

MX269010A
Mobile WiMAX Measurement Software
Operation Manual
Operation

14th 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) or MS2830A Signal Analyzer Operation Manual (Mainframe Operation). Please also refer to this document before using the equipment.
- Keep this manual with the equipment.

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



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



These indicate that the marked part should be recycled.

MX269010A
Mobile WiMAX Measurement Software
Operation Manual Operation

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CE marking



1. Product Model

Software: MX269010A Mobile WiMAX Measurement Software

2. Applied Directive and Standards

When the MX269010A Mobile WiMAX Measurement Software is installed in the MS2690A/MS2691A/MS2692A or MS2830A, the applied directive and standards of this software conform to those of the MS2690A/MS2691A/MS2692A or MS2830A main frame.

PS: About main frame

Please contact Anritsu for the latest information on the main frame types that MX269010A can be used with.

C-tick Conformity Marking

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

C-tick marking



1. Product Model

Software: MX269010A Mobile WiMAX Measurement Software

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When the MX269010A Mobile WiMAX Measurement Software is installed in the MS2690A/MS2691A/MS2692A or MS2830A, the applied directive and standards of this software conform to those of the MS2690A/MS2691A/MS2692A or MS2830A main frame.

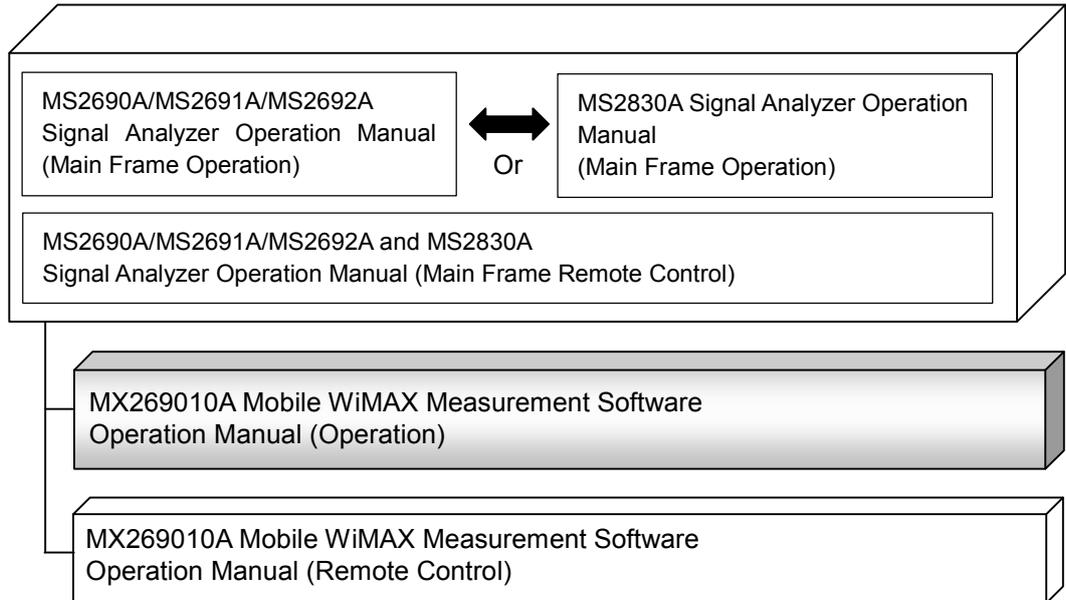
PS: About main frame

Please contact Anritsu for the latest information on the main frame types that MX269010A can be used with.

About This Manual

■ Composition of Operation Manuals

The operation manuals for the MX269010A Mobile WiMAX Measurement Software are comprised as shown in the figure below.



- 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.

- Mobile WiMAX Measurement Software Operation Manual (Operation)
<This document>

This manual describes the operation of the MX269010A Mobile WiMAX Measurement Software. An overview of the hardware of the MS2690A/MS2691A/MS2692A or MS2830A Signal Analyzer, its basic functions, and its operation can be found in the “MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Mainframe Operation)” or “MS2830A Signal Analyzer Operation Manual (Mainframe Operation)”.

- Mobile WiMAX Measurement Software Operation Manual
(Remote Control)

This manual describes remote control of the MX269010A Mobile WiMAX Measurement Software. Basics of remote control and common commands of the application for the MS2690A/MS2691A/MS2692A or MS2830A Signal Analyzer can be found in the “MS2690A/MS2691A/MS2692A or MS2830A Signal Analyzer Operation Manual (Mainframe Remote Control)”.

In this document,  indicates a panel key.

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Chapter 1 Overview

This chapter provides an overview of the MX269010A Mobile WiMAX Measurement Software and describes the product configuration and specifications.

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1.1 Overview

The MX269010A Mobile WiMAX Measurement Software (hereinafter, referred to as “MX269010A”) is software used to analyze and measure RF signals that are modulated with the WirelessMAN-OFDMA method defined by the IEEE 802.16e specifications. It operates on the MS269x Series or MS2830A Signal Analyzer.

The MX269010A samples the input signal with an A/D converter, and analyzes and measures the input data through Fast Fourier Transform (FFT) of the resulting digital data.

The MX269010A can be used for research, development, manufacturing, and maintenance of Mobile WiMAX base stations and Mobile WiMAX mobile stations.

MS2830A-005/105 and MS2830A-006/106 is required to use the MX269010A on MS2830A.

1.2 Features

The MX269010A provides the following measurement features.

- IEEE802.16e OFDMA (Mobile WiMAX) compliant
- Modulation analysis of Downlink STC zone
- Modulation analysis of Uplink Collaborative burst
- Automatic preamble synchronization
- FCH, DL-MAP, UL-MAP, Compressed Map demodulation
- Automatic color-coded display of MAP information
- Downlink EVM measurement (DL preamble EVM, pilot EVM, data EVM, symbol EVM-PUSC, FUSC, AMC2x3)
- Uplink EVM measurement (PUSC, AMC2x3)
- Easy-to-view graph display (constellation, sub-carrier vs. error vector, symbol vs. error vector, spectral flatness)
- Easy switching to/from other applications

1.3 Product Configuration

1.3.1 Standard configuration

Table 1.3.1-1 lists the standard configuration of the MX269010A.

Table 1.3.1-1 Standard configuration

Item	Model Name/Symbol	Product Name	Q'ty	Remarks
Application	MX269010A	Mobile WiMAX measurement software	1	
Standard accessory	–	Installation CD-ROM	1	Application software, operation manual CD-ROM

1.3.2 Applicable parts

Table 1.3.1-2 lists the applicable parts for the MX269010A. All applicable parts are sold separately. When ordering, specify the model name/symbol, product name, and quantity.

Table 1.3.2-1 Applicable parts

Model Name/Symbol	Product Name	Remarks
W2919AE	MX269010A Mobile WiMAX Measurement Software Operation Manual (Operation)	English, printed version
W2954AE	MX269010A Mobile WiMAX Measurement Software Operation Manual (Remote Control)	English, printed version

1.4 Specifications

Table 1.4-1 shows the specifications for the MX269010A.

The following specifications are guaranteed when a suitable input level is set for the input signal for which all-burst boosting is set to 0 dB.

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

Attenuator Mode: Mechanical Atten Only

Table 1.4-1 Specifications

Item	Specification
Analysis length	5 ms Cyclic Prefix: 1/4, 1/8, 1/16, 1/32
Bandwidth	20 MHz, 10 MHz, 8.75 MHz, 7 MHz, 5 MHz, 3.5 MHz
Modulation mode	64QAM, 16QAM, QPSK
Target signal	Downlink: PUSC, FUSC, AMC (2x3) STC: Matrix A, B Uplink: PUSC, AMC (2x3) Normal, Collaborative (Pilot Pattern A, B)
Waveform display (Downlink)	(1) Constellation (2) Power spectrum vs. sub-carrier number (3) Power vs. time (4) IQ data vs. sub-carrier number (5) Downlink map information (zone, burst) (6) Vector error vs. sub-carrier number (7) Vector error vs. symbol number (8) Spectral flatness
Waveform display (Uplink)	(1) Constellation (2) Power spectrum vs. sub-carrier number (3) Power vs. time (4) Vector error vs. sub-carrier number (5) Vector error vs. symbol number (6) Spectral flatness
Measurement frequency range	2.3 to 3.8 GHz
Measurement level range	When the MS2690A/MS2691A/MS2692A Option 008/108 6 GHz Preamplifier or MS2830A Option 008/108 Preamplifier (hereinafter referred to as "Option 008") is not installed, or when it is installed but Pre-Amplifier is set to Off: -15 to +30 dBm When Option 008 is installed and Pre-Amplifier is set to On: -30 to +20 dBm (average power output of measured signal)

Table 1.4-1 Specifications (Cont'd)

Item	Specifications
Carrier frequency accuracy	After CAL execution, at 18° to 28°C ± (reference frequency accuracy × carrier frequency + 20) Hz
Modulation Accuracy Residual vector error	After CAL execution at 18° to 28°C MS2690A/MS2691A/MS2692A Bandwidth below 10MHz <0.6 % (rms) Bandwidth 20MHz <0.8 % (rms) MS2830A Bandwidth below 10MHz <1.6 % (rms) Bandwidth 20MHz <1.8 % (rms)
Spectral Flatness Accuracy	±0.3 dB
Amplitude Measurement Accuracy	After CAL execution at 18° to 28°C MS2690A/MS2691A/MS2692A ±0.6 dB (when preamp = OFF, or Not installed) ±1.1 dB (when preamp = ON) MS2830A ±0.6 dB (when preamp = OFF, or Not installed) The amplitude measurement accuracy is obtained by an RSS (root summed square) error of the absolute amplitude accuracy and in-band frequency characteristics.

1.5 Restrictions

Restrictions regarding the use of the MX269010A and related cautions are described below. For restrictions on the remote control function, refer to the MX269010A Mobile WiMAX Measurement Software Operation Manual (Remote Control).

(1) Parameter save/recall functions

The save/recall functions displayed on the MX269010A save the current setting value(s) with a specified number(s) and load the setting value(s) saved with the specified number(s). Up to 7 settings can be saved. Neither a filename nor a destination can be specified for the data to be saved. Only the parameters displayed on the MX269010A are saved; the activation and selection statuses of the MX269010A are not saved.

When the **Save Application** command is executed for another application, only the activation and selection statuses of the MX269010A are saved. Parameters displayed on the MX269010A are not reflected by executing the **Recall all Application** command.

(2) Major differences from other applications

- (a) When a screen shot is captured by using the panel, it is saved as a bitmap file on the drive whose name is last (in alphabetic order) among the existing drives. The file name is determined by the date and sequential number automatically.
- (b) The MX269010A-unique functions cannot be executed by right-clicking on them.
- (c) Window display position cannot be changed.

(3) Precautions on application upgrade

Upgrading the MX269010A clears the parameter setting values and all setting patterns saved within the MX269010A.

Chapter 2 Preparation

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)” or “MS2830A Signal Analyzer Operation Manual (Mainframe Operation)” for common features not included in this manual.

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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)” or “MS2830A Signal Analyzer Operation Manual (Mainframe Operation)”.

2.1.1 Front panel

This section describes the front-panel keys and connectors.

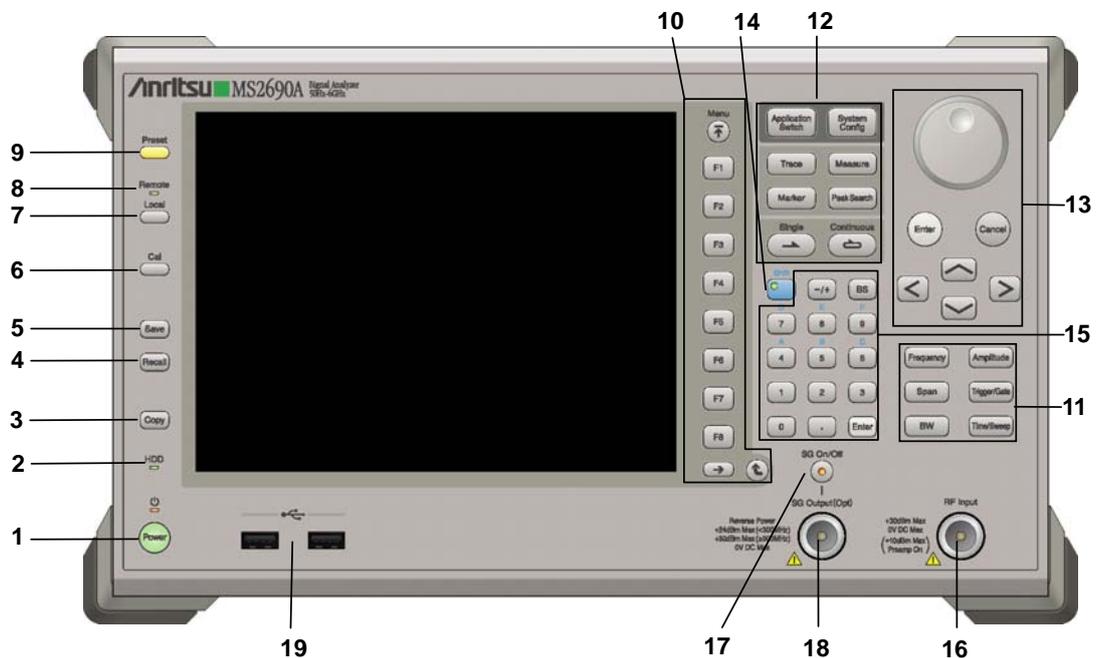


Figure 2.1.1-1 MS269x series front panel

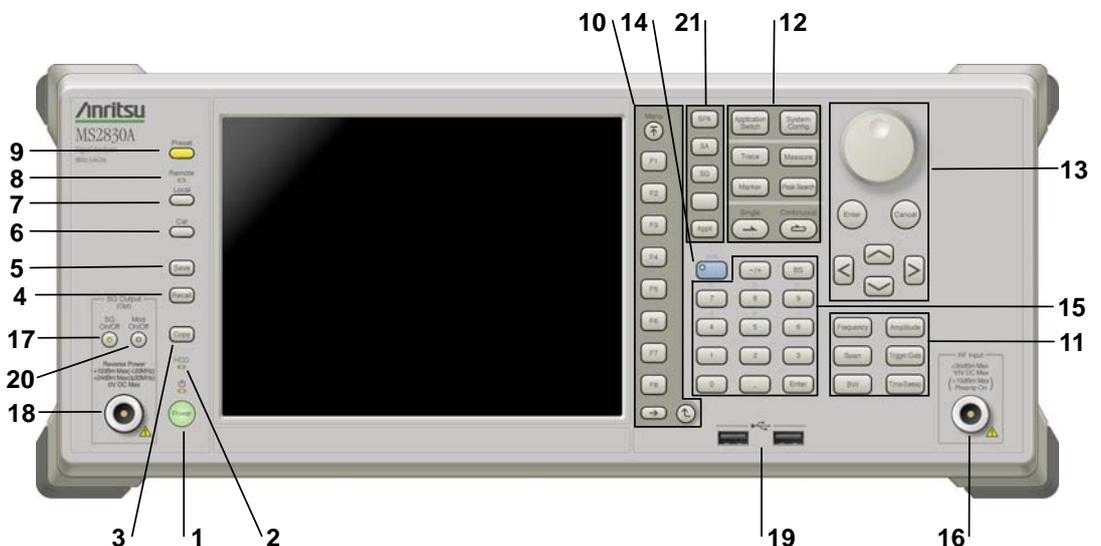
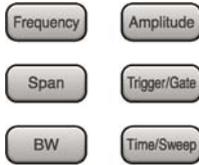


Figure 2.1.1-2 MS2830A front panel

-
- 1  **Power Switch**
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  **Hard disk access lamp**
Lights when accessing the internal hard disk
 - 3  **Copy key**
Press to capture display screen and save to file.
 - 4  **Recall key**
Press to recall parameter file.
 - 5  **Save key**
Press to save parameter file.
 - 6  **Cal key**
Press to display the Calibration menu.

- 7  Local key
Press to return to local operation from remote control via GPIB, Ethernet, or USB (B), and enable panel settings.
- 8  Remote lamp
Lights when in remote-control state
- 9  Preset key
Resets parameters to initial settings
- 10  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  to go back to the top menu.

11



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.

 Press to set frequency parameters.

 Press to set level parameters.

 No function is assigned to this key.

 Press to set trigger parameters

 No function is assigned to this key.

 Press to set measurement item parameters.

12



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.

 Press to switch application.

 Press to display Configuration screen.

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

 Press to set measurement item parameters.

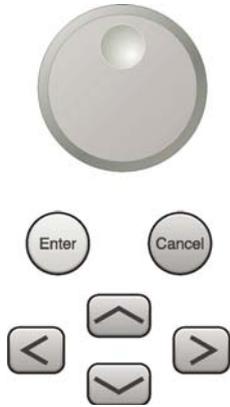
 Use when switching graph marker operation.

 Press to set parameters related to the peak search function.

 Press to start single measurement.

 Press to start continuous measurements.

13



Rotary knob/Cursor key/Enter key/Cancel key

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

Press  to set the entered or selected data.

Press  to cancel input or selected data.

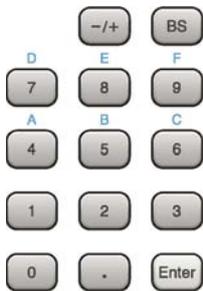
14



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



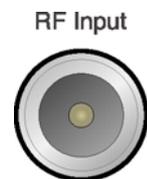
Numeric keypad

Enters numbers on parameter setup screens.

Press  to delete the last entered digit or character.

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

16



RF Input

RF Input connector

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

17



SG On/Off

RF Output Control key

Press  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.

18 SG Output(Opt)



RF Output connector (when Option 020 installed)

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

19



USB connector (type A)

Connect the accessory USB keyboard, mouse or USB memory.

20



Modulation control key (MS2830A only)

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.

21



Application key (MS2830A only)

Press to switch between applications.



Press to display the Spectrum Analyzer main screen.



Press to display the Signal Analyzer main screen, when Option 005/105 and 006/106 are installed.



Press to display the Signal Analyzer main screen, when Vector Signal Generator option is installed.



This is a blank key. Not used.



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)”.

2.1.2 Rear panel

This section describes the rear-panel connectors.

