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ADVANTEST CORPORATION

R3681 Series OPT56 GSM/EDGE Modulation Analysis Software User's Guide

MANUAL NUMBER FOE-8440177A00

Applicable Models
R3681
R3671

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1. INTRODUCTION

This chapter describes the contents of this manual and the product overview of the R3681 series Signal Analyzer Option 56; GSM/EDGE modulation analysis software to help you get the most out of this manual.

1.1 Contents of This Manual

The contents of each chapter are as follows.

For basic operating methods, functions and the remote programming method of the signal analyzer, refer to "1.3 Other Manuals Related to This Instrument."

CHAPTER 1. INTRODUCTION	This chapter describes the contents of this manual and the product overview.
CHAPTER2. BEFORE OPERATING	This chapter describes precautions when using this instrument. Read this chapter before using this instrument.
CHAPTER 3. SETUP	This chapter describes how to setup this instrument. After setting up this instrument in an appropriate location, turn on the power and check that this instrument starts correctly.
CHAPTER 4. MEASUREMENT EXAMPLES	This chapter describes example measurements.
CHAPTER 5. MENU MAP, FUNCTION EXPLANATION	This chapter describes the menu structure and functions of soft keys.
CHAPTER 6. SCPI COMMAND REFERENCE	SCPI command reference. The command reference describes the commands in order of function. The following items are described: • Command format • Function description • Parameters • Query response
CHAPTER 7. PERFORMANCE VERIFICATION	This chapter describes the performance verification test procedures of this instrument.
CHAPTER 8. SPECIFICATIONS	This chapter describes the specifications of this instrument.
APPENDIX	Describes operation principles and the error code table.

1.2 Product Overview

The GSM/EDGE modulation analysis option is software that conducts the modulation analysis of the GSM/EDGE signal.

This option includes the following features.

- Analysis of the phase error, frequency error, and EVM (Error Vector Magnitude) which are compliant with the GSM/EDGE standard.
- Analysis of the rising edge and falling edge characteristics of the burst waveforms which are compliant with the GSM/EDGE standard.

1.3 Other Manuals Related to This Instrument

The following manuals are available for this instrument:

- User's Guide (Part Code: {ER3681SERIES/U}, English)

  Describes how to setup the R3681 Series Signal Analyzer, how to perform procedures such as, basic operations, applied measurements, and maintenance, and describes the functions, specifications of the R3681 Series Signal Analyzer.

- Programming Test Guide (Part Code: {ER3681SERIES/P}, English)

  Describes how to program the R3681 Series Signal Analyzer to automate measurement sequences and includes a remote control overview, SCPI command references, and sample application programs.

- Performance Test Guide (Part Code: {ER3681SERIES/T}, English)

  Describes how to check the performance of the R3681 Series Signal Analyzer and includes performance test procedures and specifications of the R3681 Series Signal Analyzer.

1.4 Conventions of Notation Used in This Document

In this document, hard keys, touch-screen buttons and menus are represented by the following symbols:

Hard keys
"Hard keys" are hardware keys which are on the panel.

Sample	Indicates a hard key labeled "Sample."
	Example: **START**, **STOP**

Touch-screen system menus

[Sample]	Indicates a touch-screen menu, tab, button or dialog box that is labeled "Sample" and that is selected or executed when touched.
	Example: **[File]** menu, **[Normal]** tab, **[Option]** button

Touch-screen function buttons

{Sample}	Indicates a touch-screen button labeled "Sample."
	Example: **{FREQ}** button, **{SWEEP}** button

Touch-screen side menu

Sample	Indicates a touch-screen side menu labeled "Sample."
	Example: **Center** key, **Span** key

Touch-screen system menu key operation

[File]→[Save As...]	Indicates that you need to touch the **[File]** menu and then select **[Save As...]**.

Sequential key operation

{FREQ}, **Center**	Indicates that you need to touch the **{FREQ}** button and then touch the **Center** key.

Toggle key operation

ΔMarker On/Off (On)	Indicates that you need to touch the **ΔMarker On/Off** key to turn on the ΔMarker.

*NOTE: **Screen displays and diagrams such as external view of the main unit in this manual are those of the R3681 in the R3681 series.***

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2. BEFORE OPERATING

This chapter describes precautions when using this instrument. Read this chapter before using this instrument.

