
+π/4	00
+3π/4	01
−3π/4	11
−π/4	10
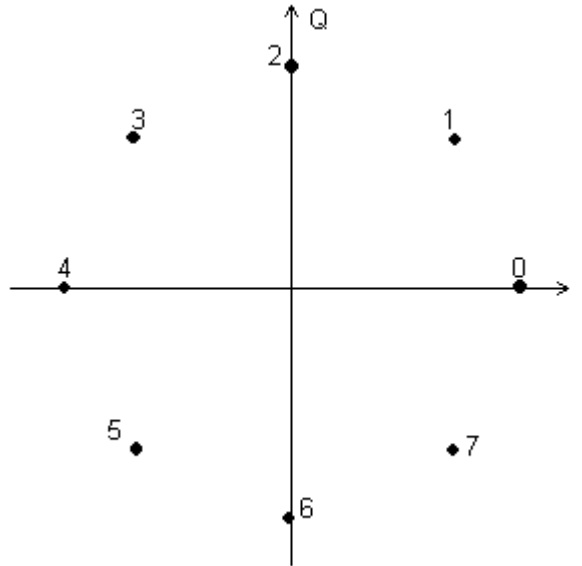
■ 8PSK

Figure B.1-5   8PSK Symbol Allocation

Table B.1-5   8PSK Symbol data

Allocation	Symbol data
0	111
1	110
2	010
3	011
4	001
5	000
6	100
7	101

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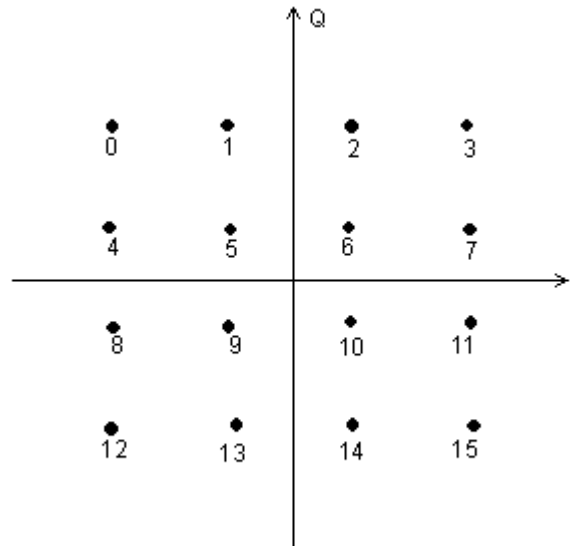
■ 16QAM

Figure B.1-6   16QAM Symbol Allocation

Table B.1-6 16QAM   Symbol data

Allocation	Symbol data	Allocation	Symbol data
0	0111	8	0010
1	0101	9	0000
2	1101	10	1000
3	1111	11	1010
4	0110	12	0011
5	0100	13	0001
6	1100	14	1001
7	1110	15	1011

■ 64QAM
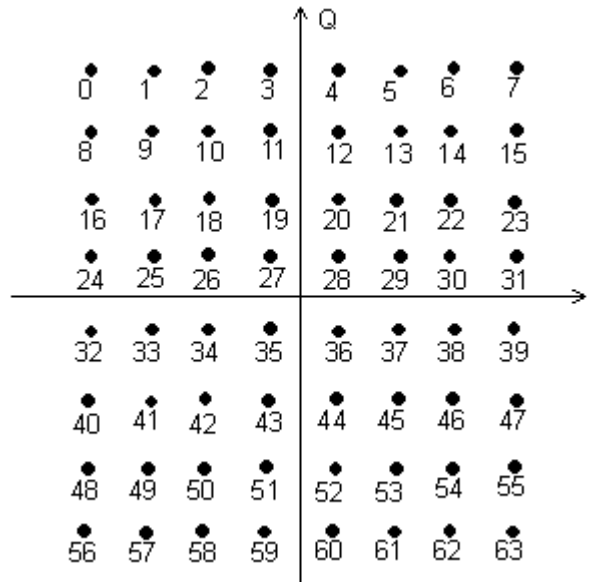
Figure B.1-7   64QAM Symbol Allocation

Table B.1-7   64 QAM Symbol data

Allocation	Symbol data	Allocation	Symbol data	Allocation	Symbol data	Allocation	Symbol data
0	100010	16	100111	32	110111	48	110010
1	100000	17	100101	33	110101	49	110000
2	101000	18	101101	34	111101	50	111000
3	101010	19	101111	35	111111	51	111010
4	001000	20	001101	36	011101	52	011000
5	001010	21	001111	37	011111	53	011010
6	000010	22	000111	38	010111	54	010010
7	000000	23	000101	39	010101	55	010000
8	100011	24	100110	40	110110	56	110011
9	100001	25	100100	41	110100	57	110001
10	101001	26	101100	42	111100	58	111001
11	101011	27	101110	43	111110	59	111011
12	001001	28	001100	44	011100	60	011001
13	001011	29	001110	45	011110	61	011011
14	000011	30	000110	46	010110	62	010011
15	000001	31	000100	47	010100	63	010001

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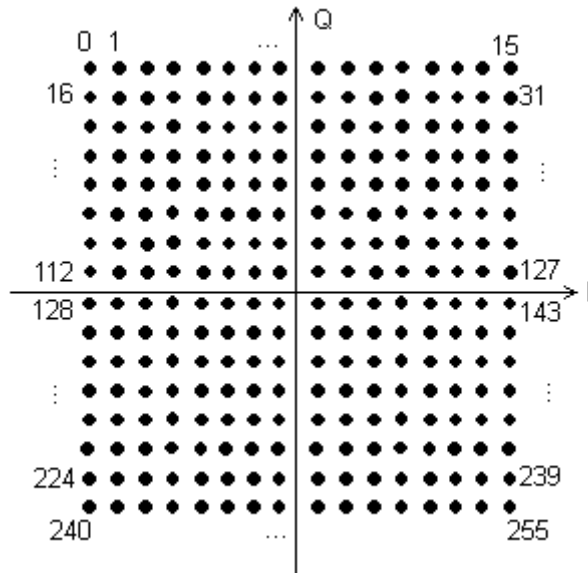
■ 256QAM

Figure B.1-8   256QAM Symbol Allocation

Table B.1-8   256QAM Symbol data (1/2)

Allocation	Symbol data	Allocation	Symbol data	Allocation	Symbol data	Allocation	Symbol data
0	10001000	32	10001101	64	10011101	96	10011000
1	10001010	33	10001111	65	10011111	97	10011010
2	10000010	34	10000111	66	10010111	98	10010010
3	10000000	35	10000101	67	10010101	99	10010000
4	10100010	36	10100111	68	10110111	100	10110010
5	10100000	37	10100101	69	10110101	101	10110000
6	10101000	38	10101101	70	10111101	102	10111000
7	10101010	39	10101111	71	10111111	103	10111010
8	00100010	40	00100111	72	00110111	104	00110010
9	00100000	41	00100101	73	00110101	105	00110000
10	00101000	42	00101101	74	00111101	106	00111000
11	00101010	43	00101111	75	00111111	107	00111010
12	00001000	44	00001101	76	00011101	108	00011000
13	00001010	45	00001111	77	00011111	109	00011010
14	00000010	46	00000111	78	00010111	110	00010010
15	00000000	47	00000101	79	00010101	111	00010000
16	10001001	48	10001100	80	10011100	112	10011001
17	10001011	49	10001110	81	10011110	113	10011011
18	10000011	50	10000110	82	10010110	114	10010011
19	10000001	51	10000100	83	10010100	115	10010001
20	10100011	52	10100110	84	10110110	116	10110011
21	10100001	53	10100100	85	10110100	117	10110001
22	10101001	54	10101100	86	10111100	118	10111001
23	10101011	55	10101110	87	10111110	119	10111011
24	00100011	56	00100110	88	00110110	120	00110011
25	00100001	57	00100100	89	00110100	121	00110001
26	00101001	58	00101100	90	00111100	122	00111001
27	00101011	59	00101110	91	00111110	123	00111011
28	00001001	60	00001100	92	00011100	124	00011001
29	00001011	61	00001110	93	00011110	125	00011011
30	00000011	62	00000110	94	00010110	126	00010011
31	00000001	63	00000100	95	00010100	127	00010001

Table B.1-8   256QAM Symbol data (2/2)