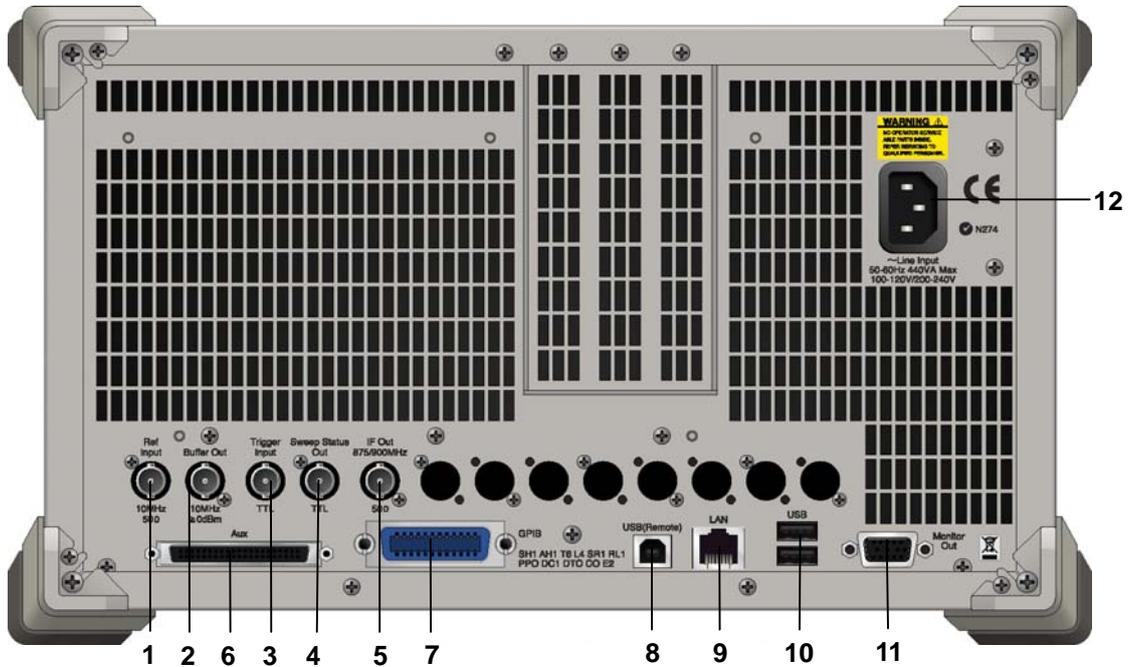


Figure 2.1.2-1 MS269x series rear panel

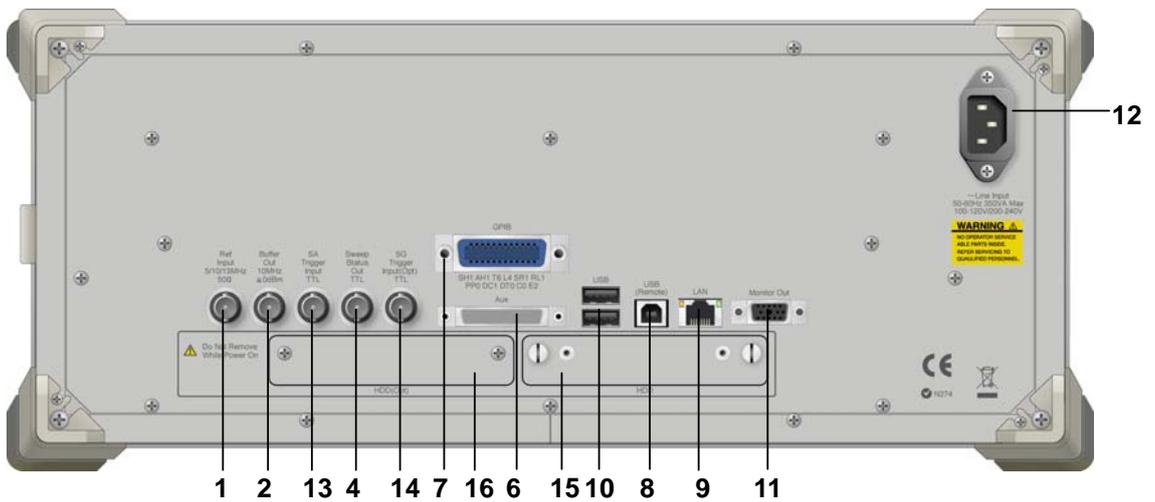


Figure 2.1.2-2 MS2830A rear panel

- | | | |
|---|---|---|
| 1 |  <p style="text-align: center;">Ref
Input</p> | <p>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 or MS2830A to that of other equipment. The following frequencies are supported:</p> <p>MS269x series: 10 MHz/13 MHz
MS2830A: 5 MHz/10 MHz/13 MHz</p> |
| 2 |  <p style="text-align: center;">Buffer Out</p> | <p>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 or MS2830A.</p> |
| 3 |  <p style="text-align: center;">Trigger
Input</p> | <p>Trigger Input connector (MS269x series only)
Inputs trigger signal from external device.</p> |
| 4 |  <p style="text-align: center;">Sweep Status
Out</p> | <p>Sweep Status Out connector
Outputs signal when internal measurement is performed or measurement data is obtained.</p> |
| 5 |  <p style="text-align: center;">IF Out
875/900MHz</p> | <p>IF Out connector (MS269x series only)
Not used</p> |
| 6 |  <p style="text-align: center;">Aux</p> | <p>AUX connector
Not used</p> |
| 7 |  <p style="text-align: center;">GP-IB</p> | <p>GP-IB connector
For external control via GPIB.</p> |
| 8 |  <p style="text-align: center;">USB(Remote)</p> | <p>USB connector (type B)
For external control via USB</p> |

- 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**

AC inlet
Supplies power
~Line Input
50-60Hz 440VA Max
100-120V/200-240V
- 13** **SA
Trigger
Input
TTL**
 SA Trigger Input connector (MS2830A 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 HDD**
HDD slot (MS2830A only)
This is a standard hard disk slot.
- 16 HDD(Opt)**
HDD slot for Option (MS2830A only)
This is a hard disk slot for the options.

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.

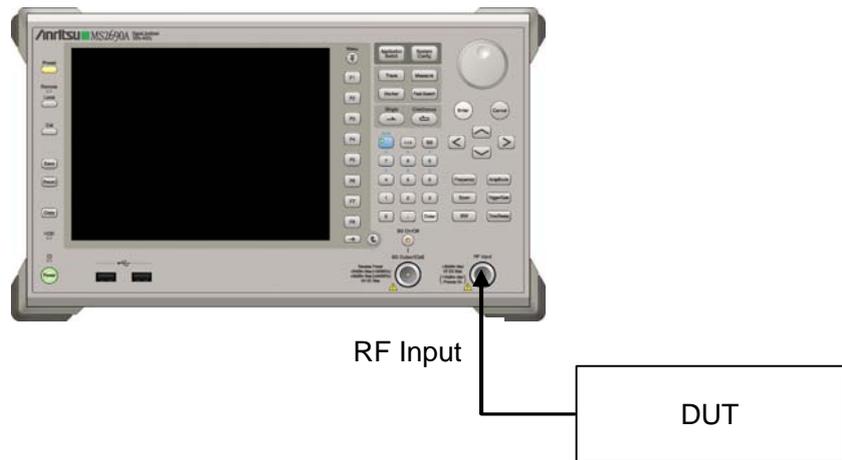


Figure 2.2-1 Signal path setup example

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

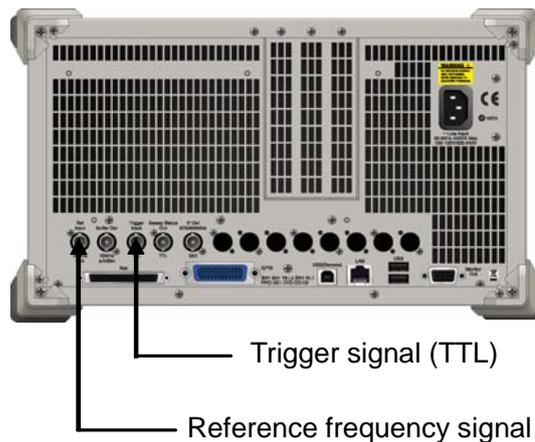


Figure 2.2-2 External signal input

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  to display the Configuration screen.
2. Press  (Application Switch Settings) to display the Application Switch Registration screen.
3. Press  (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  (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  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 Screen Layout

This section describes the screen layout of this application.

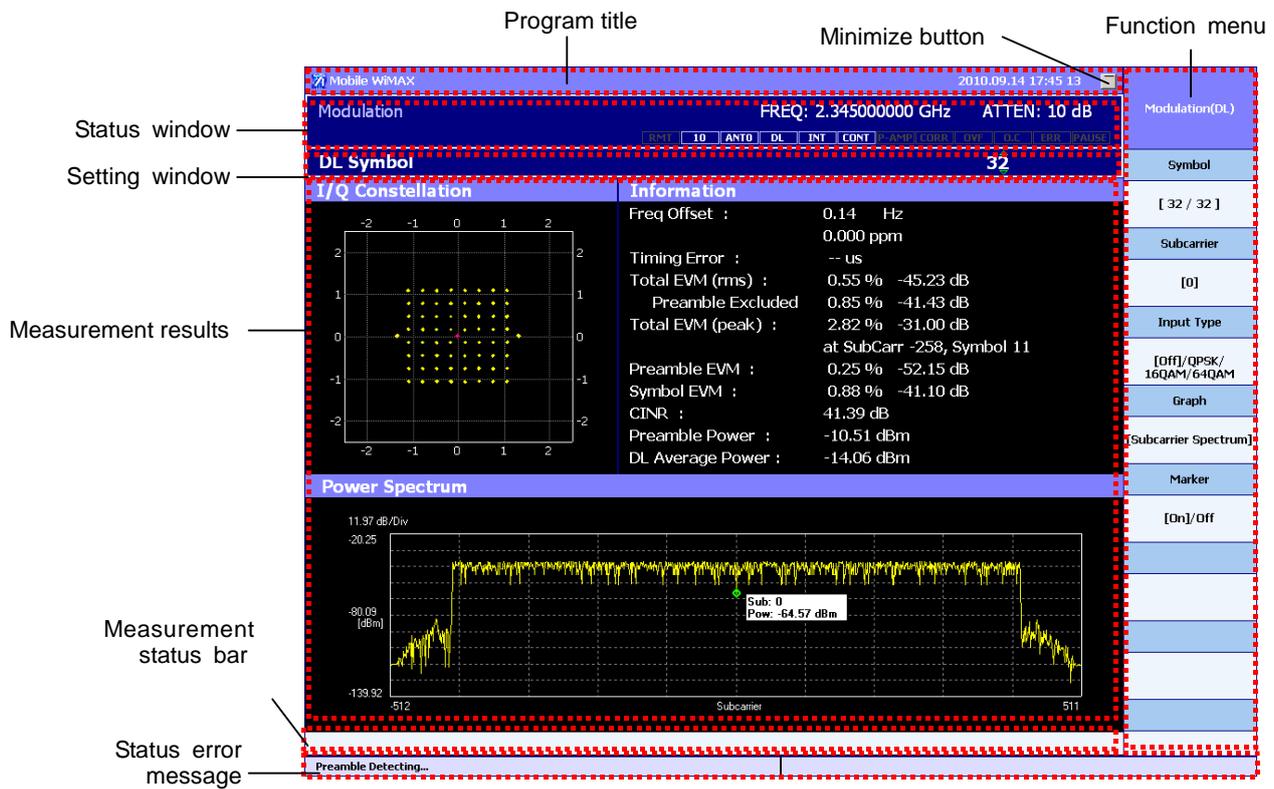


Figure 2.4-1 Screen layout

1. Program title
Displays the name of the application, the date, and the time.
2. Minimize button
Minimizes the window when clicked.
3. Status window
Displays the type of the measurement screen and the current basic statuses.
4. Function Menu
Displays the functions that can be executed with the function keys.
5. Setting window
Area for inputting numeric parameters.
6. Measurement results
Displays the latest measurement results.

7. **Measurement status bar**
Displays a message indicating that parameters have been changed during measurement.
8. **Status error message**
Displays the current measurement status and remote control error messages.

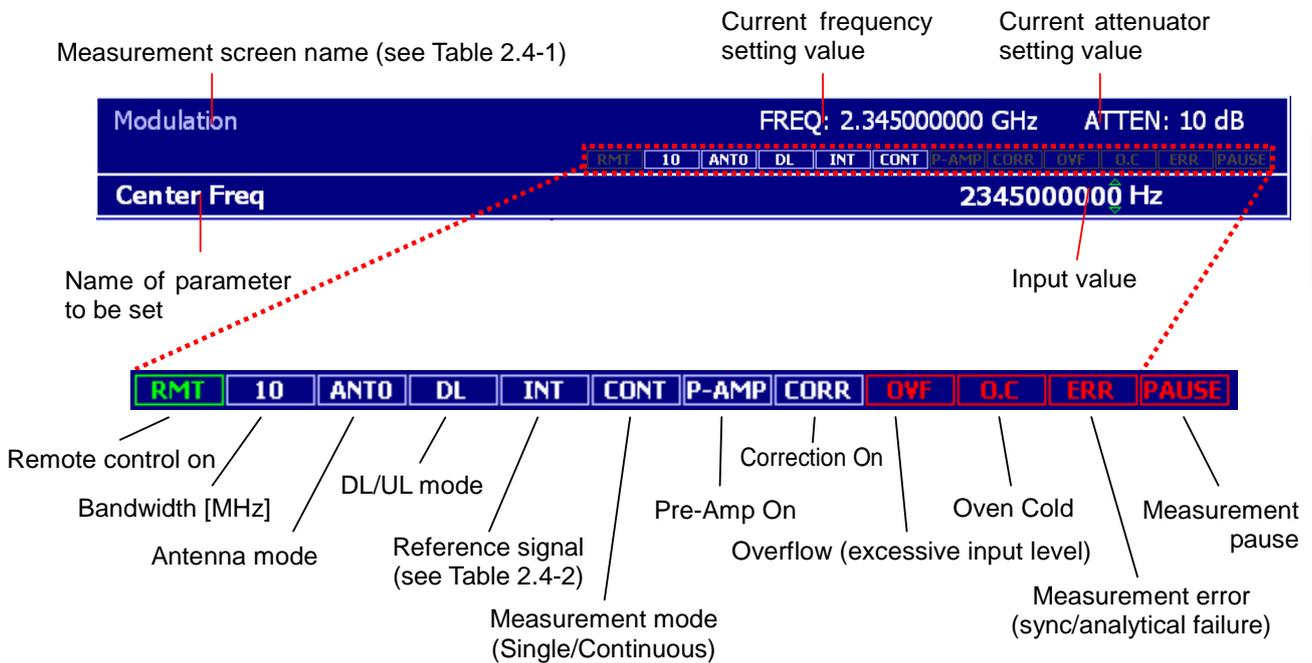


Figure 2.4-2 Setting window

Table 2.4-1 Measurement screen name and DL/UL mode display

Display character string	Measurement function name	DL/UL mode
Modulation	Downlink – Modulation Accuracy	DL
I/Q Received	Downlink – I/Q Received	DL
DL MAP Info.	Downlink – Map Info.	DL
Error Vector Spectrum	Downlink – Error Vector Spectrum	DL
Error Vector Time	Downlink – Error Vector Time	DL
Spectral Flatness	Downlink – Spectral Flatness	DL
Modulation	Uplink – Modulation	UL
Error Vector Spectrum	Uplink – Error Vector Spectrum	UL
Error Vector Time	Uplink – Error Vector Time	UL
Spectral Flatness	Uplink – Spectral Flatness	UL

Table 2.4-2 Reference signal display

Display character string	Description
INT	Synchronized with internal reference clock
INT	Not synchronized with internal reference clock
EXT	Synchronized with reference clock input from external sources
EXT	Not synchronized with reference clock input from external sources

Note:

1. "OVF" indicates that the input level greatly exceeds the "Input Level" setting. If "OVF" is displayed, set "Input Level" to a higher value than the current setting, and then perform measurement again.
2. "O.C" indicates that the frequency and level have not stabilized yet because sufficient time has not elapsed after the power has been switched on. If "O.C" is displayed, wait a little longer until it disappears. The "O.C" display time is 3 minutes at most. "O.C" is displayed when the internal reference clock is used.
3. "PAUSE" is displayed when measurement in Single mode has ended and measurement is not currently being performed.
4. Function menu operation is disabled while "RMT" is on (during remote control).
5. "CORR" displays the Correction setting status (On/Off) on the Configuration screen.

2.5 Initialization and Calibration

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

2.5.1 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  to display the Preset function menu.
2. Press  (Preset).

2.5.2 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  to display the Application Cal function menu.
2. Press  (SIGANA All).

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

2.6 Setting Frequency and Level

This section describes the center frequency (hereinafter, referred to as "frequency") and level setting method for the carrier wave of the input RF signal.

2.6.1 Setting frequency

The frequency setting procedure is as follows.

<Procedure>

1. Press .
2. Input a numerical value using the rotary knob, cursor keys, or the numeric keypad. The input value is displayed in the input value field in the setting window.

In the case of input with the rotary knob or cursor keys, the value of the digit where the cursor is positioned changes. In the case of input from the numeric keypad, the input value is displayed as is, and the setting unit is displayed in the function menu.

3. Press the function key corresponding to the unit to be set.

To set 2.345 GHz, press      and then  (GHz).

 5.1.1 "Frequency – Center"

2.6.2 Setting level

The level can be set with the Input Level parameter. "Input Level" indicates the input level of the signal at the RF Input connector.

The level setting procedure is as follows.

<Procedure>

1. Press .
2. Input a numerical value using the rotary knob, cursor keys, or the numeric keypad.
3. Press .

To set -10.0 dBm, press      and then  (dBm).

 5.1.2 "Amplitude – Input Level"

2.6.3 Level offset setting

The level offset is the difference between the input signal level and the level to be measured. For the level offset, set the difference between the output edge level of the test signal and the input level of the signal at the RF Input connector.

The output edge level of the test signal and the Input Level parameter value can be made the same by inputting the level increase/decrease value of the cable and/or amplifier between this instrument and the measurement object as the level offset.

The level offset setting procedure is as follows.

<Procedure>

1. Press  to display the Amplitude function menu.
2.  Press  (Offset).
3. Input a numerical value using the rotary knob, cursor keys, or the numeric keypad.
4. Press .

To set 10.0 dB, press     and then .

As the result of setting the level offset, the level offset value is added to the Input Level parameter. At this time, the hardware settings (attenuator setting value) in the instrument remains unchanged.

 5.1.3 “Amplitude – Offset”

2.6.4 Manual attenuator setting

When setting the input level for the Input Level parameter, the setting value of the attenuator is automatically calculated and set. The lower limit of the attenuator value set by changing the Input Level parameter is 10 dB. To set a value lower than 10 dB for the attenuator, follow the procedure shown below.

<Procedure>

1. Press  to display the Amplitude function menu.
2. To decrease the attenuator setting value by 2 dB, press  (ATTEN –).
3. To increase the attenuator setting value by 2 dB, press  (ATTEN +).

2.7 Saving and Recalling Parameters

This section describes the functions for saving the setting values of the parameters displayed on this application and loading the saved data.

2.7.1 Saving parameters

The parameter saving procedure is as follows. Up to 7 settings can be saved.

<Procedure>

1. Press  to display the Save function menu.
2. Press the function key corresponding to the save destination number.

Saving completes when the date and time on the menu are updated.

Note:

When a number with data is specified, the setting is overwritten. A confirmation message for overwriting does not appear. Check the save destination number before saving.



Figure 2.7.1-1 Save menu

2.7.2 Recalling parameters

The parameter recalling procedure is as follows.

<Procedure>

1. Press  to display the Recall function menu.
2. Press the function key corresponding to the number for the data to be loaded.

Recalling completes when the Recall function menu closes and the screen is updated.

Chapter 3 Downlink Signal Measurement

This chapter describes the downlink signal measurement.

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3.1 Basic Operation

3.1.1 Measurable signals

The features of the signals that can be measured on the downlink measurement screen are listed in Table 3.1.1-1. To execute DL burst map analysis and measurement, the input signal must include correct FCH and DL-MAP burst. If the included FCH and DL-MAP information is not correct, manually set up the burst configuration.

 3.3.5 Manually setting up DL-MAP

Table 3.1.1-1 Measurable Signals in DL Mode

Item	Value
Standard	IEEE 802.16 Rev2/D6 (July 2008) OFDMA
Duplexing Mode	TDD
Channel Bandwidth and FFT Size	20 MHz, 2048/ 10 MHz, 1024/ 8.75 MHz, 1024/ 7 MHz, 1024/ 5 MHz, 512/ 3.5 MHz, 512
Frame Length	5 ms
Subcarrier Allocation	PUSC, FUSC, AMC (2x3)
STC mode	Matrix A, Matrix B
Frames per measurement	1 frame
Maximum DL burst count that can be analyzed	128
Cyclic Prefix (G)	1/4, 1/8, 1/16, 1/32
Sampling Factor	8/7 (when Channel Bandwidth = 3.5 MHz, 7 MHz, or 8.75 MHz), 28/25 (when Channel Bandwidth = 5 MHz, 10MHz, or 20MHz.)
Used Subchannel Bitmap	101010 (when Channel Bandwidth = 3.5 MHz or 5 MHz), 111111 (when Channel Bandwidth = 7 MHz, 8.75 MHz, 10 MHz, or 20 MHz)
DIUC	0 to 12 (Burst profile) 15 (Extended DIUC)
Extended DIUC (When DIUC=15)	01 : STC_Zone_IE 05 : MIMO_DL_Basic_IE

3.1.2 Measurement screen types

The following downlink measurement screens are provided.