2.1 If a Fault Occurs

If any smoke, smell, or noise emanates from this instrument, turn off the MAIN POWER switch, remove the power cable from the AC power connector, and then contact an Advantest sales representative immediately.

2.2 Removing the Case

The case of this instrument should only be opened by Advantest service engineers.

WARNING: ***This instrument contains high-voltage and high temperature parts which may cause electrical shocks or burns.***

2.3 Overcurrent Protection

This instrument is protected from overcurrent flow by a power breaker. Located on the rear panel, the power breaker automatically interrupts the power supply when an overcurrent flows through this instrument. When the power breaker has turned off, turn off the power supply and disconnect the power cable from the AC power. Then, call upon your dealer or us for repair services to fix a possible fault that has occurred in this instrument.

2.4 Hard Disk Drive

This instrument has a built-in hard disk drive. When handling the hard disk drive, take notice of these instructions.

- Do not cause impact or vibration damage to the hard disk drive.
  Damaging the disk increasing the chances of the disk malfunctioning or failing during operation.
- Do not switch off this instrument while the HDD access lamp is lit.
  The data being accessed may become corrupt.

NOTE: ***We do not assume any responsibility for the loss or corruption of data stored on the hard disk drive that might result from the disk becoming damaged.***

2.5 Handling the Touch Screen

Because the touch screen is included in this instrument, be careful of the following:

- Avoid giving strong impact or excessive force to the screen.
  The glass screen may become damaged.
- Use the stylus pen included with this instrument to operate the screen. Using a tool with a hard-point (such as a mechanical pencil or ballpoint) may scratch the screen surface.

2.6 To Avoid Disrupting the Software Environment

This instrument includes Microsoft Windows XP Embedded.

Because the functions of this instrument depend on the Windows environment, do not alter the Windows environment in any way other than described in this manual.
This instrument is not a data processor. Only perform the operations which are described in this manual.

1. Non-permitted actions:
   - Installing other application programs
   - Changing or deleting items in the control panel (except for those procedures described in "A.2 Installing the Printer Driver" and "A.3 Setting up the Network" in R3681 Series User's Guide)
   - Opening or changing existing files in C drive
   - Starting or operating other application programs during measurement
   - Upgrading the Windows operating system
   - If this instrument operates incorrectly after an application is installed, the Windows operating system must be reinstalled. Contact Advantest and request a sales representative to reinstall the system.
   - For more information on the system recovery procedure, refer to section 8.7, "System Recovery Procedure" in the R3681 Series User's Guide.
2. Computer viruses

   Depending on how the operating environment is used, the system may become infected by a computer virus.

   To prevent any infections, we recommend the following counter measures:
   - Checking for viruses before loading a file or inserting any media from an outside source.
   - Make sure that all networks have been checked for viruses before connecting.

   Steps to take if this instrument becomes infected by a computer virus
   - We recommend that the system be reinstalled. Contact Advantest and request a sales representative to reinstall the system.
     For more information on the system recovery procedure, refer to section 8.7, "System Recovery Procedure" in the R3681 Series User's Guide.

2.7 Note on Transportation

When carrying this instrument, be careful of the following:

- If using this instrument on a cart, secure both this instrument and the cart with a belt.

2.8 Electromagnetic Interference

This instrument may cause electromagnetic interference and affect television and radio. If this instrument's power is turned off and any electromagnetic interference that may be present is reduced, then this instrument has caused the interference.

Electromagnetic interference from this instrument may be prevented by the following precautions.

- Changing the direction of the antenna of the television or radio.
- Placing this instrument on the other side of the television or radio.
- Placing this instrument away from the television or radio.
- Using a different power source for the television or radio, and this instrument.