Allocation	Symbol data	Allocation	Symbol data	Allocation	Symbol data	Allocation	Symbol data
128	11011101	160	11011000	192	11001000	224	11001101
129	11011111	161	11011010	193	11001010	225	11001111
130	11010111	162	11010010	194	11000010	226	11000111
131	11010101	163	11010000	195	11000000	227	11000101
132	11110111	164	11110010	196	11100010	228	11100111
133	11110101	165	11110000	197	11100000	229	11100101
134	11111101	166	11111000	198	11101000	230	11101101
135	11111111	167	11111010	199	11101010	231	11101111
136	01110111	168	01110010	200	01100010	232	01100111
137	01110101	169	01110000	201	01100000	233	01100101
138	01111101	170	01111000	202	01101000	234	01101101
139	01111111	171	01111010	203	01101010	235	01101111
140	01011101	172	01011000	204	01001000	236	01001101
141	01011111	173	01011010	205	01001010	237	01001111
142	01010111	174	01010010	206	01000010	238	01000111
143	01010101	175	01010000	207	01000000	239	01000101
144	11011100	176	11011001	208	11001001	240	11001100
145	11011110	177	11011011	209	11001011	241	11001110
146	11010110	178	11010011	210	11000011	242	11000110
147	11010100	179	11010001	211	11000001	243	11000100
148	11110110	180	11110011	212	11100011	244	11100110
149	11110100	181	11110001	213	11100001	245	11100100
150	11111100	182	11111001	214	11101001	246	11101100
151	11111110	183	11111011	215	11101011	247	11101110
152	01110110	184	01110011	216	01100011	248	01100110
153	01110100	185	01110001	217	01100001	249	01100100
154	01111100	186	01111001	218	01101001	250	01101100
155	01111110	187	01111011	219	01101011	251	01101110
156	01011100	188	01011001	220	01001001	252	01001100
157	01011110	189	01011011	221	01001011	253	01001110
158	01010110	190	01010011	222	01000011	254	01000110
159	01010100	191	01010001	223	01000001	255	01000100

■ 2FSK

Figure B.1-9   2FSK Symbol Allocation

Table B.1-9   2FSK Symbol data

Direction	Symbol data
+	1
−	0

■ 4FSK
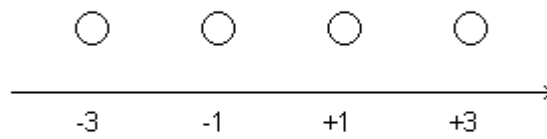
Figure B.1-10   4FSK Symbol Allocation

Table B.1-10   4FSK Symbol data

Direction	Symbol data
+3	01
+1	00
−1	10
−3	11

■ 2ASK
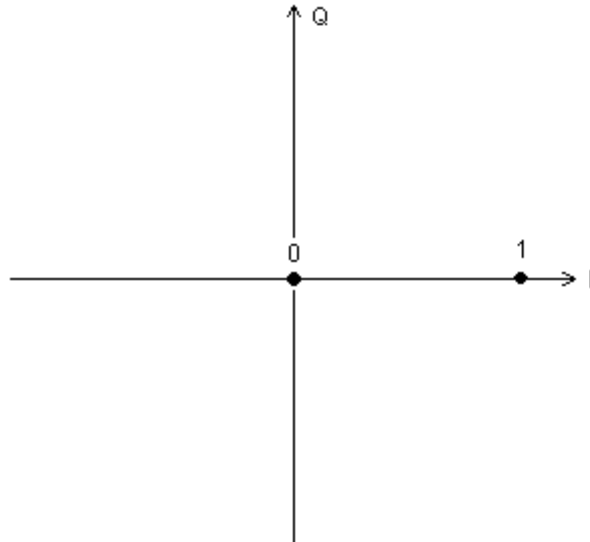
Figure B.1-11   2ASK Symbol Allocation

Table B.1-11   2ASK Symbol data

Allocation	Symbol data
0	0
1	1

■ 4ASK
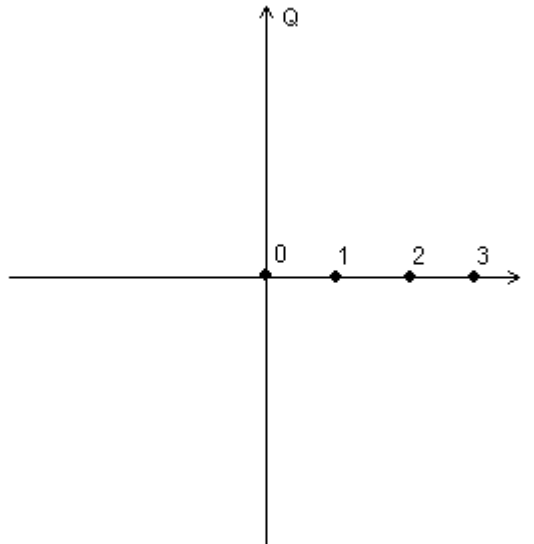
Figure B.1-12   4ASK Symbol Allocation

Table B.1-12   4ASK Symbol data

Allocation	Symbol data
0	00
1	01
2	11
3	10

B.2 Specifying Configuration File for Mapping Edit

The following describes how to specify the configuration file used to edit the mapping with this application.

Create this file in the text format. Any file name and extension can be specified.

Observe the following rules when writing a configuration file:

1. On each line, specify the symbol data bit sequence in binary (by using 0s and 1s).

2. Specify the symbol data for allocation 0 on the first line. Specify the symbol data for allocation 1 on the second line. Continue to specify symbol data for allocations until the number of symbols is reached.

3. The number of symbols depends on the specified modulation type, and the number of symbols must match the number of lines.

Example:

Specifying the mapping editing file for the modulation type 16QAM

To specify settings such that the symbol data values correspond to the symbol allocation values as shown in Table B.2-1, specify the configuration file as shown in the same table.

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Table B.2-1   Settings for Allocation and Symbol data

Allocation	Symbol data	Allocation	Symbol data
0	1000	8	1101
1	1010	9	1111
2	0010	10	0111
3	0000	11	0101
4	1001	12	1100
5	1011	13	1110
6	0011	14	0110
7	0001	15	0100

Specify the symbol data for allocation 0 on the first line.

```
1000
1010
0010
0000
1001
1011
0011
0001
1101
1111
0111
0101
1100
```

Specify the symbol data in binary, and specify the data for one symbol per line.

For 16QAM, the 16th line is the last. Specify the symbol data for allocation 15 on this line.
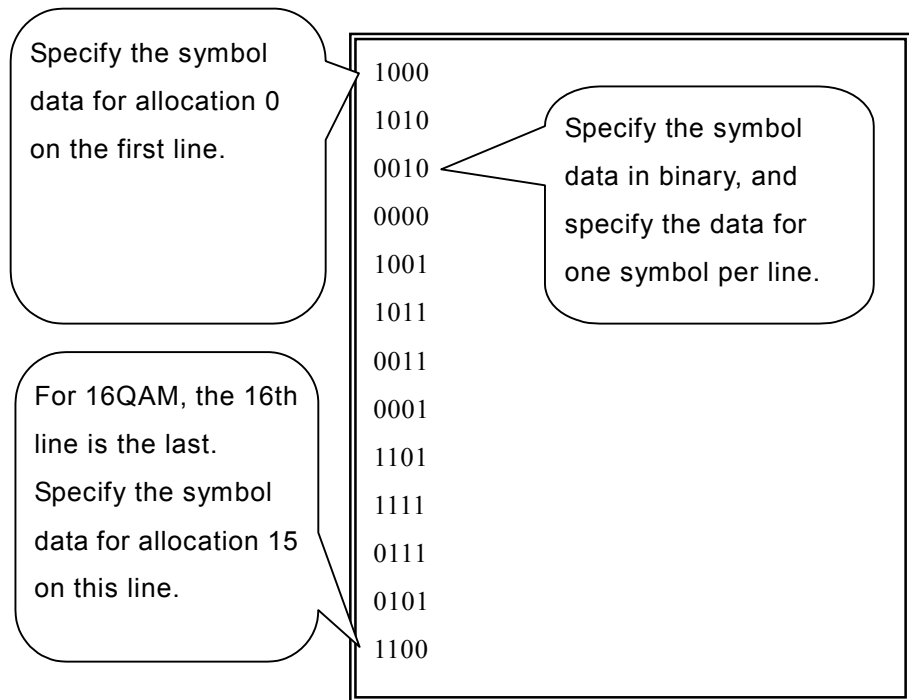
Figure B.2-1   Example of Specifying Mapping Editing Configuration File

Appendix C Predefined Settings List

The following Common Setting Parameter values are specified if the Preset Dialog Parameter function was used.