(1) Modulation screen

In addition to numeric results such as the preamble information, EVM, and power measurement values, this screen displays the constellation for the specified symbol, subcarrier domain power spectrum graph, and time domain I/Q level graph.

 3.2.1 “Modulation screen”

(2) I/Q Received screen

This screen displays the normalized IQ data for the specified symbol in three formats, i.e. table, constellation, and subcarrier domain graph.

 3.2.2 “I/Q Received screen”

(3) Map Info. screen

This screen displays the DL burst distribution map based on symbols and logical sub-channels. By specifying a burst, the information included in the burst and the modulation accuracy is displayed.

 3.2.3 “Map Info. screen”

(4) Error Vector Spectrum screen

In addition to numeric results such as the preamble information, EVM, and power measurement values, this screen displays the constellation for the specified symbol and the EVM graph of the subcarrier domain.

 3.2.4 “Error Vector Spectrum screen”

(5) Error Vector Time screen

In addition to numeric results such as the preamble information, EVM, and power measurement values, this screen displays the constellation for the specified symbol and the EVM graph of the symbol domain.

 3.2.5 “Error Vector Time screen”

(6) Spectral Flatness screen

This screen displays the constellation for the specified symbol and the average power of the subcarrier.

 3.2.6 “Spectral Flatness screen”

3.1.3 Basic settings before measurement

To perform measurements in the downlink measurement screen, the following parameters must be correctly set.

- (1) Input frequency and channel bandwidth
Parameters: Center Frequency, CH. Bandwidth
Sets the center frequency and bandwidth of the input signal.
- (2) Input level
Parameter: Input Level
Sets the level of the input signal. Set the Input Level value so that it matches the average power of the downlink segment. Also set Offset Level if needed.
- (3) Output antenna
Parameter: Antenna (DL)
Sets the type of the output antenna for downlink signals. Select ANT 0 when not using STC/MIMO transmission.
- (4) Cyclic Prefix, DIUC
Parameter: Cyclic Prefix, DIUC List
Sets the configuration, modulation method, and coding method for each burst constituting the input signal.
- (5) Frequency Offset/Channel Estimation/Sampling Frequency Offset
Parameters: Frequency Offset – On/Off,
Channel Estimation – On/Off, Equalizer,
Amplitude CH Tracking, Phase CH Tracking
Sampling Frequency Offset
Sets the correction method for the input signal.
- (6) Display symbol
Parameter: Symbol
Sets the symbol for which the measurement results are to be displayed on the downlink measurement screens except the Map Info. screen. Since the Error Vector Spectrum graph and Error Vector Time graph are for setting the preamble (symbol 0) to reference, set the symbol to a value of 1 or higher to display the results.

Note:

The **Symbol** parameter can be changed without re-measurement in the case of single measurement only.

(7) Spectrum reverse

Parameter: RF Spectrum

Normally, select Normal. Select Reverse when I/Q data of the input data is interchanged.

3.1.4 Measurement start and result update

To start measurement, press  or press .

When measurement is started with , **SGL** is displayed in the Status window. When measurement ends, **PAUSE** is displayed in the status window, and the measurement results are updated. At this time, the MX269010A ends all downlink signal measurements and stops the measuring operation. Therefore, if the measurement screen is changed from this status to another downlink measurement screen, the results for that measurement are displayed.

When measurement is started with , **CONT** is displayed in the Status window. Measurement results are updated every time measurement ends. If, while measurement is performed in the Continuous mode, the display symbol is changed and the measurement screen is changed to another downlink measurement screen, re-measurement is started, unlike in the case of Single measurement. Further, if the measurement parameters are changed while measurement is performed in the Continuous mode, those settings are applied not to the current measurement, but to the next measurement. When the parameters that were set last are not applied to current measurement, a message indicating that the parameters have been changed is displayed on the measurement status bar.

3.1.5 Measurement error handling

When, after measurement ends, **ERR** (measurement error) or **OVF** (overflow) is displayed in the status window, this indicates that measurement did not end normally. The measurement results displayed at such time are not correct. Check the input signal and the set parameters, and perform measurement again.

When overflow is displayed, set the **Input Level** parameter higher than the current setting, in accordance with the input signal level.

Measurement errors may be due to the following causes.

- (1) The input level is too low in relation to the Input Level setting.
- (2) The setting of the center frequency or channel bandwidth differs from the actual input signal.
- (3) The input signal does not include a preamble, or the preamble is not correct.
- (4) A signal with an unsupported characteristic is input.

If the measurement results are significantly worse than the expected values even though **ERR** is not displayed in the status window, this may be due to the following causes.

- (1) DIUC List is not correctly set.
- (2) The FCH and DL-MAP information, or the coding of the input signal, are incorrect. (If DL Map is **Auto**.)
- (3) The input signal information and DL-MAP information do not match (if DL MAP is **Import** or **Local Edit**).

3.2 Screen Configurations

This section describes the items displayed in the various downlink measurement screens.

3.2.1 Modulation screen

In addition to numeric results such as preamble information, EVM, and power measurement values, Figure 3.2.1-1 displays the constellation, subcarrier domain power spectrum graph, and time domain I/Q level graph.

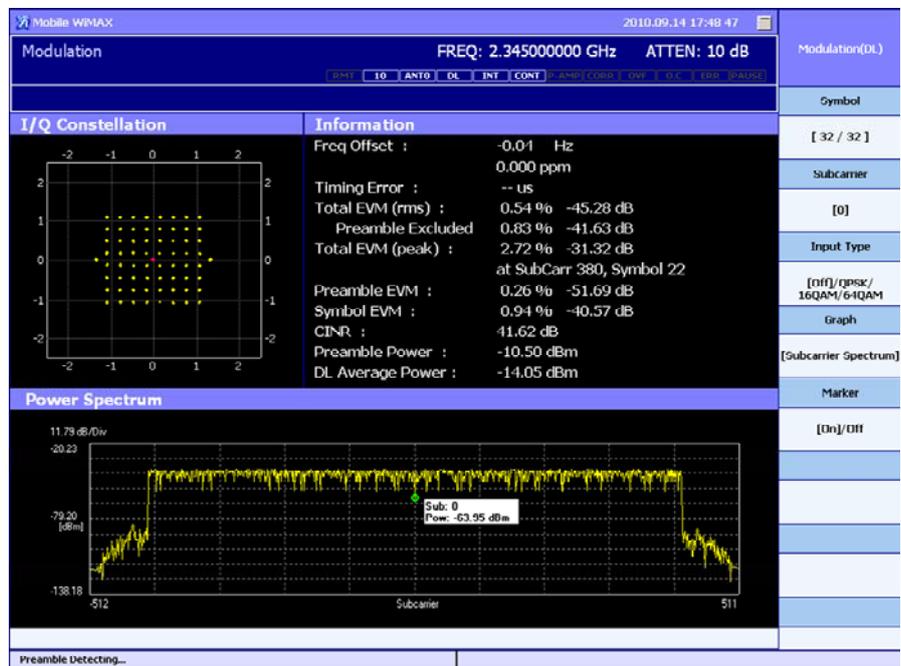


Figure 3.2.1-1 Modulation screen (Subcarrier Spectrum graph display)

The measurement results displayed on the Modulation screen are as follows.

- (1) I/Q Constellation

The normalized I/Q level of each subcarrier for the set **Symbol** is displayed with the horizontal axis I phase and vertical axis Q phase.
- (2) Information
 - (a) Freq Offset

The difference between the set **Center Frequency** parameter and the center frequency of the input signal is displayed.
 - (b) Preamble EVM

The EVM of the preamble part is displayed.

- (c) Pilot EVM Avg
Displays EVM of all pilot symbols. This is displayed only when **Symbol** is set to 0.
 - (d) Symbol EVM This command displays the EVM distribution of each pilot data subcarrier for the set **Symbol**. This is displayed only when **Symbol** is set to 1.
 - (e) CINR
Displays the CINR (Carrier to Interference and Noise Ratio) for the pilot sub carrier.
 - (f) Preamble Power
The power for the preamble part (symbol 0, all sub-channels) is displayed.
 - (g) DL Average Power
The average power for the entire downlink segment is displayed.
 - (h) Timing Error
Regarding the trigger input position as the start of the frame period (downlink preamble section), the time difference from that position to the start of the preamble is displayed. To perform measurement, set the trigger mode to External or SG Marker to generate a trigger at the start of the frame. When the trigger mode is set to Free Run, "--" is displayed.
 - (i) Total EVM (rms)
The rms average of EVM of the pilot and data subcarriers for all downlink segments is displayed.
 - (j) Total EVM (rms) – Preamble Excluded
The rms average Total EVM for the segments excluding the preamble part is displayed.
 - (k) Total EVM (peak)
The peak EVM for the entire downlink segment is displayed, along with its symbol subcarrier position.
- (3) Subcarrier Spectrum
The power distribution of all subcarriers for the set **Symbol** is displayed in all subcarrier domains. The power spectrum graph of the subcarrier domain is displayed in the lower area when the **Graph** parameter is set to **Subcarrier Spectrum**.
When the **Marker** setting is set to **On**, markers are displayed inside the graph, making it possible to know the level for the set **Subcarrier**.

(4) Time Domain

One frame of the time change of the normalized I/Q level of the input signal is displayed from the downlink beginning (preamble part). When the **Graph** parameter is set to **Time Domain**, the I/Q level graph of the time domain is displayed in the lower area.

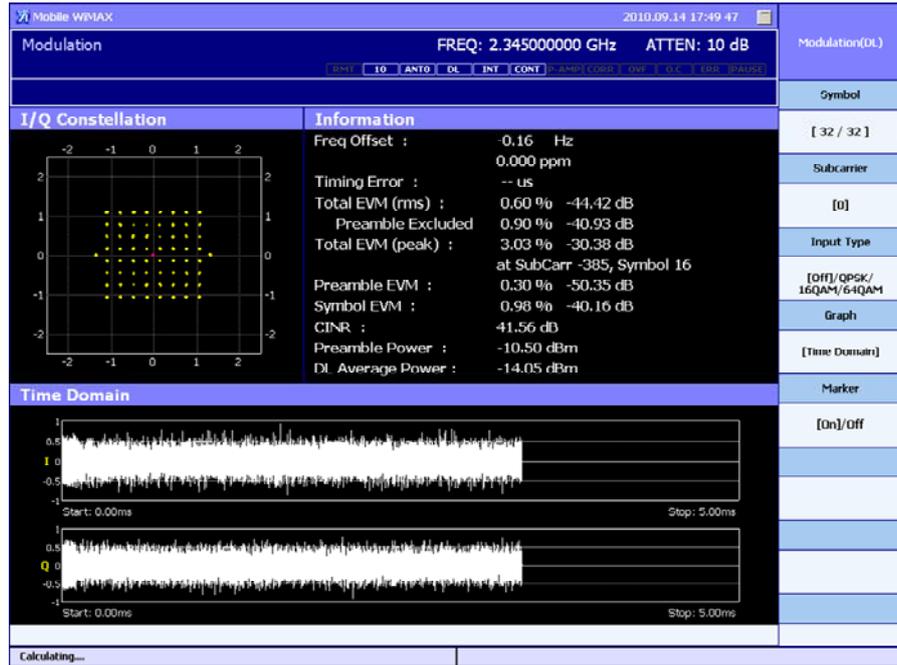


Figure 3.2.1-2 Modulation screen (Time Domain graph display)

Function menu

Table 3.2.1-1 Modulation Screen Function Menu

Menu Display	Key	Function
Symbol	F1	Sets the symbols for which the measurement results are to be displayed on the downlink measurement screens. The value to the left of “/” is the setting value, and the value to the right indicates the total number of downlink symbols that have been detected.
Subcarrier	F2	Sets the marker position on the Subcarrier Spectrum graph.
Input Type	F3	Sets the type of error scale displayed on the constellation. Off, QPSK, 16QAM, or 64QAM can be selected.
Graph	F4	Sets the type of graph displayed in the lower part of the screen. Subcarrier Spectrum or Time Domain can be selected.
Marker	F5	Switches on/off marker display on the Subcarrier Spectrum graph.
	F6	No function
	F7	No function
	F8	No function

3.2.2 I/Q Received screen

The I/Q Received screen displays the normalized I/Q data for the specified symbol in three formats, i.e. table, constellation, and subcarrier domain graph.



Figure 3.2.2-1 I/Q Received screen

The measurement results displayed on the I/Q Received screen are as follows.

- (1) I/Q Constellation
this command displays the normalized I/Q level of each subcarrier for the set **Symbol** with the horizontal axis I phase and vertical axis Q phase.
- (2) I/Q Table
This table lists the normalized I/Q level values of each subcarrier for the set **Symbol**, organized in subcarrier order. When the **Subcarrier** parameter is set, the I/Q level for that subcarrier is displayed.
- (3) Preamble/Downlink Symbol
This command displays the normalized I/Q level for the set **Symbol** in the subcarrier domain.

Function menu

Table 3.2.2-1 I/Q Received Screen Function Menu

Menu Display	Key	Function
Symbol		Sets the symbols for which the measurement results are to be displayed on the downlink measurement screens. The value to the left of “/” is the setting value, and the value to the right indicates the total number of downlink symbols that have been detected.
Subcarrier		Sets the subcarrier to be displayed on the I/Q table and the line marker position on the I/Q graph.
Input Type		Sets the type of error scale displayed on the constellation. Off (hide), QPSK, 16QAM, or 64QAM can be selected.
		No function
		No function
		No function
		No function
		No function

3.2.3 Map Info. screen

The Map Info. screen displays the DL burst distribution map based on symbols and logical sub-channels. By specifying a burst, the information included in the burst and the modulation accuracy is displayed.

The EVM results displayed on the Map Info. screen are based on an analysis of both the pilot subcarriers and data subcarriers in the specified area.



Figure3.2.3-1 Map Info. screen

The measurement results displayed on the Map Info. screen are as follows.

(1) Map

This command displays the allocation of each downlink burst, using the horizontal axis for symbols and the vertical axis for logical subchannel numbers. Bursts are displayed in different colors and the preamble, FCH, and DL-MAP are displayed using fixed colors.

A **Burst Index** beginning with 0 is assigned to each burst. Specify this **Burst Index** when specifying a burst.

The zone type is displayed at the bottom of the vertical axis (subchannel number). The zone range set with the **Zone Index** parameter is displayed with a colored frame.

(2) Information (preamble information)

This command is displayed when **Burst Index** is set to “0”. The various types of information included in the preamble and the measurement results for the preamble are displayed. The displayed contents are the same as those displayed in the **Information** field on the Modulation and other screens.

(a) Preamble Index

The preamble included in the input signal is analyzed and the included **Preamble Index** information is displayed.

(b) Cell ID

The preamble included in the input signal is analyzed and the included **Cell ID** information is displayed.

(c) Segment

The preamble included in the input signal is analyzed and the included **Segment ID** information is displayed.

(d) DL Freq Offset

The difference between the set **Center Frequency** parameter and the center frequency of the input signal is displayed.

(e) Preamble EVM

The EVM of the preamble part is displayed.

(3) Map FCH

This command is displayed when **Burst Index** is set to “1”. The various types of information included in FCH (Frame Control Header) and the measurement results for the FCH burst are displayed.

(a) Sub Channel Bitmap

This command displays in decimal the 6-bit information indicating the group of subchannels that are used. “1” indicates that a bit is used, and “0” that it is not used.

- Bit #0: Subchannel group 0
- Bit #1: Subchannel group 1
- Bit #2: Subchannel group 2
- Bit #3: Subchannel group 3
- Bit #4: Subchannel group 4
- Bit #5: Subchannel group 5

(b) Repetition Coding

This command displays the type of Repetition Code used for DL-MAP.

(c) Coding Indication

This command displays the type of encoding used for DL-MAP.

- (d) DL Map Length
This command displays the DL-MAP message length in slot units.
 - (e) EVM
This command displays the EVM of the FCH part.
- (4) Map Message
This command is displayed when **Burst Index** is set to “2”. The various types of information included in the downlink map message and the measurement results for DL-MAP burst are displayed.
- (a) Message Type
This command displays the value of Management Message Type included in the downlink map message. “2” is assigned for the downlink map message.
 - (b) Base Station ID
This command displays the 48-bit Base Station ID included in the downlink map message.
 - (c) Symbol Number
This command displays the number of downlink symbols in the downlink map message.
 - (d) DCD Count
This command displays the value of DCD (Downlink Channel Descriptor) Count included in the downlink map message.
 - (e) EVM
This command displays the EVM of the DL-MAP burst.
 - (f) Frame Number
This command displays the 24-bit frame number included in PHY Synchronization Field of the downlink map message.
 - (g) Frame Duration
This command displays the length of the frame included in the PHY Synchronization Field of the downlink map message.
- (5) Compressed DL MAP / Compressed DL/UL MAP
It is displayed when **Burst Index** is set to “2”. This command displays the measurement results for the compressed DL-MAP and the compressed UL-MAP.
- (a) Compressed Map Indicator
This command indicates the compressed map. Normally it displays 6 (110 when binary).

- (b) UL-MAP appended
This command indicates that the compressed UL-MAP is included. The compressed UL-MAP is included when the value is 0. The compressed UL-MAP is not included when the value is 1.
- (c) MAP Message Length
This command displays the length of the compressed map in byte unit.
- (d) Number of Symbol/Number of Symbol (DL)
This command displays the number of the Downlink symbol.
- (e) DCD Count
This command displays the DCD count.
- (f) EVM
This command displays the burst of EVM.
- (g) Frame Number
This command displays the 24-bit frame number included in the PHY Synchronization Field of the Downlink map message.
- (h) Operator ID
This command displays the 8 bits of the most significant 24 bits of the 48-bit Base Station ID.
- (i) DL IE Count
This command displays the number of DL-MAP IE.
- (j) Sector ID
This command displays 8bits of the 48-bit Base Station ID.
- (k) UCD Count
This command displays the UCD count. It is displayed when the compressed UL-MAP is included.
- (l) Number of Symbol (UL)
This command displays the number of the Uplink symbols. It is displayed when the compressed UL-MAP is included.
- (m) Frame Duration
This command displays the length of the frame included in the PHY Synchronization Field of the Downlink map message.
- (n) Allocation Start Time
This command displays the 32-bit Allocation Start Time (uplink start time) included in the compressed UL-MAP.

(6) UL Map Message

This command is displayed when **Burst Index** is set to the UL_MAP burst number. The various types of information included in the uplink map message and the measurement results for UL_MAP burst are displayed.

(a) UCD_Count

This command displays the value of the 8-bit UCD Count included in the Uplink map message.

(b) Allocation Start Time

This command displays the 32-bit Allocation Start Time (uplink start time) included in the Uplink map message.

(c) Symbol Number

This command displays the Uplink burst length in symbol units.

(d) DL Map IE information (other than that above)

Refer to “(6) DL Map IE”, below.

(7) DL Map IE

This command is displayed when **Burst Index** is set to the normal downlink burst number. The various types of information for the burst in DL-MAP and the measurement results for the specified burst are displayed.

(a) DIUC

This command displays the DIUC for the burst.

(b) Symbol Offset

This command displays the symbol position which indicates the start point of the burst, based on the preamble.

(c) Sub Channel Offset

This command displays the smallest subchannel number included in the burst.

(d) Boosting Index

This command displays the power amplification level used for the burst.