2.9 Before Turning On

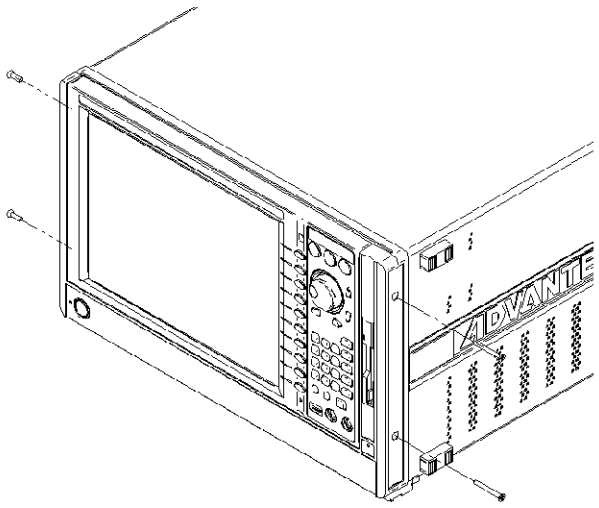
Do not connect a DUT to this instrument when turning on.

2.10 Removing and Attaching the Front Panel

This instrument can be used separately after removing the panel.
When removing the panel, take notice of these instructions.

MEMO: ***To use this instrument after removing the panel, a connecting cable is required (sold separately).***

- If this instrument's power is turned on, make sure that this instrument has stopped operating, turn off the power, and remove the power cable.
- When removing or attaching the panel, take care not to catch your fingers.
- Place this instrument on a flat and steady table when removing or attaching the panel.
- Remove the four screws that are exposed on the side of the front panel of this instrument.
- When removing the screws, steady the panel so that it will not fall.
- After all four screws have been removed, pull the panel forward.
- Remove the cable connecting the panel to the instrument.
- Replace the cable with an appropriate cable.
- If any screws become lost, use the following types of screw.
  - For the 2 screws on the key side: flat-head Phillips screws M4X35 (steel or stainless steel)
  - For the 2 screws on the liquid-crystal display: flat-head Phillips screws M4X14 (steel or stainless steel)



2.11 Restrictions Imposed when Using Windows XP

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3. SETUP

This chapter describes how to set up this instrument on delivery. Topics covered in this chapter are:

- 3.1 Inspection on Delivery
- 3.2 Installation Environment
- 3.3 Connection of Accessories
- 3.4 Power Supply
- 3.5 Checking Operations

3.1 Inspection on Delivery

After receiving the product, inspect the outside and the accessories according to the following procedure.

1. Check that the shipping container and the cushioning material are not damaged.

   IMPORTANT: ***If the shipping container or the cushioning material is damaged, keep them until the following inspections are complete.***

2. Check that the outside of the product is not damaged.

   WARNING: ***If any outside components of the product such as the cover, panel (front or rear), LCD display, power switch, or connector are damaged, do not turn on the power. You may receive an electrical shock.***

3. Check that the standard accessories listed in Table 3-1 are complete and they are not damaged.

If any of the following occur, contact an Advantest sales representative.

- The shipping container or the cushioning material is damaged, or signs of stress are found.
- The outside of the product is damaged.
- The standard accessories are incomplete or are damaged.
- Defects are found in the operation check.

Table 3-1 Standard Accessories

Name	Model	Quantity	Remarks
R3681 Series OPT56 User's Guide	ER3681OPT56	1	English