Table C-1 Parameter setting list

Parameter	Table
RCR39_PI4DQPSK_TCH_UL	C-2
RCR39_PI4DQPSK_TCH_DL	C-2
T61_SCPC_v1_0_SC	C-3
T61_SCPC_v1_1_40ms_SC	C-3
T61_SCPC_v1_1_20ms_SC	C-4
T61_FDMA_PSC_UL	C-4
T61_FDMA_PSC_DL	C-5
T86_CCH_UL	C-5
T86_CCH_DL	C-6
T86_TCH_UL	C-6
T86_TCH_DL	C-7
T98_PI4DQPSK_SC	C-7
T98_4FSK_SC	C-8
BPSK-20kbps	C-8
GFSK-100kbps	C-9
O-QPSK-250ksps	C-10
O-QPSK-250ksps_2	C-10
T102_PART1	C-11
T102_PART2	C-11

Table C-1   Parameter setting list (Cont'd)

Parameter	Table
P25_C4FM	C-12
P25_CQPSK	C-12
P25_LSM	C-13
P25_WCQPSK	C-13
P25_IB_Burst_STD_Type1	C-14
P25_IB_Burst_STD_Type2	C-14
P25_IB_LCH0_STD_Type1	C-15
P25_IB_LCH0_STD_Type2	C-15
P25_IB_LCH0_Symmetrical_Type1	C-16
P25_IB_LCH0_Symmetrical_Type2	C-16
P25_IB_LCH1_STD_Type1	C-17
P25_IB_LCH1_STD_Type2	C-17
P25_OB_STD	C-18
P25_OB_STD_BER	C-18
DMR_BS_sourced_Voice	C-19
DMR_BS_sourced_Data	C-19
DMR_MS_sourced_Voice	C-20
DMR_MS_sourced_Data	C-20
DMR_MS_sourced_RC	C-21
NXDN_2_4ksps	C-21
NXDN_4_8ksps	C-22
T86_SYNC_UL	C-23
T86_SYNC_DL	C-23
DMR_BS_sourced_Voice_2	C-24
DMR_BS_sourced_Data_2	C-24
DMR_MS_sourced_Voice_2	C-25
DMR_MS_sourced_Data_2	C-25
DMR_Normal_Burst	C-26
DMR_RC_Burst	C-26

Table C-1   Parameter setting list (Cont'd)

Parameter	Table
dPMR446_80ms	C-27
dPMR446_HeaderBurst	C-27
dPMR446_320ms_FS2	C-28
dPMR_BCH_STD	C-29
dPMR_BCH_110ms_FS1	C-30
dPMR_BCH_Uplink_FS1	C-30
dPMR_TCH_STD	C-31
dPMR_TCH_Payload80ms_FS2	C-32
dPMR_TCH_PacketHead_FS4	C-32
TETRA_DL_NORMAL_CONT	C-33
TETRA_DL_NORMAL_DISCONT	C-33
TETRA_UL_NORMAL	C-34

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Table C-2   Predefined Settings List

	RCR39_PI4DQPSK_TCH_UL	RCR39_PI4DQPSK_TCH_DL
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	PI/4DQPSK	PI/4DQPSK
Symbol Rate	16000 sps	16000 sps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	None
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.50	0.50
2nd Roll Off	1.00	1.00
Slots per Frame	4 slot	4 slot
Slot length	160 symbol	160 symbol
Measurement Offset	3 symbol	3 symbol
Measurement Interval	153 symbol	157 symbol
Sync Word Search	ON	ON
Burst Search	ON	OFF
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	10 symbol	10 symbol
1st Word Sync Word	785B4	87A4B
1st Word Sync Word Offset	78 symbol	60 symbol
2nd Word Search	Enable	Enable
2nd Word Search Slot	Slot 0	Slot 0
2nd Word Sync Word Length	10 symbol	10 symbol
2nd Word Sync Word	CE450	31BAF
2nd Word Sync Word Offset	78 symbol	60 symbol

Table C-3   Predefined Settings List

	T61_SCPC_v1_0_SC	T61_SCPC_v1_1_40ms_SC
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	PI/4DQPSK	PI/4DQPSK
Symbol Rate	4800 sps	4800 sps
Span Up	Off	Off
1st Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	None
1st Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
1st Roll Off	0.20	0.20
2nd Roll Off	1.00	1.00
Slots per Frame	1 slot	1 slot
Slot length	192 symbol	192 symbol
Measurement Offset	15 symbol	4 symbol
Measurement Interval	177 symbol	182 symbol
Sync Word Search	ON	ON
Burst Search	OFF	ON
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	10 symbol	10 symbol
1st Word Sync Word	1E56F	1E56F
1st Word Sync Word Offset	92 symbol	4 symbol
2nd Word Search	Disable	Disable
2nd Word Search Slot	–	–
2nd Word Sync Word Length	–	–
2nd Word Sync Word	–	–
2nd Word Sync Word Offset	–	–

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Table C-4   Predefined Settings List

	T61_SCPC_v1_1_20ms_SC	T61_FDMA_PSC_UL
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	PI/4DQPSK	PI/4DQPSK
Symbol Rate	4800 sps	4800 sps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	None
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.00	1.00
Slots per Frame	2 slot	1 slot
Slot length	96 symbol	192 symbol
Measurement Offset	4 symbol	15 symbol
Measurement Interval	86 symbol	177 symbol
Sync Word Search	ON	ON
Burst Search	ON	OFF
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	10 symbol	10 symbol
1st Word Sync Word	31BAF	E1A90
1st Word Sync Word Offset	4 symbol	92 symbol
2nd Word Search	Disable	Enable
2nd Word Search Slot	–	Slot 0
2nd Word Sync Word Length	–	10 symbol
2nd Word Sync Word	–	62DC9
2nd Word Sync Word Offset	–	92 symbol

Table C-5   Predefined Settings List

	T61_FDMA_PSC_DL	T86_CCH_UL
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	PI/4DQPSK	16QAM
Symbol Rate	4800 sps	11250 sps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	None
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.00	1.00
Slots per Frame	1 slot	6 slot
Slot length	192 symbol	150 symbol
Measurement Offset	15 symbol	4 symbol
Measurement Interval	177 symbol	141 symbol
Sync Word Search	ON	ON
Burst Search	OFF	ON
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	10 symbol	10 symbol
1st Word Sync Word	1E56F	000A0AA00A
1st Word Sync Word Offset	92 symbol	69 symbol
2nd Word Search	Enable	Disable
2nd Word Search Slot	Slot 0	−
2nd Word Sync Word Length	10 symbol	−
2nd Word Sync Word	9D236	−
2nd Word Sync Word Offset	92 symbol	−

Table C-6   Predefined Settings List

	T86_CCH_DL	T86_TCH_UL
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	16QAM	16QAM
Symbol Rate	11250 sps	11250 sps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	None
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.00	1.00
Slots per Frame	6 slot	6 slot
Slot length	150 symbol	150 symbol
Measurement Offset	4 symbol	4 symbol
Measurement Interval	141 symbol	141 symbol
Sync Word Search	ON	ON
Burst Search	ON	ON
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	10 symbol	10 symbol
1st Word Sync Word	000A0A00A0	00A000000A
1st Word Sync Word Offset	69 symbol	69 symbol
2nd Word Search	Disable	Disable
2nd Word Search Slot	–	–
2nd Word Sync Word Length	–	–
2nd Word Sync Word	–	–
2nd Word Sync Word Offset	–	–

Table C-7   Predefined Settings List

	T86_TCH_DL	T98_PI4DQPSK_SC
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	16QAM	PI/4DQPSK
Symbol Rate	11250 sps	4800 sps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	None
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.00	1.00
Slots per Frame	6 slot	1 slot
Slot length	150 symbol	192 symbol
Measurement Offset	4 symbol	15 symbol
Measurement Interval	141 symbol	177 symbol
Sync Word Search	ON	ON
Burst Search	ON	OFF
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	10 symbol	10 symbol
1st Word Sync Word	00A000AAAA	1E56F
1st Word Sync Word Offset	69 symbol	92 symbol
2nd Word Search	Disable	Disable
2nd Word Search Slot	–	–
2nd Word Sync Word Length	–	–
2nd Word Sync Word	–	–
2nd Word Sync Word Offset	–	–

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Table C-8　Predefined Settings List

	T98_4FSK_SC	BPSK-20kbps
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	4FSK	BPSK
Auto Deviation	–	–
Symbol Rate	2400 sps	300 ksps
Span Up	On	On
Measurement Filter	ARIB STD-T98	None
2nd Measurement Filter	None	None
Reference Filter	ARIB STD-T98	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	1.00
2nd Roll Off	1.00	1.00
Slots per Frame	1 slot	2 slot
Slot length	192 symbol	1080 symbol
Measurement Offset	0 symbol	0 symbol
Measurement Interval	192 symbol	1000 symbol
Sync Word Search	ON	ON
Burst Search	OFF	ON
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	10 symbol	120 symbol
1st Word Sync Word	CDF59	0A67EB2029985330A67EB23D640533
1st Word Sync Word Offset	0 symbol	480 symbol
2nd Word Search	Disable	Disable
2nd Word Search Slot	–	–
2nd Word Sync Word Length	–	–
2nd Word Sync Word	–	–
2nd Word Sync Word Offset	–	–
Deviation Calculation	Pre-Measurement Filtering	–

Table C-9   Predefined Settings List

	GFSK-100kbps
Measuring Object	Frame Formatted
Modulation Type	2FSK
Auto Deviation	OFF
Modulation Index	1
Symbol Rate	100 ksps
Span Up	On
Measurement Filter	None
2nd Measurement Filter	None
Reference Filter	Gaussian
2nd Reference Filter	None
Roll Off	0.50
2nd Roll Off	1.00
Slots per Frame	2
Slot length	168 symbol
Measurement Offset	0 symbol
Measurement Interval	160 symbol
Sync Word Search	ON
Burst Search	ON
1st Word Search Slot	Slot 0
1st Word Sync Word Length	8 symbol
1st Word Sync Word	E5
1st Word Sync Word Offset	32 symbol
2nd Word Search	Disable
2nd Word Search Slot	–
2nd Word Sync Word Length	–
2nd Word Sync Word	–
2nd Word Sync Word Offset	–
Deviation Calculation	Post-Measurement Filtering