(e) EVM

This command displays the EVM of the burst.

(f) Symbol Interval

This command displays the length of the symbol of the burst.

(g) Sub Channel Interval

This command displays the length of the subchannel of the burst.

(h) Repetition Code

This command displays the Repetition Coding Indication of the burst.

- (i) Extended DIUC
This command displays the extended DIUC for the burst. This command is displayed when the burst is defined by MIMO_Basic_IE.
 - (j) Matrix Indicator
This command displays the matrix indicator of the burst. This command is displayed when the burst belongs to the STC zone and is defined by MIMO_Basic_IE.
 - (k) Num Layers
This command displays Num Layers of the burst. This command is displayed when the burst belongs to the STC zone and is defined by MIMO_Basic_IE.
- (8) Information
This command is displayed when **Zone Index** is set or when **Display** is set to Zone.
- (a) Permutation
The subcarrier configuration in the zone is displayed.
 - (b) Symbol Offset
The position of the symbol that indicates the start of the burst based on the preamble is displayed.
 - (c) Symbol Interval
The length of the symbol in the zone is displayed.
 - (d) Zone EVM
The average EVM for the entire zone is displayed.
 - (e) STC/2/3 antenna select
The STC mode of the zone is displayed.
 - (f) Matrix Indicator
The matrix type is displayed when the zone is in the STC mode.
 - (g) DL PermBase
The information of the DL PermBase included in the zone is displayed.
 - (h) Pilot Subcarrier Pwr
The average power of the pilot subcarriers included in the zone is displayed as a ratio to the data subcarrier power.
 - (i) Data Subcarrier Pwr
The average power of the data subcarriers included in the zone is displayed.

- (j) Null Subcarrier Pwr
The average power of the null subcarriers included in the zone is displayed as a ratio to the data subcarrier power. Null subcarriers include guard subcarriers and DC subcarriers. If an STC zone is specified, punctured pilot subcarriers are also included in null subcarriers.
- (k) Punctured Pilot Pwr
The average power of punctured pilot subcarriers that are used by another antenna in the STC zone is displayed using a ratio to the data subcarrier.

Function Menu

Table 3.2.3-1 Map Info. Screen Function Menu

Menu Display	Key	Function
Display		Sets the type of measurement results to be displayed in the lower part of the screen. When Zone is set, measurement results for the zone specified by Zone Index are displayed. When Burst is set, measurement results for the burst specified by Burst Index are displayed.
Zone Index		Sets Zone Index . The specified zone is highlighted on the map.
Burst Index		Sets Burst Index . The measurement results for the specified burst are displayed.
		No function
		No function
		No function
		No function
		No function

3.2.4 Error Vector Spectrum screen

In addition to numeric results such as the preamble information, EVM, and power measurement values, the Error Vector Spectrum screen displays the constellation and the EVM graph of the subcarrier domain for the specified symbol.

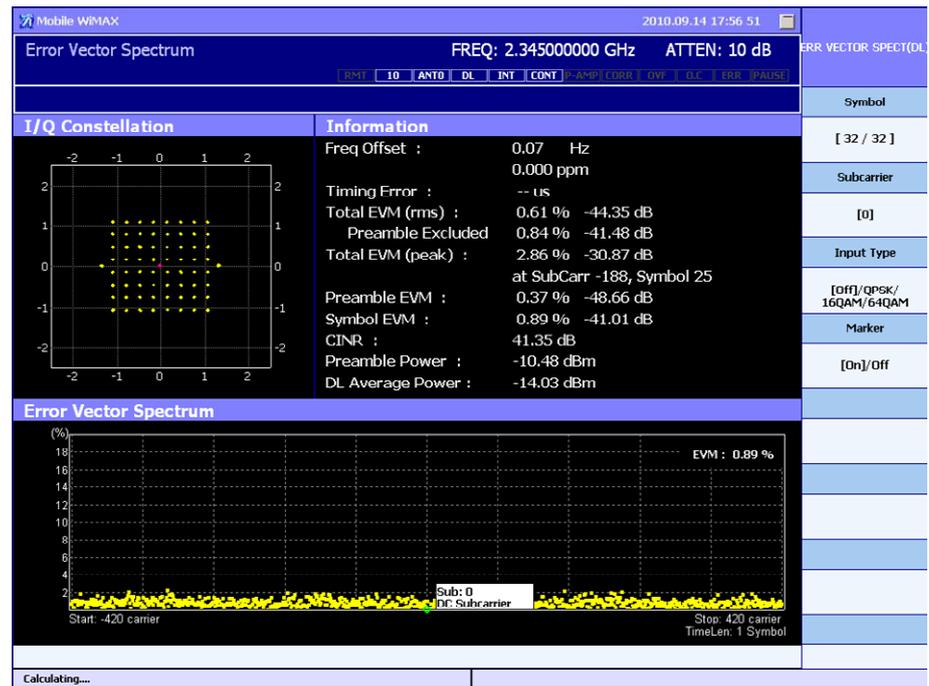


Figure3.2.4-1 Error Vector Spectrum screen

The measurement results displayed on the Error Vector Spectrum screen are as follows.

(1) I/Q Constellation

This command displays the normalized I/Q level of each subcarrier for the set **Symbol** with the horizontal axis I phase and vertical axis Q phase.

(2) Information

This command displays the same contents as those displayed on the Modulation screen.

 3.2.1 "Modulation screen"

(3) Error Vector Spectrum

This command displays the EVM distribution of each subcarrier for the set **Symbol** on the subcarrier domain.

When the Marker setting is set to **On**, markers are displayed inside the graph, making it possible to know the EVM for the set **Subcarrier**.

Function Menu

Table 3.2.4-1 Error Vector Spectrum Screen Function Menu

Menu Display	Key	Function
Symbol		Sets the symbol for which the measurement results are to be displayed on the downlink measurement screens. The value to the left of “/” is the setting value, and the value to the right indicates the total number of downlink symbols that have been detected.
Subcarrier		Sets the marker position on the Error Vector Spectrum graph.
Input Type		Sets the type of error scale displayed on the constellation. Off, QPSK, 16QAM, or 64QAM can be selected.
Marker		Switches on/off marker display on the Error Vector Spectrum graph.
		No function
		No function
		No function
		No function

3.2.5 Error Vector Time screen

In addition to numeric results such as the preamble information, EVM, and power measurement values, the Error Vector Time screen displays the constellation for the specified symbol and the EVM graph of the symbol domain.

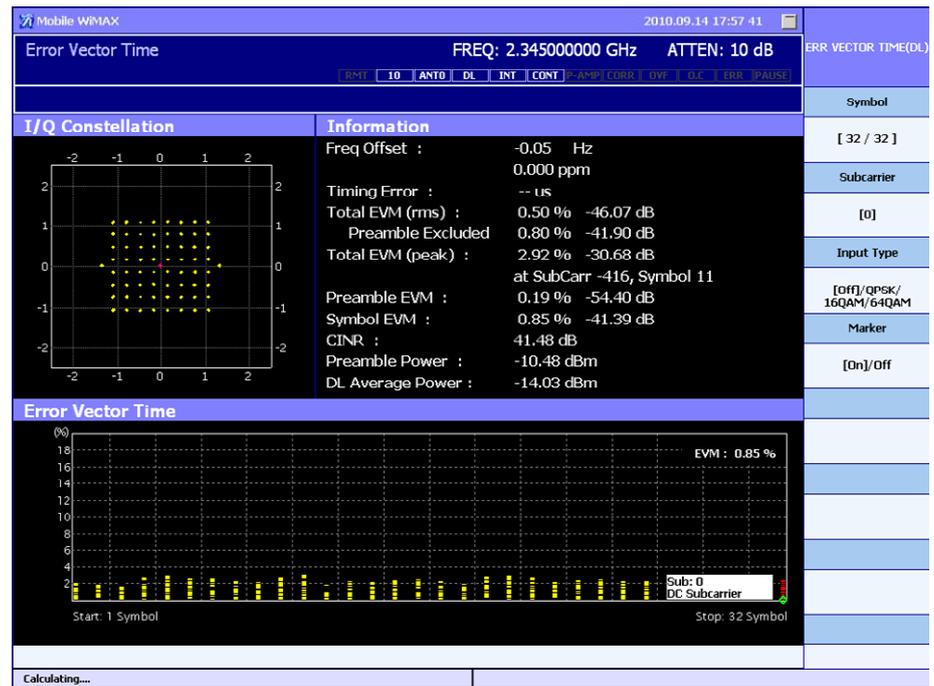


Figure 3.2.5-1 Error Vector Time screen

The measurement results displayed on the Error Vector Time screen are as follows.

(1) I/Q Constellation

This command displays the normalized I/Q level of each subcarrier for the set **Symbol** with the horizontal axis I phase and vertical axis Q phase.

(2) Information

This command displays the same contents as those displayed on the Modulation screen.

 3.2.1 “Modulation screen”

(3) Error Vector Time

This command displays the EVM distribution of each subcarrier for the set **Symbol** on the symbol (time) domain.

When the **Marker** setting is set to **On**, markers are displayed inside the graph, making it possible to know the EVM for the set **Subcarrier**.

Function Menu

Table 3.2.5-1 Error Vector Time Screen Function Menu

Menu Display	Key	Function
Symbol		Sets the symbols for which the measurement results are to be displayed on the downlink measurement screens. The value to the left of “/” is the setting value, and the value to the right indicates the total number of downlink symbols that have been detected.
Subcarrier		Sets the marker position on the Error Vector Time graph.
Input Type		Sets the type of error scale displayed on the constellation. Off, QPSK, 16QAM, or 64QAM can be selected.
Marker		Switches on/off marker display on the Error Vector Time graph.
		No function
		No function
		No function
		No function

3.2.6 Spectral Flatness screen

The Spectral Flatness screen displays the constellation for the specified symbol and the average power of the subcarrier.

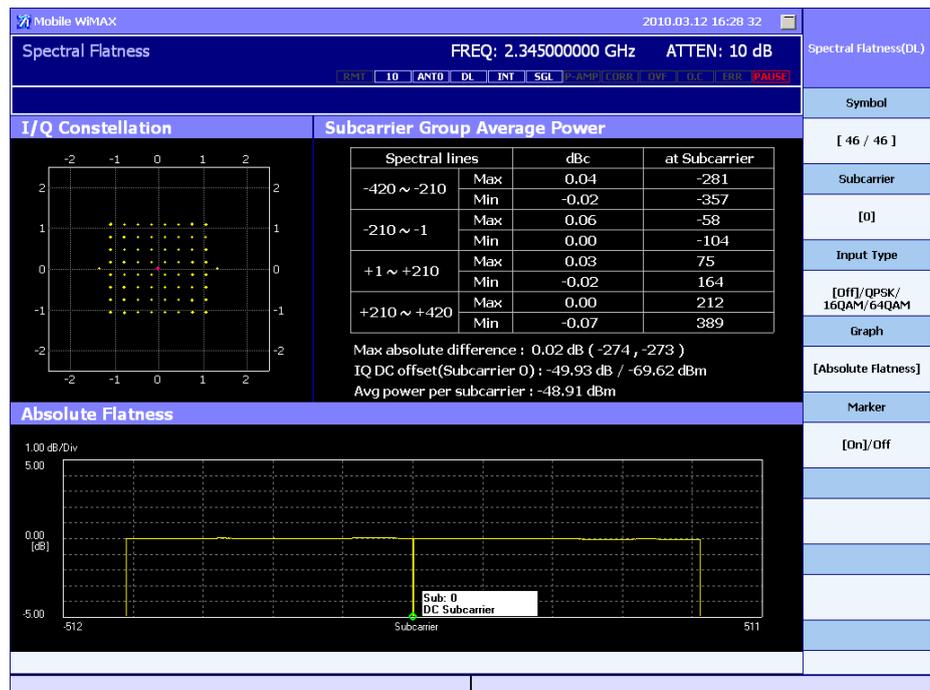


Figure 3.2.6-1 Spectral Flatness screen

The measurement results displayed on the Spectral Flatness screen are as follows.

(1) I/Q Constellation

This command displays the normalized I/Q level of each subcarrier for the set **Symbol** with the horizontal axis I phase and vertical axis Q phase.

(2) Subcarrier Group Average Power

This command displays the maximum power and minimum power between certain subcarriers, and maximum power difference between adjacent subcarriers.

(a) Max absolute difference

The maximum power difference between adjacent subcarriers and the corresponding subcarrier numbers are displayed.

(b) IQ DC Offset

The power of subcarrier 0 is displayed as a value relative to the average transmission power (in dB units) within the downlink period (Preamble excluded) and as an absolute value (in dBm units)

- (c) Avg power per subcarrier
Displays the average power per subcarrier within the downlink period excluding the preamble. It is used as the reference power for the spectral line.
- (3) Absolute Flatness
This command is displayed when the **Graph** parameter is set to **Absolute Flatness**.
The average power of each subcarrier on the subcarrier domain is displayed.
- (4) Differential Flatness
This command is displayed when the **Graph** parameter is set to **Differential Flatness**.
The average power difference between adjacent subcarriers is displayed.

Function Menu

Table 3.2.6-1 Spectral Flatness Screen Function Menu

Menu Display	Key	Function
Symbol		Sets the symbols for which the measurement results are to be displayed on the downlink measurement screens. The value to the left of “/” is the setting value, and the value to the right indicates the total number of downlink symbols that have been detected. In the Spectral Flatness screen, this setting applies to the constellation.
Subcarrier		Sets the marker position on the Spectral Flatness graph.
Input Type		Sets the type of error scale displayed on the constellation. Off, QPSK, 16QAM, or 64QAM can be selected.
Graph		Sets the type of graph displayed in the lower part of the screen. Absolute or Differential can be selected.
Marker		Switches on/off marker display on the Spectral Flatness graph.
		No function
		No function
		No function

3.2.7 Spectrum Measurement functions

The Spectrum Measurement function of the MX269010A recalls the Signal Analyzer function or the Spectrum Analyzer function and executes Adjacent Channel Leakage Power (ACP) Measurement, Occupied Bandwidth Measurement (OBW), and Spectrum Emission Mask (SEM) Measurement. This function can be used when the channel bandwidth is set to 5 MHz or 10 MHz.

When executing this function, the settings of Center Frequency/Input Level/Offset Attenuator/Pre-Amp of the MX269010A are reflected to the settings of the Signal Analyzer function or the Spectrum Analyzer function. To the contrary, when the MX269010A is selected from the Signal Analyzer function or the Spectrum Analyzer function with this function valid, the settings of Center Frequency/Reference Level/Offset/Pre-Amp of the Signal Analyzer function or the Spectrum Analyzer function are reflected to the MX269010A.

Note that the parameter is not reflected when executing the initialization function with this function executed and the Signal Analyzer function or the Spectrum Analyzer function displayed, and when selecting the MX269010A on the Application Switch menu.

<Procedure>

1. Press  to display the Mode function menu.
2. Press  (Downlink) to display the Measure (DL) function menu when measuring the Downlink signal.
Press  (Uplink) to display the Measure (UL) function menu when measuring the Uplink signal.
3. Press  (Spectrum) to select the Spectrum function menu.
4. Select the functions to be executed from the Spectrum function menu.

ACP (Swept)	The ACP measurement of the Spectrum Analyzer function
ACP (FFT)	The ACP measurement of the Signal Analyzer function
OBW (Swept)	The OBW measurement of the Spectrum Analyzer function
OBW (FFT)	The OBW measurement of the Signal Analyzer function
SEM (Swept)	The SEM measurement of the Spectrum Analyzer function

3.3 Operation Examples

This section describes the downlink signal measurement procedure, using the measured signal described in Table 3.3-1.

Table 3.3-1 Input Signal Used for Operation Examples in This Section

Parameter	Value
Center frequency	2.345 GHz
Channel bandwidth	8.75 MHz (FFT Size = 1024)
Input level	-10 dBm
Burst configuration	Preamble + FCH + DL-MAP + UL-MAP (QPSK [CTC] 1/2 – DIUC 0) + 1DL burst (16QAM [CTC] 1/2 – DIUC 1)

3.3.1 Measurement condition settings

First, set the measurement conditions. The default values are used for the parameters that are not described below.

3.1.3 “Basic settings before measurement”

Set the parameters according to the input signal, as detailed in the following table.

Table 3.3.1-1 Setting Parameters

Setting Parameter	Value
Center Frequency	2.345 GHz
Channel Bandwidth	8.75 MHz
Input Level	-10 dBm
DIUC List	[00] QPSK * CTC * 1/2 [01] 16QAM * CTC * 1/2

<Procedure>

1. Set the frequency to 2.345 GHz.
 - 1) Press . At this time, **Center Freq** is displayed in the setting window.
 - 2) After pressing     , press  (GHz).
2. Set the input level to -10 dBm.
 - 1) Press . At this time, **Input Level** is displayed in the setting window.
 - 2) After pressing   , press  (dBm).

3. Set the channel bandwidth to 8.75 MHz.
 - 1) Press  to display the Mode function menu.
 - 2) Press  (Common Parameters) to display the **CH. Bandwidth** parameter.
 - 3) Press  (CH. Bandwidth) and select 8.75.
4. Set DIUC.
 - 1) Press  (more 1/2) on the Common Parameters function menu to display page 2 of the Common Parameters function menu.
 - 2) Press  (DIUC) to display the DIUC Config function menu.
 - 3) From the DIUC Config function menu, press  (DIUC List) and move the cursor to 01 using the rotary encoder or the cursor keys.
 - 4) Press  (FEC List) and move the cursor to 16QAM * CTC * 1/2 in the same manner.
 - 5) Press  (Apply) and change 01 of the DIUC List to 16QAM * CTC * 1/2.

3.3.2 Screen selection and measurement execution

Next, select the measurement screen and execute measurement.

<Procedure>

1. Press  to display the Mode function menu.
2. Press  (Downlink) to display the Measure(DL) function menu.
3. Press  (Modulation) and select the Modulation screen.
 3.1.2 "Measurement screen types"
4. Press  to start measurement. Measurement ends when **PAUSE** is displayed in the status window.
 3.1.4 "Measurement start and result update"
5. Check that **ERR** or **OVF** is not displayed in the status window.
 3.1.5 "Measurement error handling"

3.3.3 Measurement result display

Preamble information

The Cell ID, Preamble Index, and Segment ID of the preamble can be checked on the Modulation screen, Map Info. screen (Burst Index = 0), Error Vector Spectrum screen, and Error Vector Time screen.

Power measurement

The power (Preamble Power) of the preamble part and the average power (DL Average Power) of the DL segment can be checked on the Modulation screen, Error Vector Spectrum screen, and Error Vector Time screen.

Preamble EVM

The EVM (Preamble EVM) of the preamble part can be checked on the Modulation screen, Map Info. screen (Burst Index = 0), Error Vector Spectrum screen, and Error Vector Time screen.

Measurement results for symbol

The measurement results displayed on the constellation, Symbol EVM, Subcarrier Spectrum graph, Time Domain graph, Error Vector Spectrum graph, and Error Vector Time graph differ for each symbol. Therefore, during Single measurement, set the symbol for measurement after measurement end with the **Symbol** parameter.

<Procedure> Setting the symbol

1. On the Modulation screen, Error Vector Spectrum screen, or Error Vector Time screen, press  (Symbol).
2. Set the value of the symbol to be displayed using the numeric keypad, rotary encoder, or the cursor keys.

Note:

On the Spectral Flatness screen, display of the results for specific symbols is only on the constellation, and is not described here. The constellation can also be displayed on the Modulation screen, Error Vector Spectrum screen, and Error Vector Time screen.

Marker display (measurement results for subcarrier)

To display the results for a specific subcarrier on the Subcarrier Spectrum graph, Error Vector Spectrum graph, Error Vector Time graph, or Spectral Flatness graph, set **Marker** to **On**, and set the **Subcarrier** parameter to the value of the subcarrier to be displayed.