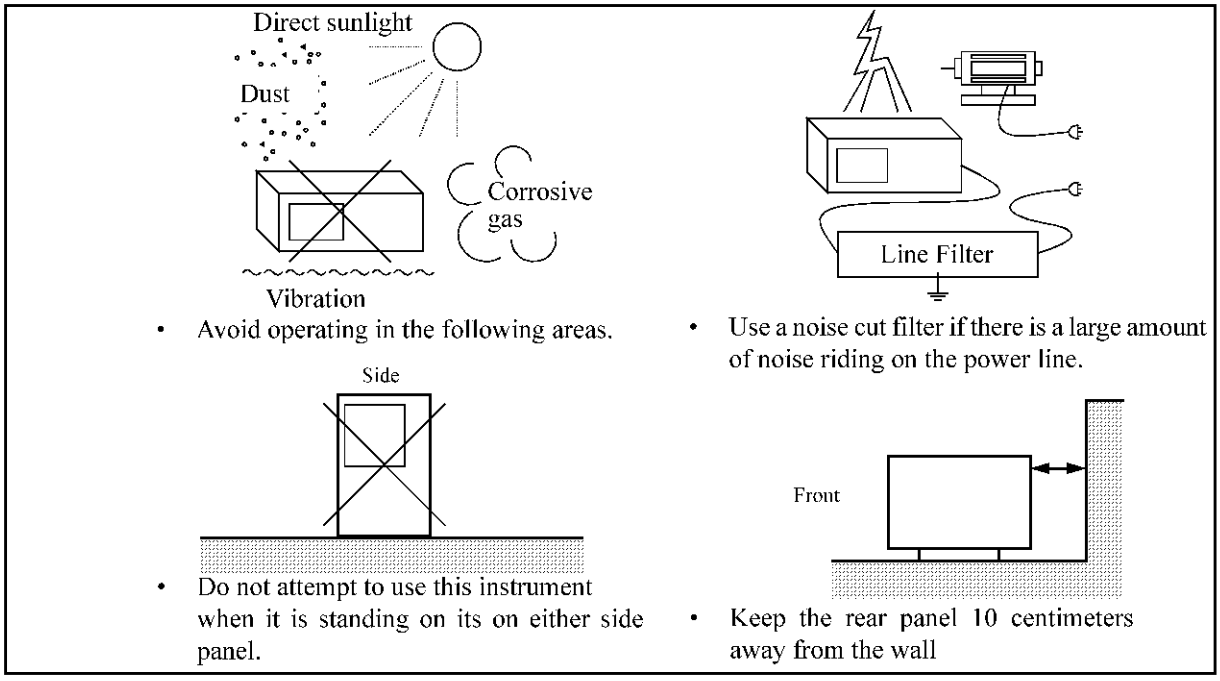
3.2 Installation Environment

This section describes the environment into which this instrument should be installed.

3.2.1 Operating Environment

Install this instrument in an environment in which the following conditions are satisfied.

- Ambient temperature: +5 °C to +40 °C (operating temperature)
  -20 °C to +60 °C (storage temperature)
- Relative humidity: 80 percent or less with no condensation
- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- A low noise area
  Although this instrument has been designed to withstand a certain amount of noise from the AC power line, it should be used in a low noise area.
  Use a noise cut filter if ambient noise is unavoidable.
- An area in which the airflow is not obstructed
  There is an exhaust-cooling fan on the rear panel and exhaust vents on both sides of this instrument. Do not block the fan and these vents. If there is insufficient exhaust, the internal temperature will rise and the instrument may operate incorrectly. Keep a space of 10 centimeters between the rear panel and the wall. Do not use this instrument on its side.



- Avoid operating in the following areas.
- Use a noise cut filter if there is a large amount of noise riding on the power line.
- Do not attempt to use this instrument when it is standing on its on either side panel.
- Keep the rear panel 10 centimeters away from the wall

Figure 3-1 Operating Environment

3.2.2 Protecting Against Electrostatic Discharge

To prevent semiconductors from being damaged by electrostatic discharge (ESD), the precautions shown below should be taken. We recommend combining two or more countermeasures to prevent damage from ESD.
(Static electricity can be generated easily by the movement of a person or the friction against insulation.)

Table 3-2 ESD Countermeasures

Human Body	Use a wrist strap (See Figure 3-2).
Work floor	Install a conductive mat, use conductive shoes, and connect to earth (See Figure 3-3).
Workbench	Install a conductive mat and connect to earth (See Figure 3-4).