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Table C-10   Predefined Settings List

	O-QPSK-250ksps	O-QPSK-250ksps_2
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	O-QPSK	O-QPSK
Auto Deviation	—	—
Modulation Index	—	—
Symbol Rate	1 Msps	1 Msps
Span Up	On	On
Measurement Filter	None	None
2nd Measurement Filter	None	None
Reference Filter	Half-sine	Half-sine
2nd Reference Filter	None	None
Roll Off	1.00	1.00
2nd Roll Off	1.00	1.00
Slots per Frame	2	2
Slot length	1128 symbol	1128 symbol
Measurement Offset	2 symbol	2 symbol
Measurement Interval	1000 symbol	1000 symbol
Sync Word Search	Off	Off
Burst Search	ON	ON
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	32 symbol	32 symbol
1st Word Sync Word	9C3522ED7B8C9607	9C3522ED7B8C9607
1st Word Sync Word Offset	128 symbol	128 symbol
2nd Word Search	Disable	Disable
2nd Word Search Slot	—	—
2nd Word Sync Word Length	—	—
2nd Word Sync Word	—	—
2nd Word Sync Word Offset	—	—
Deviation Calculation	—	—
Origin Offset Cancel	On	Off
Origin Offset Reference	Offset	Offset

Table C-11   Predefined Settings List

	T102_PART1	T102_PART2
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	4FSK	4FSK
Auto Deviation	ON	ON
Modulation Index	–	–
Symbol Rate	2.4 ksps	2.4 ksps
Span Up	On	On
Measurement Filter	Root Nyquist	ARIB STD-T98
2nd Measurement Filter	Inverse Gaussian	None
Reference Filter	Nyquist	ARIB STD-T98
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	0.769	1.00
Slots per Frame	1	1
Slot length	192 symbol	192 symbol
Measurement Offset	0 symbol	0 symbol
Measurement Interval	192 symbol	192 symbol
Sync Word Search	OFF	OFF
Burst Search	OFF	OFF
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	10 symbol	10 symbol
1st Word Sync Word	CDF59	CDF59
1st Word Sync Word Offset	72 symbol	0 symbol
2nd Word Search	Disable	Disable
2nd Word Search Slot	–	–
2nd Word Sync Word Length	–	–
2nd Word Sync Word	–	–
2nd Word Sync Word Offset	–	–
Deviation Calculation	Pre-Measurement Filtering	Pre-Measurement Filtering

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Table C-12   Predefined Settings List

	P25_C4FM	P25_CQPSK
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	4FSK	PI/4 DQPSK
Auto Deviation	Off	–
Modulation Index	–	–
Symbol Rate	4.8 ksps	4.8 ksps
Span Up	On	On
Measurement Filter	None	None
2nd Measurement Filter	Rect	None
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.000	1.00
Slots per Frame	1	1
Slot length	864 symbol	864 symbol
Measurement Offset	0 symbol	0 symbol
Measurement Interval	864 symbol	864 symbol
Sync Word Search	Off	Off
Burst Search	Off	Off
1st Word Search Slot	–	–
1st Word Sync Word Length	–	–
1st Word Sync Word	–	–
1st Word Sync Word Offset	–	–
2nd Word Search	Disable	Disable
2nd Word Search Slot	–	–
2nd Word Sync Word Length	–	–
2nd Word Sync Word	–	–
2nd Word Sync Word Offset	–	–
Deviation Calculation	Post-Measurement Filtering	–

Table C-13   Predefined Settings List

	P25_LSM	P25_WCQPSK
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	PI/4 DQPSK	PI/4 DQPSK
Auto Deviation	Off	−
Modulation Index	−	−
Symbol Rate	4.8 ksps	4.8 ksps
Span Up	On	On
Measurement Filter	None	None
2nd Measurement Filter	None	None
Reference Filter	User Defined	User Defined
2nd Reference Filter	None	None
Roll Off	1.00	1.00
2nd Roll Off	1.000	1.00
Slots per Frame	1	1
Slot length	864 symbol	864 symbol
Measurement Offset	0 symbol	0 symbol
Measurement Interval	864 symbol	864 symbol
Sync Word Search	Off	Off
Burst Search	Off	Off
1st Word Search Slot	−	−
1st Word Sync Word Length	−	−
1st Word Sync Word	−	−
1st Word Sync Word Offset	−	−
2nd Word Search	Disable	Disable
2nd Word Search Slot	−	−
2nd Word Sync Word Length	−	−
2nd Word Sync Word	−	−
2nd Word Sync Word Offset	−	−
Deviation Calculation	−	−

Table C-14   Predefined Settings List

	P25_IB_Burst_STD_Type1	P25_IB_Burst_STD_Type2
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	H-CPM	H-CPM
Auto Deviation	Off	Off
Modulation Index	—	—
Maximum Frequency Deviation	3000	3000
Symbol Rate	6 ksps	6 ksps
Span Up	—	—
Measurement Filter	H-CPM_P25	H-CPM_P25
2nd Measurement Filter	None	None
Reference Filter	H-CPM_P25	H-CPM_P25
2nd Reference Filter	None	None
Roll Off	1.00	1.00
2nd Roll Off	1.000	1.000
Slots per Frame	3	3
Slot length	180 symbol	180 symbol
Measurement Offset	4 symbol	14 symbol
Measurement Interval	164 symbol	140 symbol
Sync Word Search	Off	Off
Burst Search	On	On
1st Word Search Slot	—	—
1st Word Sync Word Length	—	—
1st Word Sync Word	—	—
1st Word Sync Word Offset	—	—
2nd Word Search	Disable	Disable
2nd Word Search Slot	—	—
2nd Word Sync Word Length	—	—
2nd Word Sync Word	—	—
2nd Word Sync Word Offset	—	—
Deviation Calculation	Post-Measurement Filtering	Post-Measurement Filtering
Deviation rms Reference	Ideal average	Ideal average
H-CPM Decode Method	Type1	Type2

Table C-15   Predefined Settings List

	P25_IB_LCH0_STD_Type1	P25_IB_LCH0_STD_Type2
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	H-CPM	H-CPM
Auto Deviation	Off	Off
Modulation Index	—	—
Maximum Frequency Deviation	3000	3000
Symbol Rate	6 ksps	6 ksps
Span Up	—	—
Measurement Filter	H-CPM_P25	H-CPM_P25
2nd Measurement Filter	None	None
Reference Filter	H-CPM_P25	H-CPM_P25
2nd Reference Filter	None	None
Roll Off	1.00	1.00
2nd Roll Off	1.000	1.000
Slots per Frame	12	12
Slot length	180 symbol	180 symbol
Measurement Offset	8 symbol	20 symbol
Measurement Interval	164 symbol	140 symbol
Sync Word Search	On	On
Burst Search	On	On
1st Word Search Slot	Slot10	Slot10
1st Word Sync Word Length	18 Symbol	18 Symbol
1st Word Sync Word	577D577FF	577D577FF
1st Word Sync Word Offset	10 Symbol	10 Symbol
2nd Word Search	On	On
2nd Word Search Slot	Slot10	Slot10
2nd Word Sync Word Length	18 Symbol	18 Symbol
2nd Word Sync Word	576D577EF	576D577EF
2nd Word Sync Word Offset	10 Symbol	10 Symbol
Deviation Calculation	Post-Measurement Filtering	Post-Measurement Filtering
Deviation rms Reference	Ideal average	Ideal average
H-CPM Decode Method	Type1	Type2

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Table C-16   Predefined Settings List

	P25_IB_LCH0_ Symmetrical_Type1	P25_IB_LCH0_ Symmetrical_Type2
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	H-CPM	H-CPM
Auto Deviation	Off	Off
Modulation Index	—	—
Maximum Frequency Deviation	3000	3000
Symbol Rate	6 ksps	6 ksps
Span Up	—	—
Measurement Filter	H-CPM_P25	H-CPM_P25
2nd Measurement Filter	None	None
Reference Filter	H-CPM_P25	H-CPM_P25
2nd Reference Filter	None	None
Roll Off	1.00	1.00
2nd Roll Off	1.000	1.000
Slots per Frame	12	12
Slot length	180 symbol	180 symbol
Measurement Offset	8 symbol	20 symbol
Measurement Interval	164 symbol	140 symbol
Sync Word Search	On	On
Burst Search	On	On
1st Word Search Slot	Slot11	Slot11
1st Word Sync Word Length	18 Symbol	18 Symbol
1st Word Sync Word	577D577FF	577D577FF
1st Word Sync Word Offset	10 Symbol	10 Symbol
2nd Word Search	On	On
2nd Word Search Slot	Slot10	Slot10
2nd Word Sync Word Length	18 Symbol	18 Symbol
2nd Word Sync Word	576D577EF	576D577EF
2nd Word Sync Word Offset	10 Symbol	10 Symbol
Deviation Calculation	Post-Measurement Filtering	Post-Measurement Filtering
Deviation rms Reference	Ideal average	Ideal average
H-CPM Decode Method	Type1	Type2