<Procedure> Setting marker display and subcarrier

1. Press **F5** (Marker) (for the Modulation screen and Spectral Flatness screen) or **F4** (Marker) (for the Error Vector Spectrum screen and Error Vector Time screen) to display the Marker function menu. On (display) and off (hide) can be switched by pressing the corresponding key.
2. Select **F2** (Subcarrier) and set the subcarrier value using the numeric keypad, rotary encoder, or cursor keys.

Measurement results for each burst

To display the measurement results for each burst, select the Map Info. screen. The burst setting is done with the **Burst Index** parameter. The **Burst Index** values are assigned in sequence starting from 0 (preamble) for the detected bursts. The display results differ according to the type of burst.

<Procedure> Setting Burst Index

1. Press **F3** (Burst Index) from the Map Info. screen.
2. Set the desired burst value using the numeric keypad, rotary encoder, or cursor keys.

3.3.4 Measurement of signal containing STC zone (MIMO signal)

When measuring Antennas 0 and 1 that output a signal containing the STC zone, measure them using the following procedure. Be sure to measure in the order of Antenna 0, then Antenna 1. Also, a frame trigger synchronizing with the signal to be measured must be input to the MS2690A/MS2691A/MS2692A or MS2830A.

<Procedure>

1. Set the basic parameters, including frequency, level, and channel bandwidth.
2. From Common Parameters function menu, select ANT 0 for Antenna.
3. Set the trigger mode according to the type of trigger to be used.
4. Input a signal containing a preamble to Antenna 0, and then perform single measurement.
5. From Common Parameters function menu, select ANT 1 for Antenna.
6. Input a signal to Antenna 1, and then perform single measurement.

How to check measurement results

The DL Map Info. screen displays Antenna 1 measurement results as shown in Figure 3.3.4-1.

- (1) The DL MAP Info. screen displays the map information analyzed by Antenna 0. The zones output by Antenna 1 are displayed in colors other than gray, and “STC using 2 antennas” is displayed in the **STC/ 2/3 antenna select** text box for such zones.
- (2) The zones that are output by Antenna 0 only and the burst signals included in these zones are displayed in gray, and no measurement results such as EVM are displayed for them.
- (3) Antenna 1 measurement cannot be performed until Antenna 0 measurement is completed normally. When a measurement condition is changed, perform Antenna 0 measurement again before Antenna 1 measurement.

3

Downlink Signal Measurement

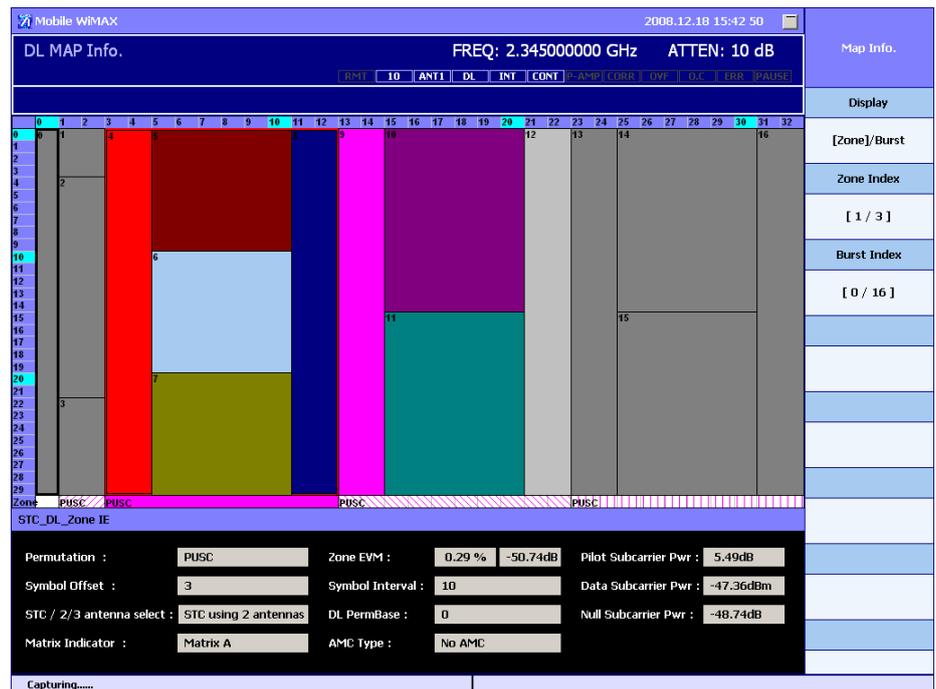


Figure 3.3.4-1 Antenna 1 measurement result example

Error messages during measurement

The following messages may be displayed during Antenna 1 measurement.

“File Load Fail”

This is displayed when no Antenna 0 map information file exists because Antenna 0 measurement has not yet been performed. Perform Antenna 0 measurement in this event.

“Setting Error: Set Trigger Mode”

This is displayed when the trigger mode is set to Free Run. Set the trigger mode to External or SG Marker, in which a trigger can be used.

3.3.5 Manually setting up DL-MAP

By default, the MX269010A automatically decodes the FCH and DL-MAP in a downlink signal to determine the position of each burst. If the FCH and DL-MAP in the signal to measure are not correct, manually set up the burst configuration.

If a signal includes one burst

If a signal to measure includes only one burst in the first PUSC zone (except preamble), set up the burst configuration using the following procedure.

<Procedure>

1. Press  to display the Mode function menu.
2. Press  (Common Parameters) to display the Common Parameters function menu.
3. Press  (DL Map) to select **Local Edit**.
4. Press  (Edit DL Map) to display the DL Map Local Edit screen.
5. Press  (FCH) to set whether to assign (On) or not to assign (Off) FCH.
6. Press  (DL-MAP) to set whether to assign (Normal) or not to assign (Off) DL-MAP.
7. Press  (Select Parameter) to select a parameter that indicates the burst attribute. A number is assigned to each parameter. Specify the corresponding number.
 - 0 : DIUC
 - 1 : Symbol Offset
 - 2 : Sub Channel Offset
 - 3 : Boosting Index

- 4 : Symbol Interval
 - 5 : Sub Channel Interval
 - 6 : Repetition Code
8. Press  (Change Value) to allow the selected parameter to change, and then enter a value.
 9. Press  (Apply Value) to apply the changed value.
 10. Repeat steps 7 to 9 as required to set up the burst attributes.
 11. Press  to select the measurement screen, and then start measurement.

Note:

Measurement is restricted as follows in Local Edit mode:

- (a) Only Normal DL Map is available for DL-MAP, and no Repetition.
- (b) One antenna is to be measured.
- (c) The total symbol length of the FCH and user burst or the symbol length of the user burst equals the symbol length of the PUSC zone.

If a signal includes multiple bursts

If a signal to measure includes multiple zones and bursts (except preamble), use the MX370105A/MX269905A Mobile WiMAX IQproducer (hereinafter “IQproducer”) to edit the downlink signal configuration, and then import the parameter file. Be sure to use IQproducer Version 8.01 (released on March 9, 2009) or later.

<Procedure>

1. Use the IQproducer to edit the downlink signal configuration, and then save the parameter file (in the XML format).
2. Copy the parameter file created in step 1 to the D drive of the hard disk or the root directory of USB memory. To copy the file to USB memory, insert the memory into the USB connector.
3. Press  to display the Mode function menu.
4. Press  (Common Parameters) to display the Common Parameters function menu.
5. Press  (DL Map) to select **Import**.
6. Press  (Import DL Map) to display the DL Map Import screen.
7. Press  (Drive Index) to specify the drive in which the parameter file is stored using a number.
8. Press  (File Index) to specify the parameter file to import using a number.
9. Press  (Import All). “Import was completed” is displayed at the lower left of the screen when the file has been imported.
10. Press  to select the measurement screen, and then start measurement.

Chapter 4 Uplink Signal Measurement

This chapter describes uplink signal measurement.

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4.1 Basic Operations

4.1.1 Measurable signals

The signals that can be measured on the uplink measurement screen are listed in Table 4.1.1-1.

Measurement is possible even when the downlink signal is included in the input signal. The data cannot be used for uplink signal measurement even if UL-MAP burst is included in the input signal.

Table 4.1.1-1 Measurable Signals in UL Mode

Item	Value
Standard	IEEE 802.16 Rev2/D6 OFDMA
Duplexing Mode	TDD
Channel Bandwidth and FFT Size	20 MHz, 2048/ 10 MHz, 1024/ 8.75 MHz, 1024/ 7 MHz, 1024/ 5 MHz, 512/ 3.5 MHz, 512
Frame Length	5 ms
Subcarrier Allocation	PUSC, AMC(2x3)
Burst type	Normal, Collaborative
Data format (User data)	All bits 1
Collaborative burst pilot pattern	A, B
Frames per measurement	1 frame
Analysis symbol position	Position of the symbol obtained by adding the offset set by the Subchannel Offset parameter to the first symbol in the zone specified by Zone Offset.
Subchannel offset	Set by the Subchannel Offset parameter
Number of measurement bursts	1
Cyclic Prefix (G)	1/4, 1/8, 1/16, 1/32
Sampling Factor	8/7 (when Channel Bandwidth = 3.5 MHz, 7 MHz, or 8.75 MHz), 28/25 (when Channel Bandwidth = 5 MHz, 10 MHz, or 20 MHz)
Used Subchannel Bitmap	101010 (when Channel Bandwidth = 3.5 MHz or 5 MHz), 111111 (when Channel Bandwidth = 7 MHz, 8.75 MHz, 10 MHz, or 20 MHz)

4.1.2 Measurement screen type

The following uplink measurement screen is provided.

(1) Modulation screen

In addition to numeric results such as EVM and power measurement values, this screen displays the constellation for the specified symbol, the subcarrier domain power spectrum graph, and time domain I/Q level graph.

 4.2.1 "Modulation screen"

(2) Error Vector Spectrum screen

In addition to numeric results such as EVM and power measurement values, this screen displays the constellation for the specified symbol and the subcarrier domain EVM graph.

 4.2.2 Error Vector Spectrum screen

(3) Error Vector Time screen

In addition to numeric results such as EVM and power measurement values, this screen displays the constellation for the specified symbol and the symbol domain EVM graph.

 4.2.3 Error Vector Time screen

(4) Spectral Flatness screen

This command displays the constellation for the specified symbol and average power of subcarriers.

 4.2.4 "Spectral Flatness screen"

4.1.3 Basic settings before measurement

To perform measurements in the uplink measurement screen, the following parameters must be correctly set.

- (1) Input frequency and channel bandwidth
Parameters: Center Frequency, CH. Bandwidth
Sets the center frequency and bandwidth of the input signal.
- (2) Input level
Parameter: Input Level
Sets the level of the input signal. Set the Input Level value so that it matches the absolute power of the symbol with the highest level. Also set Offset Level if needed.
- (3) Frequency Offset/Channel Estimation
Parameters: Frequency Offset – On/Off,
Channel Estimation – On/Off
Sets the correction method for the input signal.
- (4) Modulation method and coding method
Parameters: Cyclic Prefix, UIUC List, Modulation Type, Burst Type, Pilot Pattern, Zone Type
Sets the configuration, modulation method, and coding method for each burst constituting the input signal.
- (5) Parameter information incorporated in uplink signal (parameters for synchronization)
Parameters: Frame Sync, Frame Number, UL PermBase, DL IDCell
Sets the parameter information incorporated during uplink signal generation.
- (6) Zone position and number of input signal symbols
Parameters: Zone Offset, Num of Symbols
Sets the offset for the zone that includes the measurement target uplink burst, and the total number of symbols (symbol length) of the input uplink signal.
- (7) Number of slots and offset for measurement
Parameters: Duration, Subchannel Offset
Sets the slot length of the uplink burst for measurement as well as the offset up to the burst start position.
- (8) Display symbol
Parameter: Symbol
Sets the symbol for which the measurement results are to be displayed.

Note:

The **Symbol** parameter can be changed without re-measurement in the case of single measurement only.

(9) Spectrum reverse

Parameter: RF Spectrum

Normally, select **Normal**. Select **Reverse** when the I/Q data of the input signal is interchanged.

4.1.4 Measurement start and result update

To start measurement, press  or press .

When measurement is started with , **SGL** is displayed in the Status window. When measurement ends, **PAUSE** is displayed in the status window, and the measurement results are updated.

When measurement is started with , **CONT** is displayed in the Status window. Measurement results are updated every time measurement ends. If the display symbol is changed while measurement is performed in the Continuous mode, measurement starts again with this symbol and measurement screen, unlike in the case of Single measurement. Further, if the measurement parameters are changed while measurement is performed in the Continuous mode, those settings are applied not to the current measurement, but to the next measurement. When the parameters that were set last are not applied to current measurement, a message indicating that the parameters have been changed is displayed on the measurement status bar.

4.1.5 Measurement error handling

When, after measurement ends, **ERR** (measurement error) or **OVF** (overflow) is displayed in the status window, this indicates that measurement did not end normally. The measurement results displayed at such time are not correct. Check the input signal and the set parameters, and perform measurement again.

When overflow is displayed, set the **Input Level** parameter higher than the current setting, in accordance with the input signal level.

Measurement errors may be due to the following causes.

- (1) The input level is too low in relation to the Input Level setting.
- (2) The setting of the center frequency or channel bandwidth differs from the actual input signal.
- (3) A signal with an unsupported characteristic is input.
- (4) The type of the measurement target burst does not match the settings (possible parameters: Burst Type, Pilot Pattern, Modulation Type, Zone Type).
- (5) The position or length of the measurement target burst does not match the settings (possible parameters: Zone Offset, Num of Symbols, Duration, Subchannel Offset).
- (6) Some parameters used for encoding of the measurement target burst do not match the settings (possible parameters: Frame Mode, Frame Number, ID Cell, PermBase).
- (7) Bursts are short. (Synchronization might not be possible for multiple slot bursts.)
- (8) The input signal includes the downlink period, and the power during this period exceeds that during the uplink period.

4.2 Screen Configurations

This section describes the items displayed in the various uplink measurement screens.

4.2.1 Modulation screen

In addition to numeric results such as EVM and power measurement values, this screen displays the constellation, subcarrier domain power spectrum graph, and time domain I/Q level graph.

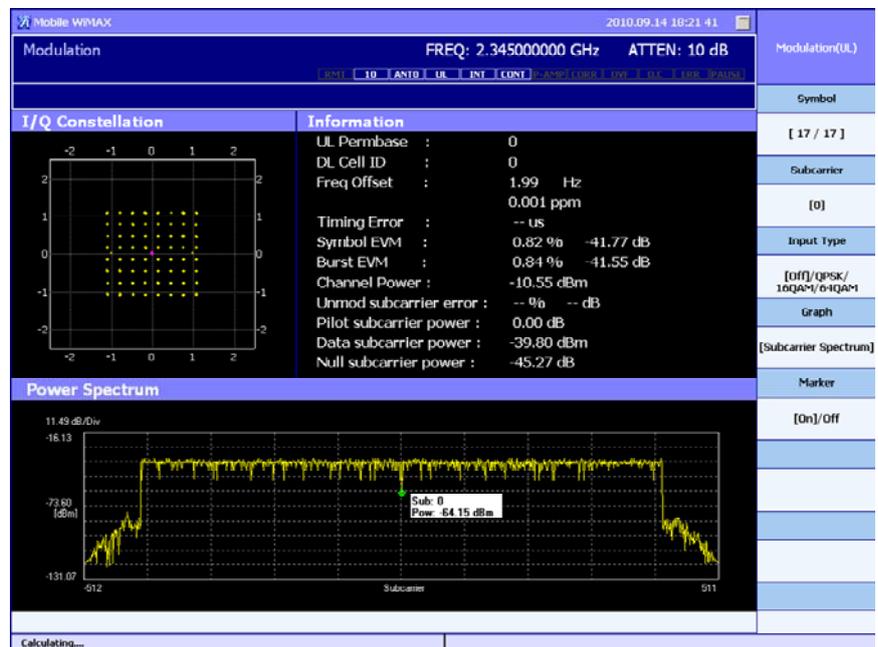


Figure 4.2.1-1 Modulation screen (Subcarrier Spectrum graph display)

The measurement results displayed on the Modulation screen are as follows.

(1) I/Q Constellation

The normalized I/Q level of each subcarrier for the set **Symbol** is displayed with the horizontal axis I phase and vertical axis Q phase.

(2) Information

(a) UL PermBase

This is the value of UL PermBase used for Uplink signal generation.

(b) DL Cell ID

This is the value of DL IDCell used for Uplink signal generation.

(c) Freq Offset

This command displays the difference between the set **Center Frequency** parameter and the center frequency of the input signal.

(d) Timing Error

Regarding the trigger input position as the start of the uplink (TTG end time), the time difference from that position to the start of the uplink of the actual input signal is displayed. To perform measurement, set the trigger mode to External or SG Marker to generate a trigger at the start of uplink. When the trigger mode is set to Free Run, "--" is displayed.

(e) Symbol EVM

This command displays the EVM for the set symbol.

(f) Burst EVM

This command displays the EVM for the measurement target burst.

(g) Channel Power

This command displays the average power of the measurement target bursts.

(h) Unmod subcarrier error

This command displays the ratio of the total power for the unmodulated subcarriers (used with the sub channels not assigned to the measurement target burst) to the total power for the modulated subcarriers (used with the subchannels assigned to the measurement target burst). When there are no unmodulated subcarriers, "--" is displayed.

(i) Pilot subcarrier power

This command displays the average power of the pilot subcarriers as a ratio to the data subcarrier power.

- (j) Pilot subcarrier power
This command displays the average power of the data subcarriers.
- (k) Null subcarrier power
This command displays the average power of the null subcarriers as a ratio to the data subcarrier power.

(3) Subcarrier Spectrum

The power distribution of all subcarriers for the set **Symbol** is displayed in all subcarrier domains. The power spectrum graph of the subcarrier domain is displayed in the lower area when the **Graph** parameter is set to **Subcarrier Spectrum**.

When the **Marker** setting is set to **On**, markers are displayed inside the graph, making it possible to know the level for the set **Subcarrier**.

(4) Time Domain

One frame of the time change of the normalized I/Q level of the input signal is displayed from the uplink beginning. When the **Graph** parameter is set to **Time Domain**, the I/Q level graph of the time domain is displayed in the lower area.

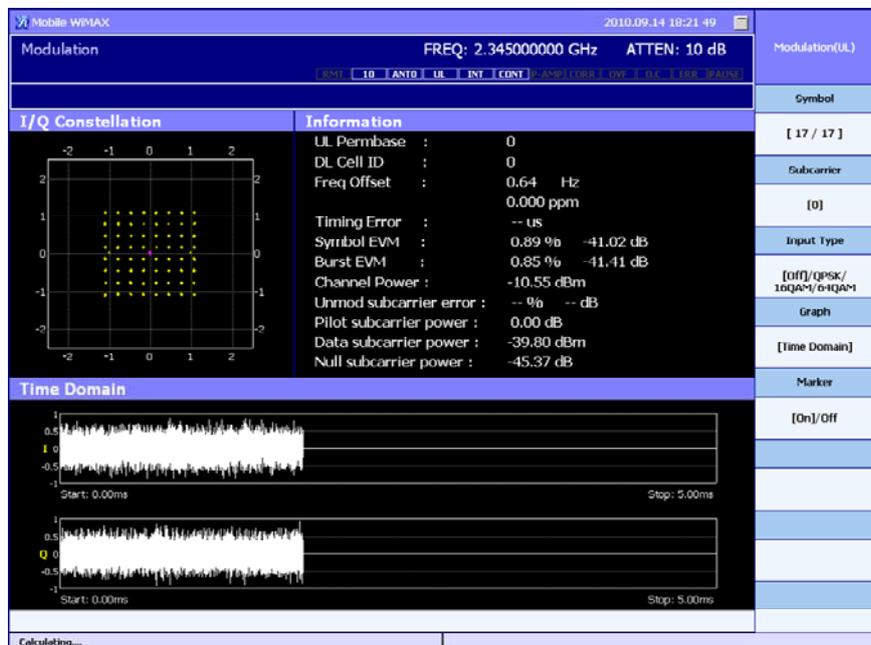


Figure 4.2.1-1 Modulation screen (Time Domain graph display)

Function Menu

Table 4.2.1-1 Modulation Screen Function Menu

Menu Display	Key	Function
Symbol	F1	Sets the symbols for which the measurement results are to be displayed on the uplink measurement screens. The value to the left of “/” is the setting value, and the value to the right indicates the total number of uplink symbols that have been detected.
Subcarrier	F2	Sets the marker position on the Subcarrier Spectrum graph.
Input Type	F3	Sets the type of error scale displayed on the constellation. Off, QPSK, 16QAM, or 64QAM can be selected.
Graph	F4	Sets the type of graph displayed in the lower part of the screen. Subcarrier Spectrum or Time Domain can be selected.
Marker	F5	Switches on/off marker display on the Subcarrier Spectrum graph.
	F6	No function
	F7	No function
	F8	No function

4.2.2 Error Vector Spectrum screen

In addition to numeric results such as EVM and power measurement values, this screen displays the constellation for the specified symbol and the subcarrier domain EVM graph.