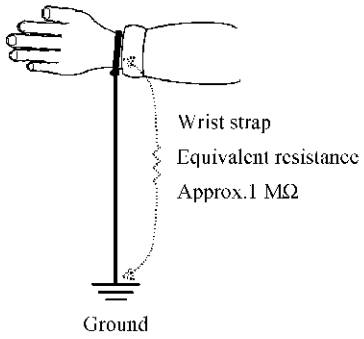


Figure 3-2 Countermeasures for Static Electricity from the Human Body

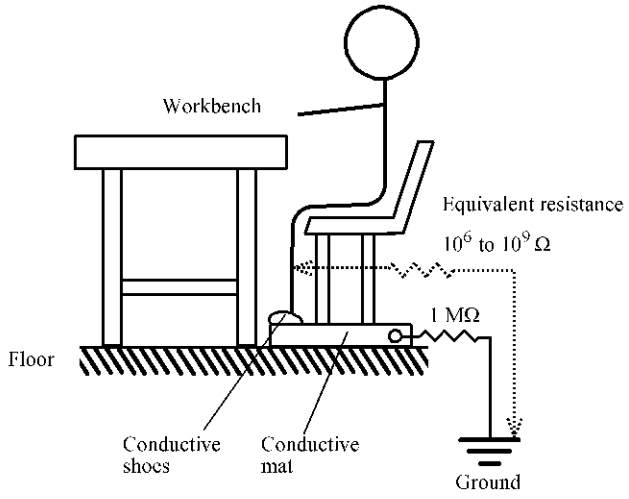


Figure 3-3 Countermeasures for Static Electricity from the Work Floor

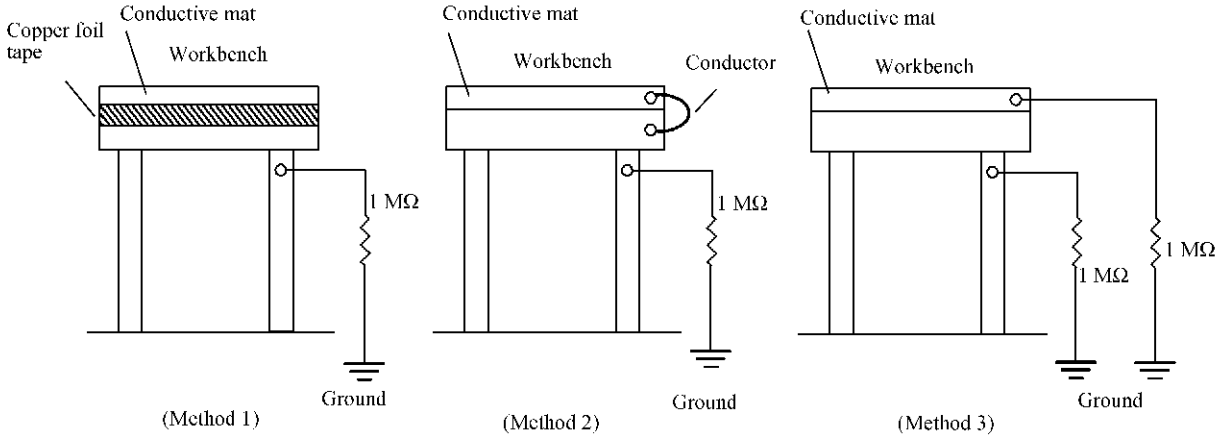


Figure 3-4 Countermeasures for Static Electricity from the Workbench

3.3 Connection of Accessories

This section describes how to connect the accessories required to operate this unit.

3.3.1 Caution when Connecting Peripherals

Plug the keyboard and mouse into their respective front-panel connectors before turning on this instrument.