Table C-17   Predefined Settings List

	P25_IB_LCH1_STD_Type1	P25_IB_LCH1_STD_Type2
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	H-CPM	H-CPM
Auto Deviation	Off	Off
Modulation Index	−	−
Maximum Frequency Deviation	3000	3000
Symbol Rate	6 ksps	6 ksps
Span Up	−	−
Measurement Filter	H-CPM_P25	H-CPM_P25
2nd Measurement Filter	None	None
Reference Filter	H-CPM_P25	H-CPM_P25
2nd Reference Filter	None	None
Roll Off	1.00	1.00
2nd Roll Off	1.000	1.000
Slots per Frame	12	12
Slot length	180 symbol	180 symbol
Measurement Offset	8 symbol	20 symbol
Measurement Interval	164 symbol	140 symbol
Sync Word Search	On	On
Burst Search	On	On
1st Word Search Slot	Slot11	Slot11
1st Word Sync Word Length	18 Symbol	18 Symbol
1st Word Sync Word	577D577FF	577D577FF
1st Word Sync Word Offset	10 Symbol	10 Symbol
2nd Word Search	On	On
2nd Word Search Slot	Slot11	Slot11
2nd Word Sync Word Length	18 Symbol	18 Symbol
2nd Word Sync Word	576D577EF	576D577EF
2nd Word Sync Word Offset	10 Symbol	10 Symbol
Deviation Calculation	Post-Measurement Filtering	Post-Measurement Filtering
Deviation rms Reference	Ideal average	Ideal average
H-CPM Decode Method	Type1	Type2

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Table C-18   Predefined Settings List

	P25_OB_STD	P25_OB_STD_BER
Measuring Object	No Formatted	Frame Formatted
Modulation Type	4FSK	4FSK
Auto Deviation	Off	Off
Modulation Index	—	—
Maximum Frequency Deviation	2250	2250
Symbol Rate	6 ksps	6 ksps
Span Up	—	—
Measurement Filter	Rect	Rect
2nd Measurement Filter	None	None
Reference Filter	Rect	Rect
2nd Reference Filter	None	None
Roll Off	1.00	1.00
2nd Roll Off	1.000	1.000
Slots per Frame	—	4
Slot length	—	2160 symbol
Measurement Offset	—	0 symbol
Measurement Interval	180 symbol	2160 symbol
Sync Word Search	—	On
Burst Search	—	Off
1st Word Search Slot	—	Slot0
1st Word Sync Word Length	—	20 Symbol
1st Word Sync Word	—	184229D461
1st Word Sync Word Offset	—	0 Symbol
2nd Word Search	—	On
2nd Word Search Slot	—	Slot0
2nd Word Sync Word Length	—	20 Symbol
2nd Word Sync Word	—	184239D460
2nd Word Sync Word Offset	—	0 Symbol
Deviation Calculation	Post-Measurement Filtering	Post-Measurement Filtering
Deviation rms Reference	Ideal average	Ideal average

Table C-19   Predefined Settings List

	DMR_BSsourced_Voice	DMR_BSsourced_Data
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	4FSK	4FSK
Auto Deviation	On	On
Modulation Index	–	–
Symbol Rate	4.8 ksps	4.8 ksps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	None
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.000	1.000
Slots per Frame	1	1
Slot length	144 symbol	144 symbol
Measurement Offset	0 symbol	0 symbol
Measurement Interval	144 symbol	144 symbol
Sync Word Search	On	On
Burst Search	Off	Off
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	24 symbol	24 symbol
1st Word Sync Word	755FD7DF75F7	DFF57D75DF5D
1st Word Sync Word Offset	60 symbol	60 symbol
2nd Word Search	Disable	Disable
2nd Word Search Slot	–	–
2nd Word Sync Word Length	–	–
2nd Word Sync Word	–	–
2nd Word Sync Word Offset	–	–
Deviation Calculation	Post-Measurement Filtering	Post-Measurement Filtering

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Table C-20   Predefined Settings List

	DMR_MSsourced_Voice	DMR_MSsourced_Data
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	4FSK	4FSK
Auto Deviation	On	On
Modulation Index	–	–
Symbol Rate	4.8 ksps	4.8 ksps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	None
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.000	1.000
Slots per Frame	1	1
Slot length	144 symbol	144 symbol
Measurement Offset	0 symbol	0 symbol
Measurement Interval	132 symbol	132 symbol
Sync Word Search	On	On
Burst Search	On	On
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	24 symbol	24 symbol
1st Word Sync Word	7F7D5DD57DFD	D5D7F77FD757
1st Word Sync Word Offset	54 symbol	54 symbol
2nd Word Search	Disable	Disable
2nd Word Search Slot	–	–
2nd Word Sync Word Length	–	–
2nd Word Sync Word	–	–
2nd Word Sync Word Offset	–	–
Deviation Calculation	Post-Measurement Filtering	Post-Measurement Filtering

Table C-21   Predefined Settings List

	DMR_MSsourced_RC	NXDN_2_4ksps
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	4FSK	4FSK
Auto Deviation	On	On
Modulation Index	–	–
Symbol Rate	4.8 ksps	2.4 ksps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	Inverse Rect
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.000	1.000
Slots per Frame	1	1
Slot length	144 symbol	192 symbol
Measurement Offset	0 symbol	0 symbol
Measurement Interval	48 symbol	192 symbol
Sync Word Search	On	On
Burst Search	On	Off
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	24 symbol	10 symbol
1st Word Sync Word	77D55F7DFD77	CDF59
1st Word Sync Word Offset	12 symbol	0 symbol
2nd Word Search	Disable	Disable
2nd Word Search Slot	–	–
2nd Word Sync Word Length	–	–
2nd Word Sync Word	–	–
2nd Word Sync Word Offset	–	–
Deviation Calculation	Post-Measurement Filtering	Pre-Measurement Filtering

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Table C-22   Predefined Settings List

	NXDN_4_8ksps
Measuring Object	Frame Formatted
Modulation Type	4FSK
Auto Deviation	On
Modulation Index	–
Symbol Rate	4.8 ksps
Span Up	On
Measurement Filter	Root Nyquist
2nd Measurement Filter	Inverse Rect
Reference Filter	Nyquist
2nd Reference Filter	None
Roll Off	0.20
2nd Roll Off	1.000
Slots per Frame	1
Slot length	192 symbol
Measurement Offset	0 symbol
Measurement Interval	192 symbol
Sync Word Search	On
Burst Search	Off
1st Word Search Slot	Slot 0
1st Word Sync Word Length	10 symbol
1st Word Sync Word	CDF59
1st Word Sync Word Offset	0 symbol
2nd Word Search	Disable
2nd Word Search Slot	–
2nd Word Sync Word Length	–
2nd Word Sync Word	–
2nd Word Sync Word Offset	–
Deviation Calculation	Pre-Measurement Filtering

Table C-23   Predefined Settings List

	T86_SYNC_UL	T86_SYNC_DL
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	16QAM	16QAM
Symbol Rate	11250 sps	11250 sps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	None
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.00	1.00
Slots per Frame	6 slot	6 slot
Measurement Slot	Slot 0 : On, Slot1-5:Off	Slot 0 : On, Slot1-5:Off
Slot length	150 symbol	150 symbol
Measurement Offset	4 symbol	4 symbol
Measurement Interval	141 symbol	141 symbol
Sync Word Search	ON	ON
Burst Search	ON	ON
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	10 symbol	10 symbol
1st Word Sync Word	0000AAA0AA	0000AA0A0A
1st Word Sync Word Offset	69 symbol	69 symbol
2nd Word Search	Disable	Disable
2nd Word Search Slot	—	—
2nd Word Sync Word Length	—	—
2nd Word Sync Word	—	—
2nd Word Sync Word Offset	—	—

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Table C-24   Predefined Settings List

	DMR_BSsourced_Voice_2	DMR_BSsourced_Data_2
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	4FSK	4FSK
Auto Deviation	Off	Off
Max Deviation	1944	1944
Modulation Index	−	−
Symbol Rate	4.8 ksps	4.8 ksps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	None
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.000	1.000
Slots per Frame	12	12
Measurement Slot	Slot 0 : On, Slot1-11:Off	Slot 0 : On, Slot1-11:Off
Slot length	144 symbol	144 symbol
Measurement Offset	0 symbol	0 symbol
Measurement Interval	144 symbol	144 symbol
Sync Word Search	On	On
Burst Search	Off	Off
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	24 symbol	24 symbol
1st Word Sync Word	755FD7DF75F7	DFF57D75DF5D
1st Word Sync Word Offset	60 symbol	60 symbol
2nd Word Search	Disable	Disable
2nd Word Search Slot	−	−
2nd Word Sync Word Length	−	−
2nd Word Sync Word	−	−
2nd Word Sync Word Offset	−	−
Deviation Calculation	Post-Measurement Filtering	Post-Measurement Filtering