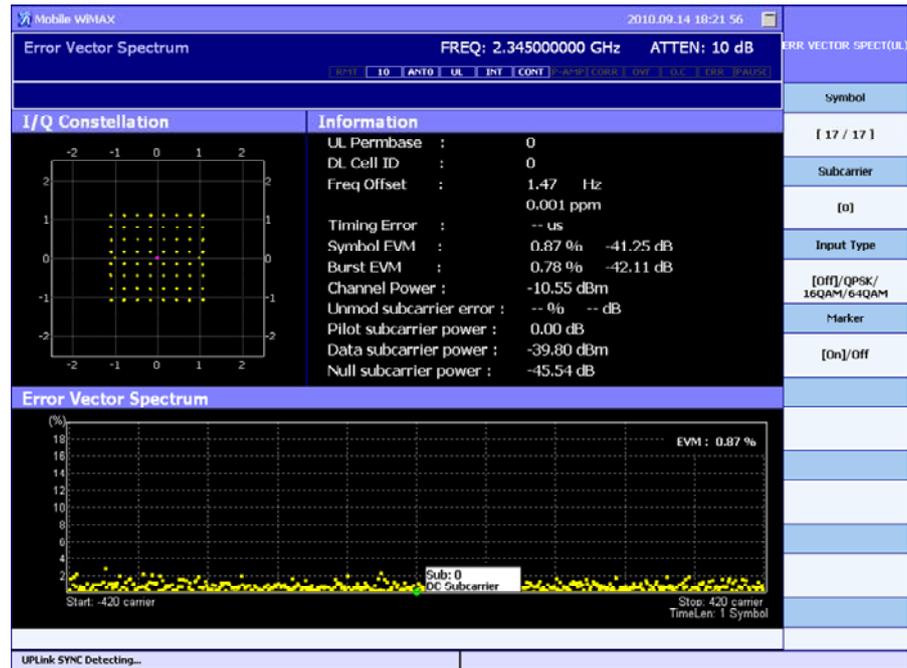


Figure 4.2.2-1 Error Vector Spectrum screen

The measurement results displayed on the Error Vector Spectrum screen are as follows.

(1) I/Q Constellation

The normalized I/Q level of each subcarrier for the set **Symbol** is displayed with the horizontal axis I phase and vertical axis Q phase.

(2) Information

The displayed contents are the same as those displayed on the Modulation screen.

4.2.1 Modulation screen

(3) Error Vector Spectrum

This command displays the EVM distribution of each subcarrier for the set **Symbol** with the subcarrier domain.

When the **Marker** setting is set to **On**, markers are displayed inside the graph, making it possible to know EVM for the set **Subcarrier**.

Function menu

Table 4.2.2-1 Error Vector Spectrum screen function menu

Menu Display	Key	Function
Symbol		Sets the symbols for which the measurement results are to be displayed on the uplink measurement screens. The value to the left of “/” is the setting value, and the value to the right indicates the total number of uplink symbols that have been set.
Subcarrier		Sets the marker position on the Error Vector Spectrum graph.
Input Type		Sets the type of error scale displayed on the constellation. Off, QPSK, 16QAM, or 64QAM can be selected.
Marker		Switches on/off marker display on the Error Vector Spectrum graph.
		No function
		No function
		No function
		No function

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Uplink Signal Measurement

4.2.3 Error Vector Time screen

In addition to numeric results such as EVM and power measurement results, this screen displays the constellation for the specified symbol and symbol domain EVM graph.

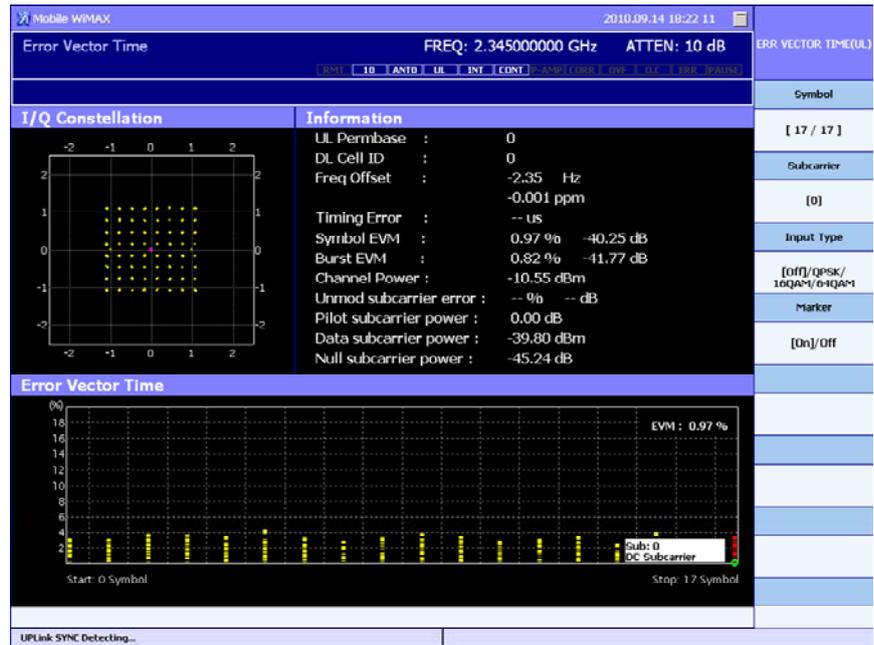


Table 4.2.3-1 Error Vector Time screen

The measurement results displayed on the Error Vector Time screen are as follows.

(1) I/Q Constellation

The normalized I/Q level of each subcarrier for the set **Symbol** is displayed with the horizontal axis I phase and vertical axis Q phase.

(2) Information

The contents are the same as those displayed on the Modulation screen.



(3) Error Vector Time

The EVM distribution of subcarriers for the set **Symbol** is displayed in symbol (time) domains.

When the **Marker** setting is set to **On**, markers are displayed inside the graph, making it possible to know EVM for the set **Subcarrier**.

Function menu

Table 4.2.3-1 Error Vector Time screen function menu

Menu Display	Key	Function
Symbol		Sets the symbols for which the measurement results are to be displayed on the uplink measurement screens. The value to the left of “/” is the setting value, and the value to the right indicates the total number of uplink symbols that have been set.
Subcarrier		Sets the marker position on the Error Vector Time graph.
Input Type		Sets the type of error scale displayed on the constellation. Off, QPSK, 16QAM, or 64QAM can be selected.
Marker		Switches on/off marker display on the Error Vector Time graph.
		No function
		No function
		No function
		No function

4

Uplink Signal Measurement

4.2.4 Spectral Flatness screen

This screen displays the constellation for the specified symbol and the average power of subcarriers.

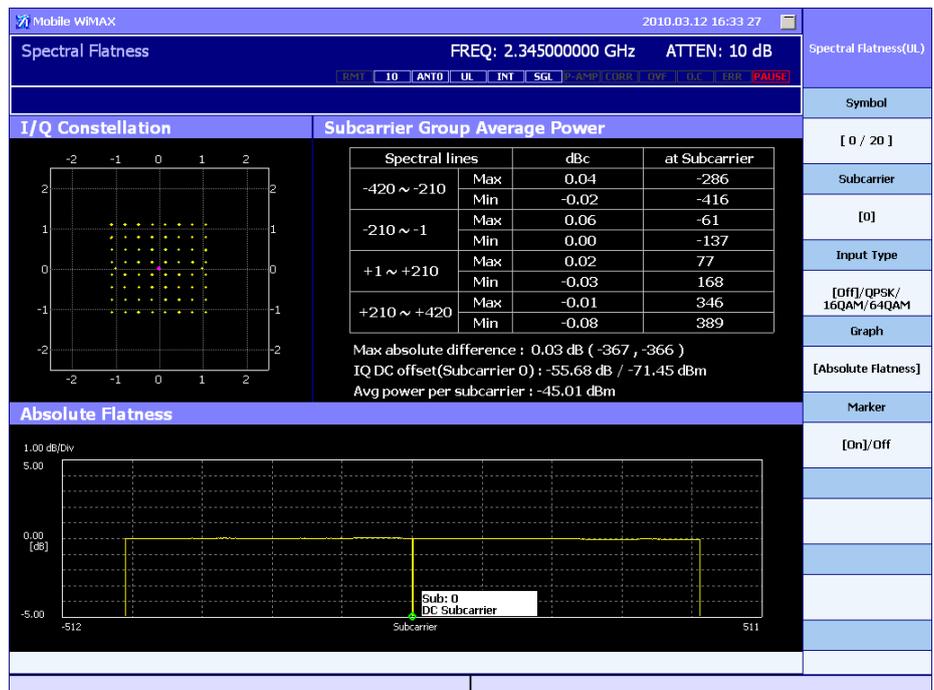


Figure 4.2.4-1 Spectral Flatness screen

The measurement results displayed on the Spectral Flatness screen are as follows.

- (1) I/Q Constellation

The normalized I/Q level of each subcarrier for the set **Symbol** is displayed with the horizontal axis I phase and vertical axis Q phase.
- (2) Subcarrier Group Average Power

This command displays the maximum power and the minimum power of specific subcarriers, as well as the maximum power difference from the adjacent subcarrier.

 - (a) Max absolute difference

The maximum power difference between adjacent subcarriers and the corresponding subcarrier numbers are displayed.
 - (b) IQ DC Offset

The power of subcarrier 0 is displayed as a value relative to the Channel Power (in dB units) and as an absolute value (in dBm units)
 - (c) Avg power per subcarrier

This is the channel power per subcarrier. It is used as the reference power for the spectral line.

(3) Absolute Flatness

This command is displayed when the **Graph** parameter is set to **Differential**.

The average power of each subcarrier on the subcarrier domain is displayed.

(4) Differential Flatness

This command is displayed when the **Graph** parameter is set to **Differential**.

The average power difference between adjacent subcarriers is displayed.

Function Menu

Table 4.2.4-1 Spectral Flatness Screen Function Menu

Menu Display	Key	Function
Symbol		Sets the symbols for which the measurement results are to be displayed on the Uplink measurement screens. The value to the left of “/” is the setting value, and the value to the right indicates the total number of uplink symbols that have been set. On the Spectral Flatness screen, this setting is for the constellation.
Subcarrier		Sets the marker position on the Spectral Flatness graph.
Input Type		Sets the type of error scale displayed on the constellation. Off, QPSK, 16QAM, or 64QAM can be selected.
Graph		Sets the type of graph displayed in the lower part of the screen. Differential or Absolute can be selected.
Marker		Switches on/off marker display on the Spectral Flatness graph.
		No function
		No function
		No function

4.2.5 Spectrum Measurement function

Refer to Section 3.2.7 “Spectrum Measurement function.”

 3.2.7 Spectrum Measurement function

4.3 Operation Examples

This section describes the uplink signal measurement procedure, using the measured signal described in Table 4.3-1.

Table 4.3-1 Input Signal Used for Operation Examples in This Section

Parameter	Value
Center frequency	2.345 GHz
Channel bandwidth	10 MHz (FFT Size = 1024, CP = 1/8)
Input level	-10 dBm (average level)
Zone Type	PUSC
Burst configuration	1UL burst (QPSK [CTC] 1/2 – UIUC 0)
Frame number	0 (fixed)
UL PermBase	0
DL IDCell	0
Zone Offset	3 Note: Although the position offset for the zone is 0, set 3 for Zone Offset if the first three symbols are occupied by the control burst.
Measurement target burst	Symbol length = 18 Number of slots = 140 Subchannel offset = 10

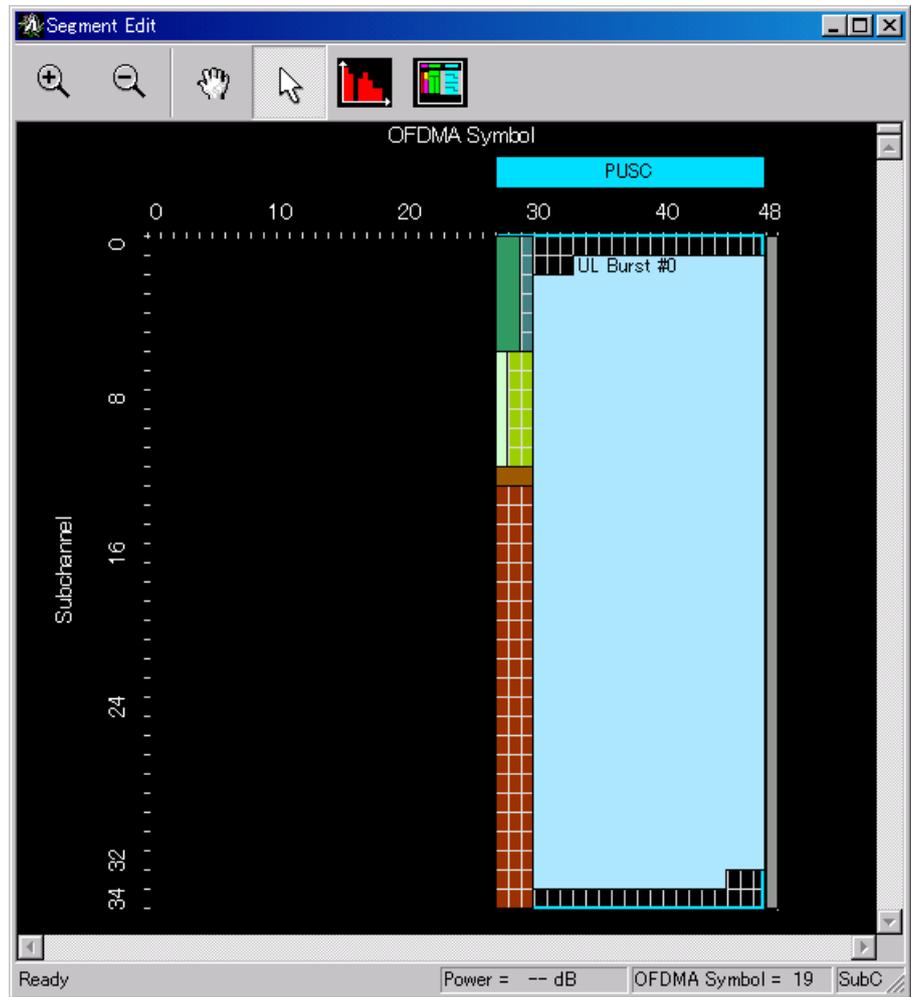


Figure 4.3-1 Uplink signal example (IQproducer screen)

4.3.1 Measurement condition settings

First, set the measurement conditions. The default values are used for the parameters that are not described below.

 4.1.3 “Basic settings before measurement”

Set the parameters according to the input signal, as detailed in the following table.

Table 4.3.1-1 Setting Parameters

Setting Parameter	Value
Center Frequency	2.345 GHz
Channel Bandwidth	8.75 MHz
Input Level	-10 dBm
UIUC List	[01] QPSK * CTC * 1/2
Modulation Type	[1] QPSK (CTC) 1/2
Zone Type	PUSC
Zone Offset	0
Num of Symbols	18
Frame Mode	Fixed
Frame Number	0
UL PermBase	0
DL IDCell	0
Duration	35
Subchannel Offset	0

<Procedure>

1. Set the frequency to 2.345 GHz.
 - 1) Press . At this time, **Center Freq** is displayed in the setting window.
 - 2) After pressing     , press  (GHz).
2. Set the input level to -10 dBm.
 - 1) Press . At this time, **Input Level** is displayed in the setting window.
 - 2) After pressing   , press  (dBm).
3. Set the channel bandwidth to 8.75 MHz.
 - 1) Press  to display the Mode function menu.
 - 2) Press  (Common Parameters) to display the **CH. Bandwidth** parameter.
 - 3) Press  (CH. Bandwidth) and select **8.75**.
4. Set UIUC.
 - 1) From the Common Parameters function menu, press  (more 1/2) to display page 2 of the Common Parameters function menu.
 - 2) Press  (UIUC) to display the UIUC Config function menu.
 - 3) From the UIUC Config function menu, press  (UIUC List) and move the cursor to **01** using the rotary encoder or the cursor keys.
 - 4) Press  (FEC List) and move the cursor to **QPSK * CTC * 1/2** in the same manner.
 - 5) Press  (Apply) and change **01** of the UIUC List to **QPSK * CTC * 1/2**.
5. Set Modulation Type to [[1] QPSK (CTC) 1/2].
 - 1) Press  to display the Mode function menu.
 - 2) Press  (Uplink Parameters) to display the Uplink Parameters function menu.
 - 3) Press  (Modulation Type) and select [[1] QPSK (CTC) 1/2].
6. Set the number of symbols for measurement.
 - 1) From the Uplink Parameters function menu, press  (Num of Symbols).
 - 2) After pressing , press  (Enter).

7. Set the frame number for measurement.
 - 1) From the Uplink Parameters function menu, press  (Frame Number).
 - 2) After pressing , press  (Enter).
8. Set UL PermBase.
 - 1) From the Uplink Parameters function menu, press  (more 1/2) to display page 2 of the Uplink Parameters function menu.
 - 2) Press  (UL PermBase).
 - 3) After pressing , press  (Enter).
9. Set DL IDCell.
 - 1) From the Uplink Parameters function menu, press  (more 1/2) to display page 2 of the Uplink Parameters function menu.
 - 2) Press  (DL IDCell).
 - 3) After pressing , press  (Enter).
10. Set the slot length for measurement.
 - 1) From the Uplink Parameters function menu, press  (Duration).
 - 2) After pressing  , press  (Enter).

4.3.2 Screen selection and measurement execution

Next, select the measurement screen and execute measurement.

<Procedure>

1. Press  to display the Mode function menu.
2. Press  (Uplink) to display the Measure(UL) function menu.
3. Press  (Modulation) and select the Modulation screen.

 4.1.2 "Measurement screen types"
4. Press  to start measurement. Measurement ends when **PAUSE** is displayed.

 4.1.4 "Measurement start and result update"
5. Check that **ERR** or **OVF** is not displayed in the status window.

 4.1.5 "Measurement error handling"

4.3.3 Measurement result display

Measurement results for symbol

The measurement results displayed on the constellation, Symbol EVM, Subcarrier Spectrum graph, and Time Domain graph differ for each symbol. Therefore, during Single measurement, set the symbol for measurement after measurement end with the **Symbol** parameter.

<Procedure> Setting the symbol

1. Press  (Symbol) from the Modulation screen.
2. Set the value of the symbol to be displayed using the numeric keypad, rotary encoder, or the cursor keys.