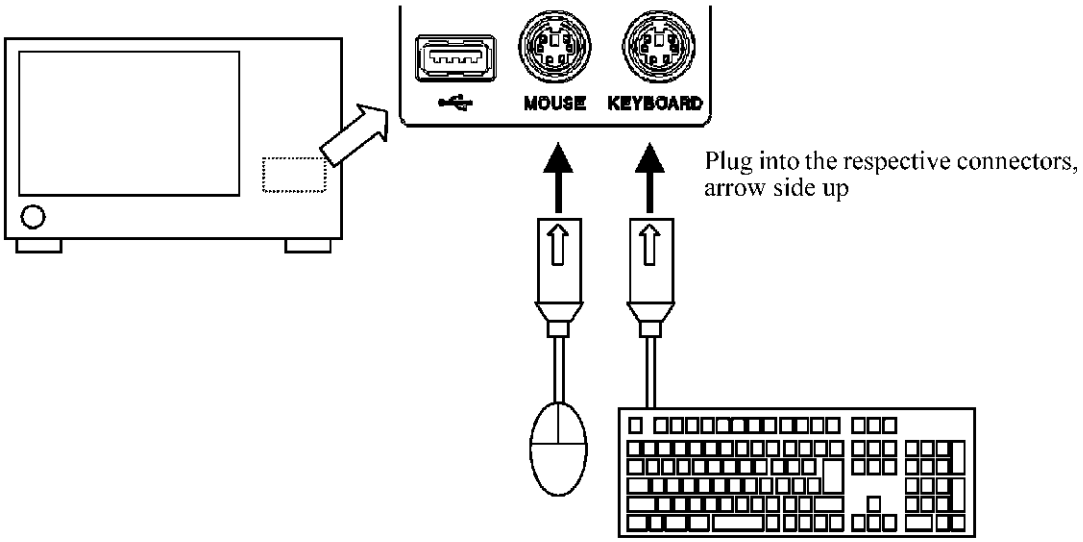


Figure 3-5 Connecting the Keyboard and Mouse

3.4 Power Supply

This section describes power requirements and how to connect the power cable.

3.4.1 Power Requirements

The power requirements of this instrument are shown in Table 3-3. Check that the power supply, which satisfies the conditions shown in Table 3-3, is supplied to this instrument.

Table 3-3 Power Requirements

	100 V AC	200 V AC	Remarks
Input voltage range	90 V-132 V	198 V-250 V	Automatically switches the input voltage between 100 V AC and 200 V AC.
Frequency range	47 Hz-63 Hz		
Power consumption	450 VA or less		

WARNING: ***Make sure the power supply, which satisfies the power requirements, is supplied to this instrument. If the power requirements are not satisfied, this instrument may be damaged.***

3.4.2 Connecting the Power Cable

This instrument includes a three-core power cable with a grounding conductor. To prevent accidents caused by electric shocks, use the included power cable and securely connect to the ground through a three-pin power outlet.

1. Check that the included power cable is not damaged.

   WARNING: ***Never use a damaged power cable. You may receive an electrical shock.***

2. Connect the AC power connector on the rear panel of this instrument to a three-pin power outlet that has a protected ground terminal by using the included power cable (see Figure 3-6).

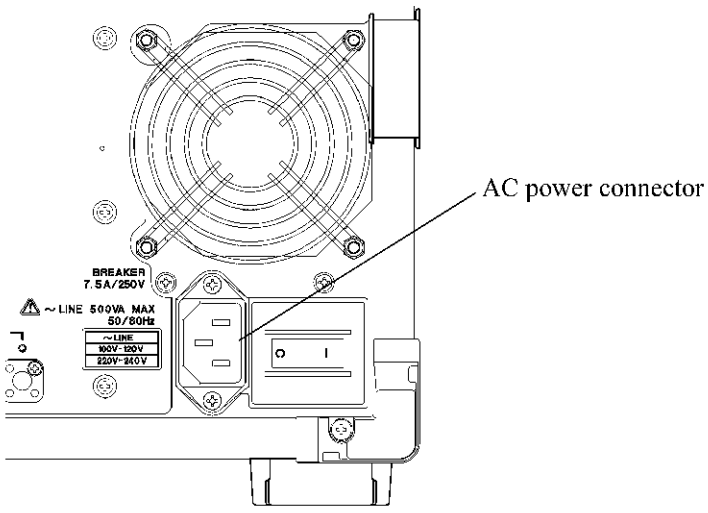


Figure 3-6 Connecting the Power Cable

WARNING:

1. ***Use a power cable that is suitable for the power supply voltage. Use a power cable that complies with safety standards of your country (Refer to "Safety Summary").***
2. ***To prevent any danger of electrical shock, connect the power cable to a three-pin power outlet that is connected to a protected ground terminal. The instrument will not be grounded if an extension cord, which does not include a protected ground terminal, is used.***

3.5 Checking Operations

This section describes how to check operations by using the auto-calibration function of this instrument. Check that this instrument operates correctly by following the procedure below.

Starting this instrument

1. Connect the power cable according to "3.4.2 Connecting the Power Cable."
2. Turn on the MAIN POWER switch on the rear panel.
   After turning on the MAIN POWER switch, wait for three seconds or more.
3. Press the **POWER** switch to turn on the instrument.