Table C-25   Predefined Settings List

	DMR_MSsourced_Voice_2	DMR_MSsourced_Data_2
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	4FSK	4FSK
Auto Deviation	Off	Off
Max Deviation	1944	1944
Modulation Index	—	—
Symbol Rate	4.8 ksps	4.8 ksps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	None
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.000	1.000
Slots per Frame	12	12
Measurement Slot	ON: Slot 0,2,4..10	ON: Slot 0,2,4..10
Slot length	144 symbol	144 symbol
Measurement Offset	0 symbol	0 symbol
Measurement Interval	132 symbol	132 symbol
Sync Word Search	On	On
Burst Search	On	On
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	24 symbol	24 symbol
1st Word Sync Word	7F7D5DD57DFD	D5D7F77FD757
1st Word Sync Word Offset	54 symbol	54 symbol
2nd Word Search	Disable	Disable
2nd Word Search Slot	—	—
2nd Word Sync Word Length	—	—
2nd Word Sync Word	—	—
2nd Word Sync Word Offset	—	—
Deviation Calculation	Post-Measurement Filtering	Post-Measurement Filtering

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Table C-26   Predefined Settings List

	DMR_Normal_Burst	DMR_RC_Burst
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	4FSK	4FSK
Auto Deviation	Off	Off
Max Deviation	1944	1944
Modulation Index	—	—
Symbol Rate	4.8 ksps	4.8 ksps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	None
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.000	1.000
Slots per Frame	2	2
Measurement Slot	Slot0 ：On, Slot1:Off	Slot0 ：On, Slot1:Off
Slot length	144 symbol	144 symbol
Measurement Offset	5 symbol	0 symbol
Measurement Interval	132 symbol	48 symbol
Sync Word Search	Off	Off
Burst Search	On	On
1st Word Search Slot	—	—
1st Word Sync Word Length	—	—
1st Word Sync Word	—	—
1st Word Sync Word Offset	—	—
2nd Word Search	—	—
2nd Word Search Slot	—	—
2nd Word Sync Word Length	—	—
2nd Word Sync Word	—	—
2nd Word Sync Word Offset	—	—
Deviation Calculation	Post-Measurement Filtering	Post-Measurement Filtering

Table C-27   Predefined Settings List

	dPMR446_80ms	dPMR446_HeaderBurst
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	4FSK	4FSK
Auto Deviation	On	On
Max Deviation	—	—
Modulation Index	—	—
Symbol Rate	2.4 ksps	2.4 ksps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	Inverse Rect	Inverse Rect
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.000	1.000
Slots per Frame	1	2
Measurement Slot	Slot0：On	Slot0：On, Slot1:Off
Slot length	192 symbol	192 symbol
Measurement Offset	0 symbol	12 symbol
Measurement Interval	192 symbol	160 symbol
Sync Word Search	Off	Off
Burst Search	On	On
1st Word Search Slot	—	—
1st Word Sync Word Length	—	—
1st Word Sync Word	—	—
1st Word Sync Word Offset	—	—
2nd Word Search	—	—
2nd Word Search Slot	—	—
2nd Word Sync Word Length	—	—
2nd Word Sync Word	—	—
2nd Word Sync Word Offset	—	—
Deviation Calculation	Post-Measurement Filtering	Post-Measurement Filtering

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Table C-28   Predefined Settings List

	dPMR446_320ms_FS2	—
Measuring Object	Frame Formatted	—
Modulation Type	4FSK	—
Auto Deviation	On	—
Max Deviation	—	—
Modulation Index	—	—
Symbol Rate	2.4 ksps	—
Span Up	On	—
Measurement Filter	Root Nyquist	—
2nd Measurement Filter	Inverse Rect	—
Reference Filter	Nyquist	—
2nd Reference Filter	None	—
Roll Off	0.20	—
2nd Roll Off	1.000	—
Slots per Frame	2	—
Measurement Slot	Slot0：On, Slot1:Off	—
Slot length	384 symbol	—
Measurement Offset	0 symbol	—
Measurement Interval	384 symbol	—
Sync Word Search	On	—
Burst Search	On	—
1st Word Search Slot	Slot0	—
1st Word Sync Word Length	12 Symbol	—
1st Word Sync Word	5FF77D	—
1st Word Sync Word Offset	0	—
2nd Word Search	Disable	—
2nd Word Search Slot	—	—
2nd Word Sync Word Length	—	—
2nd Word Sync Word	—	—
2nd Word Sync Word Offset	—	—
Deviation Calculation	Post-Measurement Filtering	—

Table C-29   Predefined Settings List

	dPMR_BCH_STD	—
Measuring Object	Frame Formatted	—
Modulation Type	4FSK	—
Auto Deviation	On	—
Max Deviation	—	—
Modulation Index	—	—
Symbol Rate	2.4 ksps	—
Span Up	On	—
Measurement Filter	Root Nyquist	—
2nd Measurement Filter	Inverse Rect	—
Reference Filter	Nyquist	—
2nd Reference Filter	None	—
Roll Off	0.20	—
2nd Roll Off	1.000	—
Slots per Frame	4	—
Measurement Slot	Slot0 : On, Slot1-3:Off	—
Slot length	192 symbol	—
Measurement Offset	10 symbol	—
Measurement Interval	160 symbol	—
Sync Word Search	Off	—
Burst Search	On	—
1st Word Search Slot	—	—
1st Word Sync Word Length	—	—
1st Word Sync Word	—	—
1st Word Sync Word Offset	—	—
2nd Word Search	—	—
2nd Word Search Slot	—	—
2nd Word Sync Word Length	—	—
2nd Word Sync Word	—	—
2nd Word Sync Word Offset	—	—
Deviation Calculation	Post-Measurement Filtering	—

Table C-30   Predefined Settings List

	dPMR_BCH_110ms_FS1	dPMR_BCH_Uplink_FS1
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	4FSK	4FSK
Auto Deviation	On	On
Max Deviation	—	—
Modulation Index	—	—
Symbol Rate	2.4 ksps	2.4 ksps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	Inverse Rect	Inverse Rect
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.000	1.000
Slots per Frame	2	4
Measurement Slot	Slot0 : On, Slot1:Off	Slot0 : On, Slot1-3:Off
Slot length	264 symbol	192 symbol
Measurement Offset	0 symbol	8 symbol
Measurement Interval	264 symbol	184 symbol
Sync Word Search	On	On
Burst Search	On	On
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	24	24
1st Word Sync Word	57FF5F75D577	57FF5F75D577
1st Word Sync Word Offset	108	36
2nd Word Search	Disable	Disable
2nd Word Search Slot	—	—
2nd Word Sync Word Length	—	—
2nd Word Sync Word	—	—
2nd Word Sync Word Offset	—	—
Deviation Calculation	Post-Measurement Filtering	Post-Measurement Filtering

Table C-31   Predefined Settings List

	dPMR_TCH_STD	—
Measuring Object	Frame Formatted	—
Modulation Type	4FSK	—
Auto Deviation	On	—
Max Deviation	—	—
Modulation Index	—	—
Symbol Rate	2.4 ksps	—
Span Up	On	—
Measurement Filter	Root Nyquist	—
2nd Measurement Filter	Inverse Rect	—
Reference Filter	Nyquist	—
2nd Reference Filter	None	—
Roll Off	0.20	—
2nd Roll Off	1.000	—
Slots per Frame	4	—
Measurement Slot	Slot0：On, Slot1-3:Off	—
Slot length	192 symbol	—
Measurement Offset	12 symbol	—
Measurement Interval	164 symbol	—
Sync Word Search	Off	—
Burst Search	On	—
1st Word Search Slot	—	—
1st Word Sync Word Length	—	—
1st Word Sync Word	—	—
1st Word Sync Word Offset	—	—
2nd Word Search	—	—
2nd Word Search Slot	—	—
2nd Word Sync Word Length	—	—
2nd Word Sync Word	—	—
2nd Word Sync Word Offset	—	—
Deviation Calculation	Post-Measurement Filtering	—

Table C-32   Predefined Settings List

	dPMR_TCH_Payload80ms_FS2	dPMR_TCH_PacketHead_FS4
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	4FSK	4FSK
Auto Deviation	On	On
Max Deviation	—	—
Modulation Index	—	—
Symbol Rate	2.4 ksps	2.4 ksps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	Inverse Rect	Inverse Rect
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.20	0.20
2nd Roll Off	1.000	1.000
Slots per Frame	4	4
Measurement Slot	Slot0：On, Slot1-3:Off	Slot0：On, Slot1-3:Off
Slot length	192 symbol	192 symbol
Measurement Offset	0 symbol	8 symbol
Measurement Interval	192 symbol	184 symbol
Sync Word Search	On	On
Burst Search	On	On
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	12	24
1st Word Sync Word	5FF77D	FD55F5DF7FDD
1st Word Sync Word Offset	0	36
2nd Word Search	Disable	Disable
2nd Word Search Slot	—	—
2nd Word Sync Word Length	—	—
2nd Word Sync Word	—	—
2nd Word Sync Word Offset	—	—
Deviation Calculation	Post-Measurement Filtering	Post-Measurement Filtering