Marker display (measurement results for subcarrier)

To display the results for a specific subcarrier on the Subcarrier Spectrum graph, set **Marker** to **On**, and set the **Subcarrier** parameter to the value of the subcarrier to be displayed.

<Procedure> Setting marker display and subcarrier

1. Switch on (display) or off (hide) marker display by pressing  (Marker) from the Modulation screen.
2. Select  (Subcarrier) and set the subcarrier value using the numeric keypad, rotary encoder, or cursor keys.

Chapter 5 Parameter Settings

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5.1 Basic Parameter Settings

This section provides an overview of the basic parameters such as frequency and level, which are applied to all the measurement screens.

5.1.1 Frequency – Center

This command sets the center frequency of the input signal.

Setting range: 50 MHz to the upper limit of the main unit

Default value: 2.345 GHz

 2.6.1 “Frequency setting”

5.1.2 Amplitude – Input Level

This command sets the level of the input signal.

Setting range: $-120.00 + \text{Offset}$ to $34.00 + \text{Offset}$ dBm

Default value: -15.00 dBm

Note:

When Pre-Amplifier is set to On, the upper limit value of setting range lowers by 20 dB.

 2.6.2 “Level setting”

5.1.3 Amplitude – Offset

This command sets the offset for Ref. Level.

Setting range: -100.00 to 100.00 dB

Default value: 0.00 dB

 2.6.3 “Level offset setting”

5.1.4 Pre-Amplifier

This command is displayed only when Option 008 is enabled. Setting Pre-Amplifier On improves the level sensitivity.

Setting range: On, Off

Default value: Off

5.1.5 RF Spectrum

This command sets whether to reverse the input signal spectrum.

Setting range: Normal, Reverse

Default value: Normal

5.2 Common System Parameter Settings

The common system parameters, which are applied to both downlink and uplink measurements, are parameters related to the IEEE802.16e OFDMA specifications. If the common parameters are not set correctly, synchronization cannot be established and measurement is not possible.

The common system parameters are displayed in the Common Parameters function menu.

<Procedure>

1. Press  to display the Mode function menu.
2. Press  (Common Parameters) to display the Common Parameters function menu.

5.2.1 Spec Version

This command displays the version of the IEEE802.16e standard that is applied to measurement. This is a display-only parameter and its setting value cannot be changed.

Display value: 802.16e-2005

5.2.2 CH. Bandwidth/FFT Size

This command sets the channel bandwidth.

Setting range: 3.5 MHz, 5 MHz, 7 MHz, 8.75 MHz, 10 MHz, 20 MHz

Default value: 10 MHz

Once the channel bandwidth is selected, the FFT size is also set automatically. The FFT size cannot be changed.

FFT 2048: 20 MHz

FFT 1024: 7 MHz, 8.75 MHz, 10 MHz

FFT 512: 3.5 MHz, 5 MHz

5.2.3 Frequency – Offset

This command sets whether to correct frequency errors of the input signal frequency.

Setting range: On, Off

Default value: On

5.2.4 DIUC List

This command sets the FEC code corresponding to the DIUC code. When measuring a downlink signal, the MX269010A decodes the DL-Map of the input signal to acquire DIUC of each burst, and then performs modulation analysis based on the corresponding FEC code set in this screen. Measurements are not performed on the DIUC List screen.

Function menu

Table 5.2.4-1 DIUC List Screen Function Menu

Menu Display	Key	Function
FEC List		Displays a cursor in FEC List at the left of the screen to start selection.
DIUC List		Displays a cursor in DIUC List at the left of the screen to start selection.
Apply		Applies the value at the cursor position in FEC List to the DIUC at the cursor position in DIUC List. After application, cursors disappear from FEC List and DIUC List.
Restore		Restores the values in DIUC List to the setting when the DIUC List screen was previously selected.
Default		Sets the values in DIUC List to the default values.
		No function
		No function
		No function

<Procedure> When DIUC 1 burst is encoded by 16QAM CTC 1/2

1. Select the DIUC List screen.
2. Press  (FEC List), then move the cursor onto “16QAM * CTC * 1/2” in FEC Code Type List.
3. Press  (DIUC List), then move the cursor onto **01** in DIUC List.
4. Press  (Apply) to determine the setting.

5.2.5 UIUC List

This command sets the FEC code corresponding to the UIUC code. Combinations of the UIUC and FEC codes set in UIUC List are displayed in “Modulation Type” of the Uplink parameter. Measurements are not performed on the UIUC List screen.

Usually, the UIUC List is not required to be changed because the number of corresponding FEC Codes and the number of UIUC codes in the UIUC List are the same.

Function menu

Table 5.2.5-1 UIUC List Screen Function Menu

Menu Display	Key	Function
FEC List		Displays a cursor in FEC List at the left of the screen to start selection.
UIUC List		Displays a cursor in UIUC List at the left of the screen to start selection.
Apply		Applies the value at the cursor position in FEC List to the UIUC at the cursor position in UIUC List. After application, cursors disappear from FEC List and UIUC List.
Restore		Restores the values in UIUC List to the setting when the UIUC List screen was previously selected.
Default		Sets the values in UIUC List to the default values.
		No function
		No function
		No function

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Parameter Settings

5.2.6 Sampling Offset

This command sets whether to correct sampling frequency errors of the input signal.

Setting range: On, Off

Default value: Off

5.2.7 Cyclic Prefix

This command sets the cyclic prefix.

Setting range: 1/4, 1/8, 1/16, 1/32

Default value: 1/8

5.2.8 Antenna (DL)

This command sets the type of the output antenna for downlink signals.

Setting range

ANT 0: Set when using one antenna for transmission or when using two antennas and measuring signals at Antenna 0.

ANT 1: Set when using two antennas for transmission and measuring signals at Antenna 1.

Default value: ANT 0

5.2.9 DL Map

This parameter sets the method for processing DL Map information in a downlink signal.

Setting range

Auto: The MX269010A automatically decodes FCH and DL-MAP in the input signal.

Import: Applies the information in the imported Mobile WiMAX IQproducer parameter file.

Local Edit: Applies the settings on the DL Map Edit screen.

Default value: Auto

5.3 Channel Estimation Settings

Channel Estimation parameters are used to configure the settings related to the correction and evaluation methods used for the downlink input signal.

The Channel Estimation parameters can be set by selecting **Channel Estimation** in the Common Parameters function menu.

<Procedure>

1. Press  to display the Mode function menu.
2. Press  (Common Parameters) to display the Common Parameters function menu.
3. Press  (more 1/2) on the Common Parameters function menu to display page 2 of the Common Parameters function menu.
4. Press  (Channel Estimation).

5.3.1 Channel Estimation

This command enables/disables the Channel Estimation function. This setting is applied to both downlink and uplink.

Setting range

On: Enables the Channel Estimation function.

Off: Disables the Channel Estimation function.

Default value: On

5.3.2 Equalizer

This command performs settings related to the subcarrier used for channel estimation. This command sets up the subcarrier used for channel estimation. The setting by this command is valid only for ANTO downlink measurement.

Setting range

Preamble Only: Only the preamble is used.

Preamble + Data : Preamble, pilot, and data subcarriers are used.
The data obtained for each symbol to be corrected is used for equalizing.

Preamble + Data (Average) :
Preamble, pilot, and data subcarriers are used.
The average data of all symbols within the downlink period is used for equalizing.

Default value: Preamble Only

5.3.3 Amplitude CH Tracking

This command enables/disables amplitude correction through the pilot symbol. The setting by this command is valid only for ANT0 downlink measurement.

Setting range: On, Off
Default value: On

5.3.4 Phase CH Tracking

This command enables/disables phase correction through the pilot symbol. The setting by this command is valid only for ANT0 downlink measurement.

Setting range: On, Off
Default value: On

5.3.5 Difference in channel estimation processing according to measurement target

The MX209010A uses different methods for channel estimation according to the signal to be measured.

When measuring a downlink signal transmitted from a single antenna:

The settings of all parameters displayed on Channel Estimation apply.

When measuring a downlink signal transmitted from a two-antenna configured station:

Zones of ANT 0 other than STC:

The settings of all parameters displayed on Channel Estimation apply.

STC zones of ANT 0 and ANT 1:

Only the Channel Estimation parameter setting (On/Off) applies.

The pilot subcarrier is referenced for channel estimation and amplitude/phase tracking.

When measuring an uplink signal:

The pilot subcarrier is always referenced to perform channel estimation and amplitude/phase tracking.

5.4 External Trigger Settings

External Trigger Settings parameters are used to set the external trigger that is used for the measurement start timing. These settings are applied to both downlink and uplink. There are two types of triggers for the MX269010A, i.e. **Free run**, which starts measurement at the internal timing, and **External**, which starts measurement using the signal input via the Trigger In connector.

The External Trigger Settings parameters can be set by selecting **Trigger** in the Mode function menu or pressing .

<Procedure>

1. Press  to display the Mode function menu.
2. Press  (more 1/2) on the Mode function menu to display page 2 of the Mode function menu.
3. Press  (Trigger).

5.4.1 Source

This command sets the trigger type. SG Marker can be selected when the following option is installed.

MS269x Series	Option 020, 120
MS2830A:	Option 020/120, 021/121

Setting range: Free Run, External, SG Marker (option)

Default value: Free Run

5.4.2 Slope

This command sets the detection timing for the external trigger signal that is input.

Setting range

Rise: Triggered by the rising slope of the signal waveform.

Fall: Triggered by the falling slope of the signal waveform.

Default value: Rise

5.4.3 Delay

This command sets the delay time from the detected external trigger until measurement starts.

Setting range: -5000.0 to +5000.0 μ s

Default value: 0 μ s

5.4.4 Search Time

This command sets the period of time from the start of the measurement until a trigger signal is detected. A measurement error occurs if a trigger signal is not detected during the specified period.

Setting range: 100 to 5000 μs

Default value: 100 μs

5.5 Downlink – Modulation Screen Settings

This section describes the parameters that can be set on the Downlink – Modulation screen.

5.5.1 Symbol

The measurement results for the specific symbol specified with this parameter are displayed on the Modulation screen, I/Q Received screen, Error Vector Spectrum screen, Error Vector Time screen, and Spectral Flatness screen for downlink. Symbol 0 indicates the preamble.

Only a valid symbol segment of the input signal analyzed last can be specified for this parameter. If analysis of the input signal could not be done, this parameter is fixed to 0. In this case, the set value is not saved.

Setting range: 0 to valid symbol segment of input signal

Default value: 0

Table 5.5.1-1 Downlink Maximum Significant Symbol Number

Cyclic Prefix	CH Bandwidth					
	3.5 MHz	5 MHz	7 MHz	8.75 MHz	10 MHz	20MHz
1/4	31	43	31	39	43	43
1/8	33	47	33	43	47	47
1/16	35	51	35	45	51	51
1/32	37	53	37	47	53	53

5.5.2 Subcarrier

This command sets the display position of the marker on the Subcarrier Spectrum graph. If RF Spectrum is set to Reverse, the direction of change (increasing or decreasing) for the input value is opposite the rotation direction of the rotary knob.

Setting range: –1024 to 1023 (FFT 2048)

–512 to 511 (FFT 1024)

–256 to 255 (FFT 512)

Default value: 0

 5.1.5 “RF Spectrum”

5.5.3 Input Type

This command sets the error scale for the constellation displayed on the Modulation screen, I/Q Received screen, Error Vector Spectrum screen, Error Vector Time screen, and Spectral Flatness screen for Downlink. The error scale is 1%.

Setting range: Off, QPSK, 16QAM, 64QAM

Default value: Off

5.5.4 Graph

This command sets the type of graph displayed in the lower part of the Modulation screen.

Setting range: Subcarrier Spectrum, Time Domain

Default value: Subcarrier Spectrum

5.5.5 Marker

This command switches on/off the markers displayed on the Subcarrier Spectrum graph.

Setting range: On, Off

Default value: On

5.6 Downlink – I/Q Received Screen Settings

This section describes the parameters that can be set on the Downlink – I/Q Received screen.

5.6.1 Symbol

This is a common parameter for the Modulation screen, I/Q Received screen, Error Vector Spectrum screen, Error Vector Time screen, and Spectral Flatness screen for downlink.

 5.5.1 “Symbol”

5.6.2 Subcarrier

This command sets the subcarrier index number to be marking displayed on the constellation, I/Q table, and subcarrier domain on the I/Q Received screen. If RF Spectrum is set to Reverse, the direction of change (increasing or decreasing) for the input value is opposite the rotation direction of the rotary knob.

Setting range: –1024 to 1023 (FFT 2048)
 –512 to 511 (FFT 1024)
 –256 to 255 (FFT 512)

Default value: 0

 5.1.5 “RF Spectrum”

5.6.3 Input Type

This is a common parameter for the Modulation screen, I/Q Received screen, Error Vector Spectrum screen, Error Vector Time screen, and Spectral Flatness screen for downlink.

 5.5.3 “Input Type”

5.7 Downlink – Map Info. Screen Settings

This section describes the parameters that can be set on the Downlink – Map Info. screen.

5.7.1 Display

This command sets the type of numeric measurement results to be displayed in the lower part of the Map Info. screen. Zone is automatically set when Zone Index is changed, and Burst is automatically set when Burst Index is changed.

Setting range

Zone: Displays the measurement results for the zone set by Zone Index.

Burst: Displays the measurement results for the burst set by Burst Index.

Default value: Zone

5.7.2 Zone Index

This command highlights the bursts for the specified zone. If analysis of the input signal could not be done, this parameter is fixed to 0. In this case, the set value is not saved.

Setting range: 0 to valid zone segment of input signal (7 max.)

Default value: 0

5.7.3 Burst Index

The measurement results for the burst set with this parameter are displayed in the lower part of the Map Info. screen.

Only a valid burst segment of the input signal that was analyzed last can be specified for this parameter. If analysis of the input signal could not be done, this parameter is fixed to 0. In this case, the set value is not saved.

Setting range: 0 to valid burst segment of input signal (128 max.)

Default value: 0

5.8 Downlink – Error Vector Spectrum Screen Settings

This section describes the parameters that can be set on the Downlink – Error Vector Spectrum screen.

5.8.1 Symbol

This is a common parameter for the Modulation screen, I/Q Received screen, Error Vector Spectrum screen, Error Vector Time screen, and Spectral Flatness screen for downlink.

 5.5.1 “Symbol”

5.8.2 Subcarrier

This command sets the marker display position on the Error Vector Spectrum graph. If RF Spectrum is set to Reverse, the direction of change (increasing or decreasing) for the input value is opposite the rotation direction of the rotary knob.

Setting range:

–840 to –1, 1 to 840 (FFT2048, PUSC)
 –851 to –1, 1 to 851 (FFT2048, FUSC)
 –864 to –1, 1 to 864 (FFT2048, AMC (2x3))
 –420 to –1, 1 to 420 (FFT1024, PUSC)
 –425 to –1, 1 to 425 (FFT1024, FUSC)
 –432 to –1, 1 to 432 (FFT1024, AMC (2x3))
 –210 to –1, 1 to 210 (FFT512, PUSC)
 –213 to –1, 1 to 213 (FFT512, FUSC)
 –216 to –1, 1 to 216 (FFT512, AMC (2x3))

Default value: 0

 5.1.5 “RF Spectrum”

5.8.3 Input Type

This is a common parameter for the Modulation screen, I/Q Received screen, Error Vector Spectrum screen, Error Vector Time screen, and Spectral Flatness screen for downlink.

 5.5.3 “Input Type”

5.8.4 Marker

This command switches on/off the markers displayed on the Error Vector Spectrum graph.

Setting range: On, Off

Default value: On

5.9 Downlink – Error Vector Time Screen Settings

This section describes the parameters that can be set on the Downlink – Error Vector Time screen.

5.9.1 Symbol

This is a common parameter for the Modulation screen, I/Q Received screen, Error Vector Spectrum screen, Error Vector Time screen, and Spectral Flatness screen for downlink.

 5.5.1 “Symbol”

5.9.2 Subcarrier

This command sets the marker display position on the Error Vector Time graph.

Setting range: –840 to –1, 1 to 840 (FFT2048, PUSC)
 –851 to –1, 1 to 851 (FFT2048, FUSC)
 –864 to –1, 1 to 864 (FFT2048, AMC (2x3))
 –420 to –1, 1 to 420 (FFT1024, PUSC)
 –425 to –1, 1 to 425 (FFT1024, FUSC)
 –432 to –1, 1 to 432 (FFT1024, AMC (2x3))
 –210 to –1, 1 to 210 (FFT512, PUSC)
 –213 to –1, 1 to 213 (FFT512, FUSC)
 –216 to –1, 1 to 216 (FFT512, AMC (2x3))

Default value: 0

5.9.3 Input Type

This is a common parameter for the Modulation screen, I/Q Received screen, Error Vector Spectrum screen, Error Vector Time screen, and Spectral Flatness screen for downlink.

 5.5.3 “Input Type”

5.9.4 Marker

This command switches on/off the markers displayed on the Error Vector Time graph.

Setting range: On, Off

Default value: On

5.10 Downlink – Spectral Flatness Screen Settings

This section describes the parameters that can be set on the Downlink – Spectral Flatness screen.

5.10.1 Symbol

This is a common parameter for the Modulation screen, I/Q Received screen, Error Vector Spectrum screen, Error Vector Time screen, and Spectral Flatness screen for downlink.

 5.5.1 “Symbol”

5.10.2 Subcarrier

This command sets the marker display position on the Spectral Flatness graph. If RF Spectrum is set to Reverse, the direction of change (increasing or decreasing) for the input value is opposite the rotation direction of the rotary knob.

Setting range: –840 to –1, 1 to 840 (FFT2048, PUSC)
 –851 to –1, 1 to 851 (FFT2048, FUSC)
 –864 to –1, 1 to 864 (FFT2048, AMC (2x3))
 –420 to –1, 1 to 420 (FFT1024, PUSC)
 –425 to –1, 1 to 425 (FFT1024, FUSC)
 –432 to –1, 1 to 432 (FFT1024, AMC (2x3))
 –210 to –1, 1 to 210 (FFT512, PUSC)
 –213 to –1, 1 to 213 (FFT512, FUSC)
 –216 to –1, 1 to 216 (FFT512, AMC (2x3))

Default value: 0

 5.1.5 “RF Spectrum”

5.10.3 Input Type

This is a common parameter for the Modulation screen, I/Q Received screen, Error Vector Spectrum screen, Error Vector Time screen, and Spectral Flatness screen for downlink.

 5.5.3 “Input Type”

5.10.4 Graph

This command sets the type of graph to be displayed in the lower part of the Spectral Flatness screen.

Setting range: Absolute Flatness, Differential Flatness

Default value: Absolute Flatness

5.10.5 Marker

This command switches on/off the markers displayed on the Spectral Flatness graph.

Setting range: On, Off

Default value: On

5.11 Uplink Parameter Settings

This section describes the parameters related to the uplink measurement target burst that are used in common on the Uplink screen.

5.11.1 Modulation Type

This command sets the modulation method for the input signal. The setting range is set with UIUC List.

Setting range: UIUC List 01 to 08
Default value: 01

5.11.2 Zone Type

This command sets the zone type to which the measurement target burst belongs.

Setting range: PUSC, AMC (2x3)
Default value: PUSC

5.11.3 Zone Offset

This command sets the position of the zone that includes the measurement target burst by an offset value from the first uplink symbol. Be sure to set 3 for Zone Offset if the burst is allocated to the first zone and control information is assigned to all of the first three symbols of that zone.

Setting range: 0 to 21 – setting value of Num of Symbols
(5 MHz, 10MHz , 20 MHz bandwidth)
0 to 18 – setting value of Num of Symbols
(8.75 MHz bandwidth)
0 to 15 – setting value of Num of Symbols
(3.5 MHz, 7 MHz bandwidth)
Default value: 3

5.11.4 Number of Symbols

This command sets the symbol length of the uplink signal to be input.