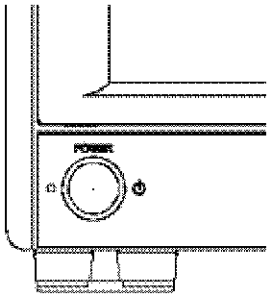


Figure 3-7 **POWER** switch

NOTE:

1. ***If the power supply of this instrument is abruptly disconnected, such as by pulling the power cable out of position, while the instrument is operating, Scandisk launches the next time this instrument starts because the internal flash memory may become damaged.***
2. ***Scandisk***
   If the power of this instrument is turned off without being shut down, Scandisk launches automatically. Do not abort Scandisk while it is running. If Scandisk detects any faulty clusters, follow the displayed messages and take the appropriate action. The software in this instrument starts automatically after Scandisk is complete.

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4. The power-on diagnostic program starts the self-diagnostic.
   The self-diagnostic takes approximately one minute to complete.
5. The initial screen shown in Figure 3-8 is displayed if no faults are detected in this instrument during the self-diagnostic.
   The initial screen display may differ from Figure 3-8 depending on the status of the settings when the power supply was last turned off.

MEMO: If any error message is displayed as a result of the self-diagnostic, refer to Chapter 8, "MAINTENANCE" of R3681 Series User's Guide.

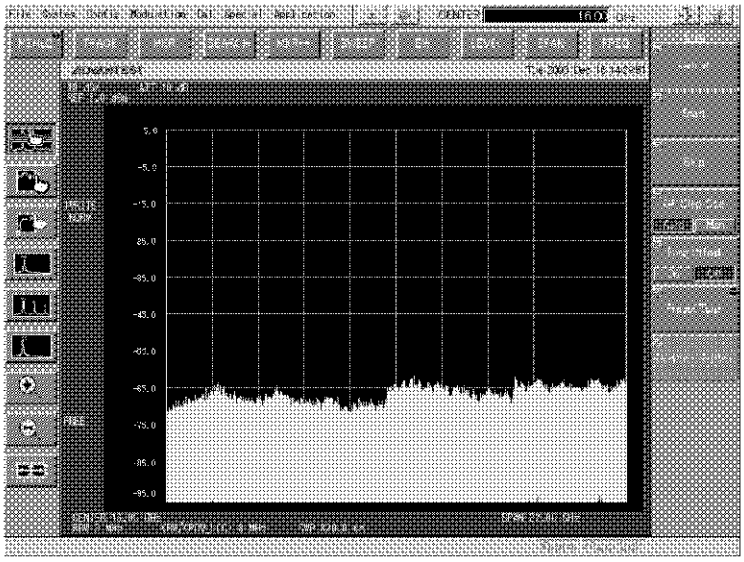


Figure 3-8 Initial Screen

Performing autocalibration

6. <R3681>
Install this instrument as shown in Figure 3-9 by using the SMA (f)-SMA (f) adapter, SMA (m)-BNC (f) adapter, and input cable (A01261-30) that come with this instrument as standard.

<R3671>
Hook up this instrument as shown in Figure 3-9 by using the N (m)-BNC (f) adapter, and input cable (A01261-30) that come with this instrument as standard.