Table C-33   Predefined Settings List

	TETRA_DL_NORMAL_CONT	TETRA_DL_NORMAL_DISCONT
Measuring Object	Frame Formatted	Frame Formatted
Modulation Type	PI/4DQPSK	PI/4DQPSK
Symbol Rate	18000 sps	18000 sps
Span Up	On	On
Measurement Filter	Root Nyquist	Root Nyquist
2nd Measurement Filter	None	None
Reference Filter	Nyquist	Nyquist
2nd Reference Filter	None	None
Roll Off	0.35	0.35
2nd Roll Off	1.00	1.00
Slots per Frame	4 slot	4 slot
Measurement Slot	Slot0 : On, Slot1-3:Off	Slot0 : On, Slot1-3:Off
Slot length	255 symbol	255 symbol
Measurement Offset	0 symbol	5 symbol
Measurement Interval	255 symbol	246 symbol
Sync Word Search	On	On
Burst Search	On	On
1st Word Search Slot	Slot 0	Slot 0
1st Word Sync Word Length	11 symbol	11 symbol
1st Word Sync Word	343A74	343A74
1st Word Sync Word Offset	122 symbol	122 symbol
2nd Word Search	Disable	Disable
2nd Word Search Slot	-	-
2nd Word Sync Word Length	-	-
2nd Word Sync Word	-	-
2nd Word Sync Word Offset	-	-
Origin Offset Cancel	On	On
Droop Cancel	On	On
Method of Symbol Rate Error	Slot	Slot

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Table C-34 Predefined Settings List

	TETRA_UL_NORMAL	
Measuring Object	Frame Formatted	
Modulation Type	PI/4DQPSK	
Symbol Rate	18000 sps	
Span Up	On	
Measurement Filter	Root Nyquist	
2nd Measurement Filter	None	
Reference Filter	Nyquist	
2nd Reference Filter	None	
Roll Off	0.35	
2nd Roll Off	1.00	
Slots per Frame	4 slot	
Measurement Slot	Slot0：On, Slot1-3:Off	
Slot length	255 symbol	
Measurement Offset	17 symbol	
Measurement Interval	231 symbol	
Sync Word Search	On	
Burst Search	On	
1st Word Search Slot	Slot 0	
1st Word Sync Word Length	11 symbol	
1st Word Sync Word	343A74	
1st Word Sync Word Offset	127 symbol	
2nd Word Search	Disable	
2nd Word Search Slot	-	
2nd Word Sync Word Length	-	
2nd Word Sync Word	-	
2nd Word Sync Word Offset	-	
Origin Offset Cancel	On	
Droop Cancel	On	
Method of Symbol Rate Error	Slot	

Appendix D   User Defined Filter

This section explains the User Defined Filter definition and the filter definition file description method.

D.1 User Defined Filter Definition

The User Defined Filter is defined as shown below.

- There must be a FIR filter coefficient string expressing the 8 times oversampling time response (as real number) for the symbol rate.
- The filter coefficient tap number must be an odd number in the range 1 to 501.
- The filter coefficient center must match the symbol timing.

D.2 User Defined Filter Definition File Description Method

This section explains the User Defined Filter definition file.

The definition file is created in text format. Any file name and extension can be specified.

Observe the following rules when writing a configuration file:

1. The filter coefficient string is described sequentially as one real number declaration per line.
2. The line count must match the tap count. When the last line is just an LF code, it is not included in the line count.

Example:

Definition file description for 9 tap FIR filter

When the filter coefficient string is set as shown in Table D.2-1, the
setting file is described as shown in Table D.2-1.

Table D.2-1 9   Tap FIR Filter Coefficient String

Allocation	Filter Coefficient	Allocation	Filter Coefficient
0	6.055e–3	5	2.619e–1
1	–1.339e–2	6	–5.052e–2
2	–5.052e–2	7	–1.339e–2
3	2.619e–1	8	6.055e–3
4	6.000e–1		

Specify the symbol
data for allocation 0
on the first line.

The line count must
match tap count but
if the last line is just
an LF code, it is not
included in line
count

```
6.055e-3
-1.339e-2
-5.052e-2
2.619e-1
6.000e-1
2.619e-1
-5.052e-2
-1.339e-2
6.055e-3
```

LF code at end of
each line
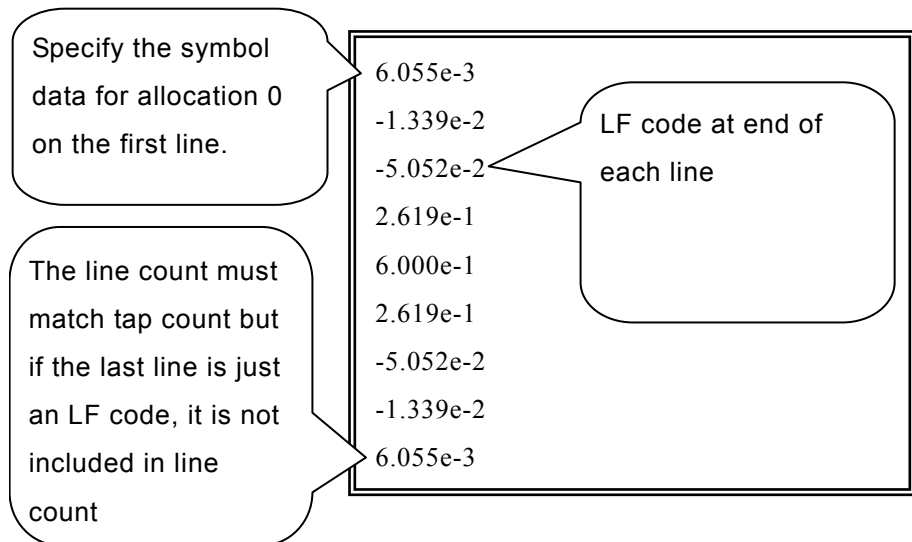
Figure D.2-1   Mapping Edit Setting File Description Example

This appendix explains the test patterns prepared for BER pattern in BER setting.

Test Patterns for APCO Project25 Phase1

The BER patterns in Table E-1 are test patterns defined by TIA-102.CAAA-C. (Except P25_PN9)

Table E-1   BER Pattern

Pattern name	Description
P25_Tone	Standard Tone Test Pattern
P25_Silence	Standard Silence Test Pattern
P25_Interference	Standard Interference Test Pattern
P25_Busy	Standard Busy Test Pattern
P25_Idle	Standard Idle Test Pattern
P25_Calibration	Calibration Test Pattern
P25_AutoFreqControl	Automatic Frequency Control Test Pattern
P25_PN9	PN9

Refer to TIA-102.CAAA-C for Detail.

Test Patterns for APCO Project25 Phase2

The BER patterns in Table E-2 are test patterns defined by TIA-102.CCAA.

Table E-2   BER Pattern

Pattern name	Description
P25_Phase2_STTP-OB1031_Frame0	Outbound Standard Tone Test Pattern Super Frame 1
P25_Phase2_STTP-OB1031_Frame1	Outbound Standard Tone Test Pattern Super Frame 2
P25_Phase2_STTP-OB1031_Frame2	Outbound Standard Tone Test Pattern Super Frame 3
P25_Phase2_STTP-OB1031_Frame3	Outbound Standard Tone Test Pattern Super Frame 4
P25_Phase2_STTP-IB1031-0_Slot01	Inbound Standard Tone Test Pattern Channel 0 TimeSlot 1
P25_Phase2_STTP-IB1031-0_Slot03	Inbound Standard Tone Test Pattern Channel 0 TimeSlot 3
P25_Phase2_STTP-IB1031-0_Slot05	Inbound Standard Tone Test Pattern Channel 0 TimeSlot 5
P25_Phase2_STTP-IB1031-0_Slot07	Inbound Standard Tone Test Pattern Channel 0 TimeSlot 7
P25_Phase2_STTP-IB1031-0_Slot09	Inbound Standard Tone Test Pattern Channel 0 TimeSlot 9
P25_Phase2_STTP-IB1031-0_Slot10	Inbound Standard Tone Test Pattern Channel 0 TimeSlot 10
P25_Phase2_STTP-IB1031-1_Slot00	Inbound Standard Tone Test Pattern Channel 1 TimeSlot 0
P25_Phase2_STTP-IB1031-1_Slot02	Inbound Standard Tone Test Pattern Channel 1 TimeSlot 2
P25_Phase2_STTP-IB1031-1_Slot04	Inbound Standard Tone Test Pattern Channel 1 TimeSlot 4
P25_Phase2_STTP-IB1031-1_Slot06	Inbound Standard Tone Test Pattern Channel 1 TimeSlot 6
P25_Phase2_STTP-IB1031-1_Slot08	Inbound Standard Tone Test Pattern Channel 1 TimeSlot 8
P25_Phase2_STTP-IB1031-1_Slot11	Inbound Standard Tone Test Pattern Channel 1 TimeSlot 11

Refer to TIA-102.CCAA for Detail.

Appendix F   Power vs Time Mask

This appendix explains the preset masks provided for Power vs Time measurement.

Mask Setting for DMR

Table F-1 lists the DMR masks that comply with the ETSI TS 102 361-1 V2.1.1 (2012-04).