Setting range: 3 to 21 – setting value of Zone Offset
(5 MHz, 10,MHz, and 20 MHz bandwidth)
3 to 18 – setting value of Zone Offset
(8.75 MHz bandwidth)
3 to 15 – setting value of Zone Offset
(3.5 MHz, 7 MHz bandwidth)
Default value: 15

5.11.5 Duration

This command sets the number of slots for measurement.

Setting range: 1 to [(setting value of Number of Symbols)/3 × Number of subchannels] – setting value of Subchannel Offset
 Number of subchannels: Refer to Table 5.11.5-1.

Table 5.11.5-1 Number of Subchannel

FFT Size	Zone Type	
	PUSC	AMC (2x3)
512	17	24
1024	35	48
2048	70	96

Default value: 140

5.11.6 Subchannel Offset

This command sets the subchannel offset for measurement.

Setting range: 0 to [(setting value of Number of Symbols)/3 × Number of subchannels] – 1
 Number of subchannels: Refer to Table 5.11.5-1.

Default value: 0

Figure 5.11.6-1 shows the positional relationships between the measurement target burst (gray area in the figure) and the uplink parameters **Zone Offset**, **Number of Symbols**, **Subchannel Offset**, and **Duration**.

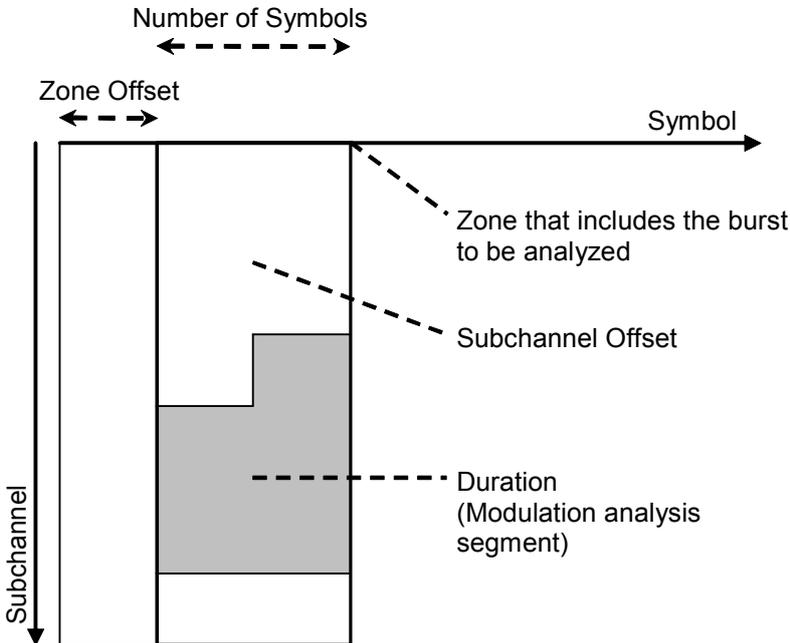


Figure 5.11.6-1 Relationship between Uplink parameters and measurement target burst

5.11.7 Frame Sync

This command sets the synchronization method for the frame numbers of uplink signals. When Auto is selected, the frame numbers are automatically scanned in the MS2690A/MS2691A/MS2692A. When Manual is selected, the value set by the **Frame Number** parameter is used.

Setting range: Auto, Manual
Default value: Auto

5.11.8 Frame Number

This command sets the frame number of the uplink signal to be input.

Setting range: 0 to 16777215
Default value: 0

5.11.9 UL PermBase

This command sets the UL PermBase used for generating the uplink signal to be input.

Setting range: 0 to 69
Default value: 0

5.11.10 DL IDCell

This command sets the DL IDCell used for generating the uplink signal to be input.

Setting range: 0 to 31
Default value: 0

5.11.11 Burst Type

This command sets the type of the uplink burst.

Setting range: Normal, Collaborative
Default value: Normal

5.11.12 Pilot Pattern

This command sets the pilot subcarrier assignment mode when Collaborative is selected for Burst Type.

Setting range: A, B
Default value: A

5.12 Uplink – Modulation Screen Settings

This section describes the parameters that can be set on the Uplink – Modulation screen.

5.12.1 Symbol

The measurement results for the specific symbol specified with this parameter are displayed on the Modulation screen for uplink.

Setting range: 0 to setting value of Number of Symbols – 1
 Default value: 0

5.12.2 Subcarrier

This command sets the marker display position on the Subcarrier Spectrum graph. If RF Spectrum is set to Reverse, the direction of change (increasing or decreasing) for the input value is opposite the rotation direction of the rotary knob.

Setting range: –1024 to 1023 (FFT 2048)
 –512 to 511 (FFT 1024)
 –256 to 255 (FFT 512)
 Default value: 0

 5.1.5 “RF Spectrum”

5.12.3 Input Type

This command sets the error scale for the constellation. The error scale is 1%.

Setting range: Off, QPSK, 16QAM, 64QAM
 Default value: Off

5.12.4 Graph

This command sets the type of graph to be displayed in the lower part of the Modulation screen.

Setting range: Subcarrier Spectrum, Time Domain
 Default value: Subcarrier Spectrum

5.12.5 Marker

This command switches on/off the markers displayed on the Subcarrier Spectrum graph.

Setting range: On, Off
 Default value: On

5.13 Uplink – Error Vector Spectrum Screen Settings

This section describes the parameters that can be set on the Uplink – Error Vector Spectrum screen.

5.13.1 Symbol

This is a common parameter for the Uplink Modulation screen, the Error Vector Spectrum screen, the Error Vector Time screen, and the Spectral Flatness screen.

 5.12.1 “Symbol”

5.13.2 Subcarrier

This command sets the marker display position on the Error Vector Spectrum graph.

Setting range: -840 to -1, 1 to 840 (FFT2048, PUSC)
 -864 to -1, 1 to 864 (FFT2048, AMC (2x3))
 -420 to -1, 1 to 420 (FFT1024, PUSC)
 -432 to -1, 1 to 432 (FFT1024, AMC (2x3))
 -204 to -1, 1 to 204 (FFT512, PUSC)
 -216 to -1, 1 to 216 (FFT512, AMC (2x3))

Default value: 0

 5.1.5 “RF Spectrum”

5.13.3 Input Type

This is a common parameter for the Uplink Modulation screen, the Error Vector Spectrum screen, the Error Vector Time screen, and the Spectral Flatness screen.

 5.12.3 “Input Type”

5.13.4 Marker

This command sets On/Off of the marker to be displayed on the Error Vector Spectrum graph.

Setting range : On, Off

Default value : On

5.14 Uplink – Error Vector Time Screen

This section describes the parameter that can be set on the Uplink – Error Vector Time screen.

5.14.1 Symbol

This is a common parameter for the Uplink Modulation screen, the Error Vector Spectrum screen, the Error Vector Time screen, and the Spectral Flatness screen.

 5.12.1 “Symbol”

5.14.2 Subcarrier

This command sets the marker display position on the Error Vector Time graph.

Setting range : -840 to -1, 1 to 840 (FFT2048, PUSC)
 -864 to -1, 1 to 864 (FFT2048, AMC (2x3))
 -420 to -1, 1 to 420 (FFT1024, PUSC)
 -432 to -1, 1 to 432 (FFT1024, AMC (2x3))
 -204 to -1, 1 to 204 (FFT512, PUSC)
 -216 to -1, 1 to 216 (FFT512, AMC (2x3))

Default value : 0

5.14.3 Input Type

This is a common parameter for the Uplink Modulation screen, the Error Vector Spectrum screen, the Error Vector Time screen, and the Spectral Flatness screen.

 5.12.3 “Input Type”

5.14.4 Marker

This command sets On/Off of the marker to be displayed on the Error Vector Time graph.

Setting range: On, Off

Default value: On

5.15 Uplink – Spectral Flatness Screen Settings

This section describes the parameters that can be set on the Uplink – Spectral Flatness screen.

5.15.1 Symbol

This is a common parameter for the Uplink Modulation screen, the Error Vector Spectrum screen, the Error Vector Time screen, and the Spectral Flatness screen.

 5.12.1 “Symbol”

5.15.2 Subcarrier

This parameter sets the position of the marker to display on the Subcarrier Spectrum graph. If RF Spectrum is Reverse, the input value adjusted by rotating the rotary knob is incremented or decremented in the reverse direction.

Setting range : –840 to +840 (Bandwidth 20 MHz)
 –420 to +420 (Bandwidth 7/8.75/10 MHz)
 –204 to +204 (Bandwidth 3.5/5 MHz)

Default value : 0

 5.1.5 “RF Spectrum”

5.15.3 Input Type

This is a common parameter for the Uplink Modulation screen, the Error Vector Spectrum screen, the Error Vector Time screen, and the Spectral Flatness screen.

 5.12.3 “Input Type”

5.15.4 Graph

Sets the type of the graph to display at the bottom of the Spectral Flatness screen.

Setting range : Absolute Flatness, Differential Flatness
Default value : Absolute Flatness

5.15.5 Marker

Shows (On) or hides (Off) the marker on the Spectral Flatness graph.

Setting range : On, Off
Default value : On

5.16 DL MAP Local Edit Screen Settings

This section describes the parameters that can be set on the DL MAP Local Edit screen.

If the DL Map parameter is **Local Edit**, the parameters below must be set correctly according to the input signal.

5.16.1 FCH

Enables or disables FCH. The FCH length is fixed to 4 slots.

Setting range : On (enables FCH), Off (disables FCH)

Default value : On

5.16.2 DL-MAP

Enables or disables Normal DL-MAP. The DL-MAP length is fixed to 5 slots.

Setting range : Normal (enables Normal DL-MAP), Off (disables DL-MAP)

Default value : On

Note:

Compressed Map is not supported in the Local Edit mode.

5.16.3 DIUC

Sets the downlink burst modulation method using DIUC, which is set by DIUC List.

Setting range : 0 to 12

Default value : 0

 5.2.4 "DIUC List"

5.16.4 Symbol Offset

Sets the downlink burst symbol offset. This parameter can be set to 1 if FCH and DL-MAP are set to **Off**.

Setting range : 1, 3

Default value : 1

 5.16.1 "FCH"
 5.16.2 "DL-MAP"

5.16.5 Symbol Interval

Sets the downlink burst symbol length.

Setting range : See Table 5.16.5-1.

Resolution : 2

Default value : 2

Table 5.16.5-1 Setting Range for Symbol Interval

Cyclic Prefix	CH Bandwidth					
	3.5 MHz	5 MHz	7 MHz	8.75 MHz	10 MHz	20 MHz
1/4	30	42	30	38	42	42
1/8	32	46	32	42	46	46
1/16	34	50	34	44	50	50
1/32	36	52	36	46	52	52

5.16.6 Sub Channel Offset

Sets the downlink burst subchannel offset.

Setting range : See Table 5.16.6-1.

Default value : 9

Table 5.16.6-1 Setting Range for Sub Channel Offset

Symbol Offset	FCH	DL-MAP	FFT Size		
			512	1024	2048
1	Off	Off	0 to 14	0 to 29	0 to 59
	Off	On	5 to 14	5 to 29	5 to 59
	On	Off	4 to 14	4 to 29	4 to 59
	On	On	9 to 14	9 to 29	9 to 59
3	N/A	N/A	0 to 14	0 to 29	0 to 59

5.16.7 Sub Channel Interval

Sets the downlink burst subchannel interval.

Setting range : See Table 5.16.7-1.

Resolution : When Repetition Code is No Repetition: 1
 When Repetition Code is 2 Repetitions: 2
 When Repetition Code is 4 Repetitions: 4
 When Repetition Code is 6 Repetitions: 6

Default value : 9

Table 5.16.7-1 Setting Range for Sub Channel Interval

Symbol Offset	FCH	DL-MAP	FFT Size		
			512	1024	2048
1	Off	Off	1 to 15	1 to 30	1 to 60
	Off	On	1 to 10	1 to 25	1 to 55
	On	Off	1 to 11	1 to 26	1 to 56
	On	On	1 to 6	1 to 21	1 to 51
3	N/A	N/A	1 to 15	1 to 30	1 to 60

5.16.8 Boosting Index Interval

Sets the downlink burst boosting level using a number assigned to each level.

Setting range : 0 (0 dB)
 1 (+6 dB)
 2 (-6 dB)
 3 (+9 dB)
 4 (+3 dB)
 5 (-3 dB)
 6 (-9 dB)
 7 (-12 dB)

Resolution : 1

Default value : 0 (0 dB)

5.16.9 Repetition Code

Sets the downlink burst repetition code using a number assigned to each code.

Setting range : 0 (No Repetition)
 1 (2 Repetitions)
 2 (4 Repetitions)
 3 (6 Repetitions)
Resolution : 1
Default value : 0 (No Repetition)

Chapter 6 Performance Test

This chapter describes the measuring instruments, setup methods, and performance test procedures required for testing the performance of the MS2690A/MS2691A/MS2692A or MS2830A in which the MX269010A is installed.

6.1	Overview of Performance Test	6-2
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6.1 Overview of Performance Test

6.1.1 Performance test

Performance tests are performed as part of preventive maintenance in order to prevent the performance of the MS2690A/MS2691A/MS2692A or MS2830A 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 MS2690A/MS2691A/MS2692A or MS2830A.

- Carrier frequency accuracy
- Residual Vector 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 can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.

6.1.2 Performance test items and instruments used

Table 6.1.2-1 lists measuring instruments used or performance tests.

Table 6.1.2-1 List of measuring instruments for performance test

Item	Model Name
MS2690A/MS2691A/MS2692A	MS2690A/MS2691A/MS2692A Or, MS2830A
Vector signal generator with Mobile WiMAX signal generation function	MG3700A + MX370105A
3 dB attenuator × 2	

6.1.3 Setting of signal used for performance test

The signal used for performance testing must satisfy the IEEE802.16e OFDMA parameters listed below. Items marked with “*” are the same as for the MX370105A Mobile WiMAX IQproducer.

Table 6.1.3-1 IEEE802.16e OFDMA Signal Used for Performance Testing

Item	Value
FFT Size*	1024 (Bandwidth 10MHz) 2048 (Bandwidth 20MHz)
Oversampling Ratio*	2
Bandwidth*	10 MHz and 20MHz
G* (Cyclic Prefix)	1/8
Frame Duration*	5.0 ms
Roll Off Length*	0
Filter Type*	Non
Repetition Coding Indication*	None
Burst configuration	Preamble + FCH + DL-MAP + measured Downlink burst
Measured burst	Modulation 64QAM No repetition No boosting Symbol offset: 3 Symbol length: 2 Subchannel offset: 0 Number of subchannels: 30

6.2 Performance Test Items

6.2.1 Carrier frequency accuracy/residual vector error

(1) Test target standards

Carrier frequency accuracy: $\pm(\text{reference frequency accuracy} \times \text{Carrier frequency} + 20 \text{ Hz})$

Input level: -15 to +30 dBm (average power of measured signal)

Residual Vector Error:

MS2690A/MS2691A/MS2692A

CH Bandwidth 10MHz below < 0.6% (rms)

CH Bandwidth 20MHz <0.8% (rms)

MS2830A

CH Bandwidth 10MHz below <1.6% (rms)

CH Bandwidth 20MHz <1.8% (rms)

Input level: -15 to +30 dBm (average power of measured signal)

(2) Measuring instrument for test

- Vector signal generator: MG3700A + MX370105A
- 3-dB attenuator $\times 2$

(3) Setup

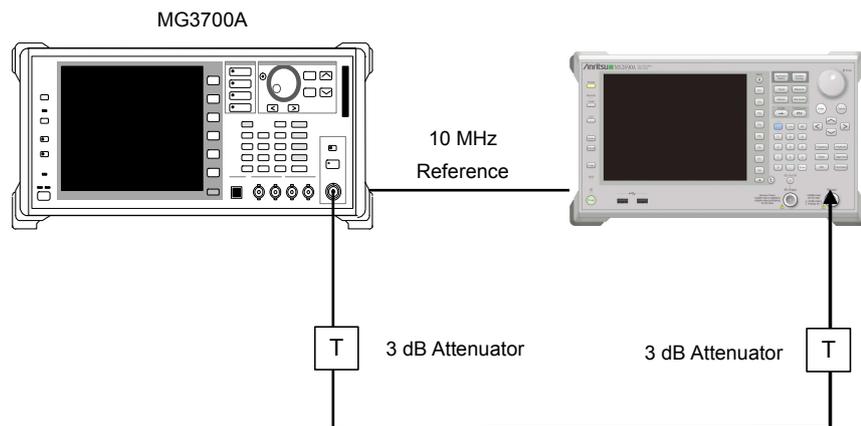


Figure 6.2.1-1 Performance test

(4) Test procedure

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

<Procedure>

1. Connect the 10 MHz Buffered Output of MG3700A to the Reference Input of this instrument.
2. Set the MG3700A as follows and enable modulation (On). Select a pattern file that satisfies the items listed in Table 6.1.3-1.
 - Frequency: 2.3 GHz
 - Level: -15 dBm
3. Set as follows for the MS2690A/MS2691A/MS2692A.
 - Center Frequency: 2.3 GHz
 - Input Level: -15 dBm
 - Freq Offset: On
 - Channel Estimation: On
 - Equalizer: Preamble Only
 - CH Tracking – Amp.: On
 - CH Tracking – Phase: On
 - Pre-Amp: Off
4. Select the Modulation (DL) screen.
5. Press  to perform measurement.
6. Adjust the output level of the MG3700A so that the DL Averaged Power reading from the measurement results on the screen are -15 dBm \pm 0.1 dB.
7. Press  to perform measurement.

When measuring the carrier frequency accuracy, select **Auto** for **Reference Signal**. When measuring the residual vector error, select **Fixed to Internal**.

Press  (System Settings) after pressing  to display the System Settings screen. Select and set Reference Signal with cursor key, and then press  (Set).

8. Set  (Symbol) to “3” to display the results for symbol number 3. Check if the values of **DL Freq. Offset** (carrier frequency accuracy) and **Total EVM (Preamble Excluded)** (residual vector error) satisfy the specifications.
9. Set the frequency of the MG3700A and MS2690A/MS2691A/MS2692A to 2.69 GHz, and repeat Steps 2 through 8.

10. Set the frequency of the MG3700A and MS2690A/MS2691A/MS2692A to 3.3 GHz, and repeat Steps 2 through 8.
11. Set the frequency of the MG3700A and MS2690A/MS2691A/MS2692A to 3.8 GHz and repeat Steps 2 through 8.

(5) Test results

Table 6.2.1-1 Carrier frequency accuracy

Frequency	Min. limit	Deviation (Hz)	Max. limit	Uncertainty	Pass/Fail
2.3 GHz	-20 Hz		+20 Hz	±1 Hz	
2.69 GHz					
3.3 GHz					
3.8 GHz					

Table 6.2.1-2 Residual Vector Error (CH Bandwidth 10MHz)

Frequency	Measured value [% (rms)]	Max. limit	Uncertainty	Pass/Fail
2.3 GHz		MS269xA 0.6 %(rms)	MS269xA 0.04 %(rms)	
2.69 GHz				
3.3 GHz		MS2830A 1.6 %(rms)	MS2830A 0.1 %(rms)	
3.8 GHz				

Table 6.2.1-3 Residual Vector Error (CH Bandwidth 20 MHz)

Frequency	Measured value [% (rms)]	Max. limit	Uncertainty	Pass/Fail
2.3 GHz		MS269xA 0.8 %(rms)	MS269xA 0.04 %(rms)	
2.69 GHz				
3.3 GHz		MS2830A 1.8 %(rms)	MS2830A 0.1 %(rms)	
3.8 GHz				

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