Before performing measurement complying with the ETSI TS 102 361-1 V2.1.1 (2012-04), set the filter type and bandwidth to Gaussian and 100 kHz, respectively.

For details of setting values, refer to Table F-2 and F-3.

Table F-1   Mask Setting for DMR

Mask name	Description	Setting
DMR_Normal_burst	DMR Normal burst	Table F-2
DMR_RC_burst	DMR RC burst	Table F-3

Table F-2   DMR_Normal_burst

	No.	Time [ms]	REL [dB]	ABS [dBm]	Fail Logic
Rise Upper	6	−1.61	−99.99	−57.00	OFF
	7	−1.61	−99.99	−57.00	ABS or REL
	8	−1.61	4.00	−57.00	REL
	9	−0.10	4.00		REL
	10	−0.10	1.00		REL
Fall Upper	0	0.11	1.00		REL
	1	0.11	4.00		REL
	2	1.60	4.00	−57.00	ABS or REL
	3	1.60	−99.99	−57.00	OFF
Rise Lower	8	−0.10			OFF
	9	−0.10	−3.00	−57.00	ABS or REL
	10	−0.10	−3.00		REL
Fall Lower	0	0.11	−3.00		ABS or REL
	1	0.11	−3.00	−57.00	OFF
	2	0.11		−57.00	OFF

Table F-3   DMR_RC_burst

	No.	Time [ms]	REL [dB]	ABS [dBm]	Fail Logic
Rise Upper	6	−2.61	−99.99	−57.00	OFF
	7	−2.61	−99.99	−57.00	ABS or REL
	8	−2.61	4.00	−57.00	REL
	9	−0.10	4.00		REL
	10	−0.10	1.00		REL
Fall Upper	0	0.11	1.00		REL
	1	0.11	4.00		REL
	2	2.60	4.00	−57.00	ABS or REL
	3	2.60	−99.99	−57.00	OFF
Rise Lower	8	−0.10			OFF
	9	−0.10	−1.00	−57.00	ABS or REL
	10	−0.10	−1.00		REL
Fall Lower	0	0.11	−1.00		ABS or REL
	1	0.11	−1.00	−57.00	OFF
	2	0.11		−57.00	OFF

Mask Setting for P25 Phase2

Table F-4 lists the APCO-P25 Phase2 masks that comply with the TIA-102.CCAA and TIA-102.CCAB.

Before performing measurement complying with the TIA-102.CCAA and TIA-102.CCAB, set the filter type and bandwidth to Gaussian and 100 kHz, respectively.

For details of setting values, refer to Table F-5 and F-6.

Table F-4   Mask Setting for APCO-P25 Phase2

Mask name	Description	Setting
P25_Phase2_IB_Burst_MeasInt164	For MeasInterval = 164	Table F-5
P25_Phase2_IB_Burst_MeasInt168	For MeasInterval = 168	Table F-6

Table F-5   P25_Phase2_IB_Burst_MeasInt164

	No.	Time [ms]	REL [dB]	ABS [dBm]	Fail Logic
Rise Upper	7	−1.61	−99.99	−57.00	ABS or REL
	8	−1.61	4.00	−57.00	REL
	9	−0.42	4.00		REL
	10	−0.42	1.00		REL
Fall Upper	0	0.42	1.00		REL
	1	0.42	4.00		REL
	2	1.61	4.00	−57.00	ABS or REL
	3	1.61	−99.99	−57.00	OFF
Rise Lower	9	−0.42	−3.00		ABS or REL
	10	−0.42	−3.00	−57.00	REL
Fall Lower	0	0.42	−3.00		REL
	1	0.42	−3.00	−57.00	OFF

Table F-6   P25_Phase2_IB_Burst_MeasInt168

	No.	Time [ms]	REL [dB]	ABS [dBm]	Fail Logic
Rise Upper	7	−1.28	−99.99	−57.00	ABS or REL
	8	−1.28	4.00	−57.00	REL
	9	−0.09	4.00		REL
	10	−0.09	1.00		REL
Fall Upper	0	0.09	1.00		REL
	1	0.09	4.00		REL
	2	1.28	4.00	−57.00	ABS or REL
	3	1.28	−99.99	−57.00	OFF
Rise Lower	9	−0.09	−3.00		ABS or REL
	10	−0.09	−3.00	−57.00	REL
Fall Lower	0	0.09	−3.00		REL
	1	0.09	−3.00	−57.00	OFF

Mask Setting for TETRA

Table F-7 lists the TETRA masks that comply with the ETSI TS 100 392-2 V3.6.1 (2013-05).

Before performing measurement complying with the ETSI TS 100 392-2 V3.6.1 (2013-05), set the filter type, Roll-off Factor, and bandwidth to Root Nyquist, 0.35, and 18 kHz, respectively.

For details of setting values, refer to Table F-8 and F-9.

Table F-7   Mask Setting for TETRA

Mask Name	Description	Setting
TETRA_UL_NORMAL	Tetra Uplink Burst	Table F-8
TETRA_DL_NORMAL_DISCONT	Tetra Downlink Burst	Table F-9

Table F-8   TETRA_UL_NORMAL

	No.	Time [x100µs]	REL [dB]	ABS [dBm]	Fail Logic
Rise Upper	7	−10.00	−70.00	−36.00	ABS or REL
	8	−8.89	−70.00	−36.00	REL
	9	−8.89	6.00		REL
	10	0	6.00		OFF
Fall Upper	0	0	3.00		REL
	1	8.33	3.00		REL
	2	8.33	−70.00	−36.00	ABS or REL
	3	10.00	−70.00	−36.00	OFF

Table F-9   TETRA_DL_NORMAL_DISCONT

	No.	Time [x100μs]	REL [dB]	ABS [dBm]	Fail Logic
Rise Upper	7	−5.00	−40.00		REL
	8	−3.89	−40.00		REL
	9	−3.89	6.00		REL
	10	0	6.00		OFF
Fall Upper	0	0	3.00		REL
	1	3.89	3.00		REL
	2	3.89	−40.00		REL
	3	5.00	−40.00		OFF

This section describes the filter function.

G.1 Gaussian/Gaussian2 Filter

The impulse response is expressed as the formula below when the filter is set to Gaussian.

$$h(t) = \frac{\exp\left(\dfrac{-t^2}{2\delta^2 T^2}\right)}{\sqrt{(2\pi)} \,.\, \delta T} * rect\left(\frac{t}{T}\right)$$

It is under the condition below. (T is symbol cycle)

$$rect\left(\frac{t}{T}\right) = \frac{1}{T} \quad for |t| < \frac{T}{2}, \qquad rect\left(\frac{t}{T}\right) = 0 \quad otherwise$$

The impulse response is expressed as the formula below when the filter is set to Gaussian2.

$$h(t) = \frac{\exp\left(\dfrac{-t^2}{2\delta^2 T^2}\right)}{\sqrt{(2\pi)} \,.\, \delta T}$$

Here δ is a constant expressed as the formula below.

$$\delta = \frac{\sqrt{\ln(2)}}{2\pi B T}$$

T : Inverse of Symbol Rate

The following figure shows the comparison of amplitude characteristics between the filter types (Gaussian and Gaussian2).

(Horizontal axis: Frequency normalized to the symbol rate, BT = 0.5, Over Sampling = 8)

In comparison with Gaussian2, Gaussian has the narrower passband, and its amplitude becomes 0 at an integer multiples of the Symbol Rate frequency, due to the influence of rect(t/T).
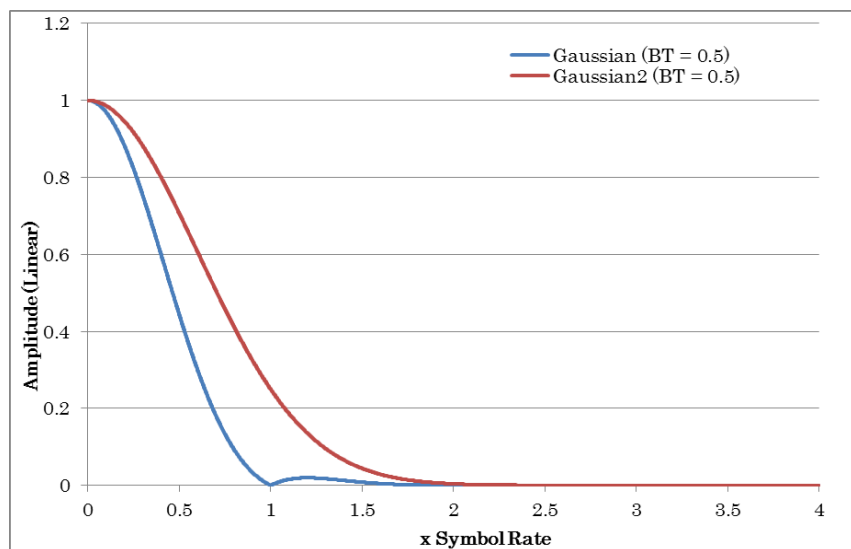
Figure G.1-1   Amplitude characteristics of Gaussian and Gaussian2 filters

References are to page numbers.

Symbol and Numbers

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