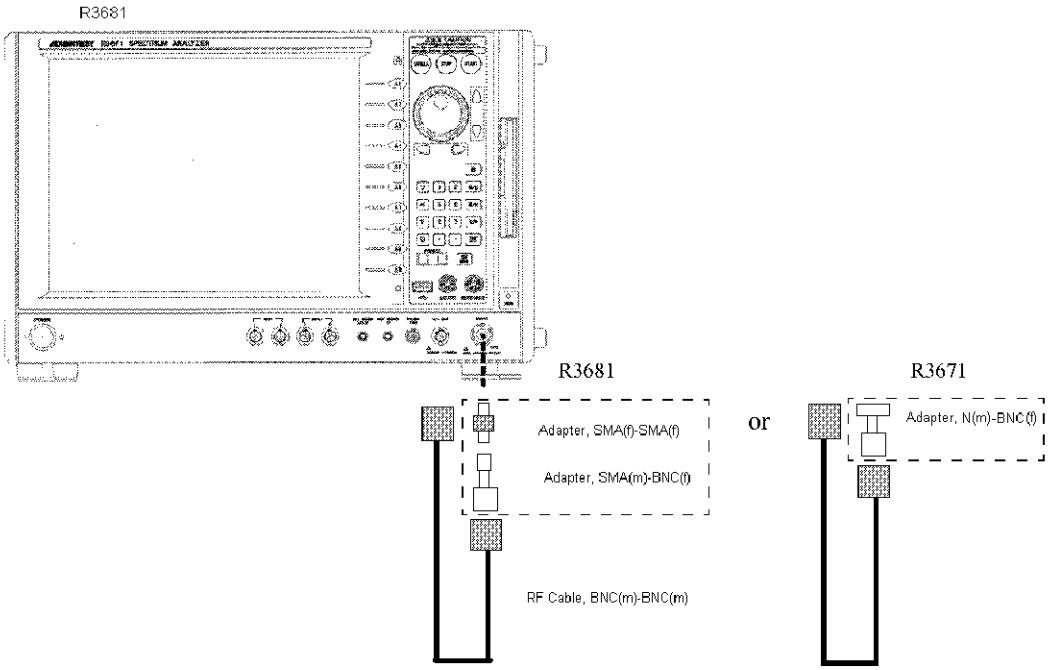


Figure 3-9 Autocalibration

IMPORTANT: ***Allow this instrument to warm up for at least 30 minutes before running the autocalibration. For more information on how to use the autocalibration, refer to Section 4.3.1, "Autocalibration" of the R3681 Series User's Guide.***

7. Touch the **[Cal]** button on this instrument's menu bar to select **[SA Cal]** from the dropdown menu.
8. Autocalibration starts.
   It takes approximately one minute to complete the autocalibration.
9. Check that no error message is displayed as a result of the autocalibration.

MEMO: ***Refer to Chapter 8, "MAINTENANCE" of the R3681 Series User's Guide if error messages are displayed as a result of the autocalibration.***

Turning off the power supply

10. Press the **POWER** switch.
    The system shuts down and the power of the instrument turns off automatically.

4. MEASUREMENT EXAMPLES

This chapter describes how to use this option by using specific measurement examples.

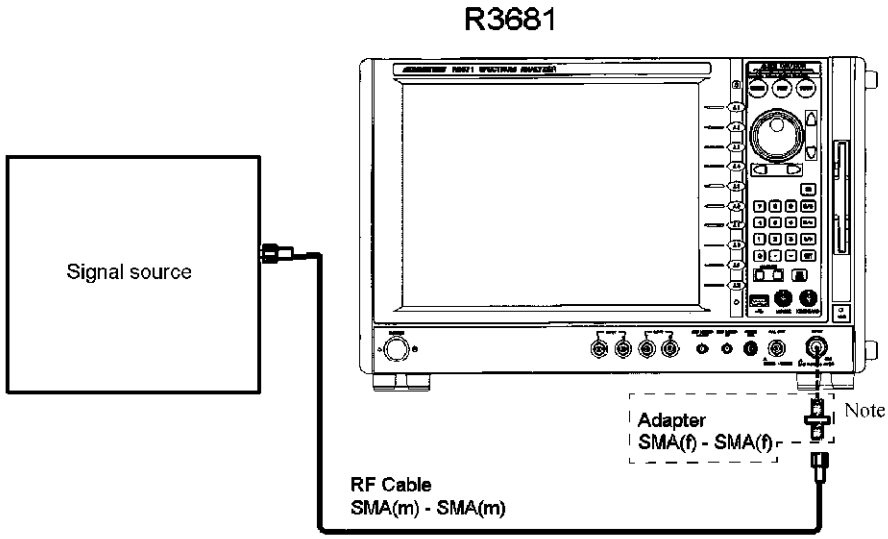
4.1 Modulation Accuracy Measurement

The modulation accuracy, which is compliant with the standard, can be measured by using Modulation Analysis Mode.

[Specifications of the measured signal]

Compliant standard:	GSM (GMSK modulation)
Center frequency:	870.4 MHz
Synchronous word:	TSC0

[Connections]



Note: The R3671 uses the N(m)-SMA(f) adapter.

Figure 4-1 Modulation Accuracy Measurement Connection Diagram

[Setting the measurement conditions]

1. Touch **[Config]** on the menu bar and select **[Modulation Analyzer]**.

2. Touch **[Modulation]** on the menu bar and select **[GSM/EDGE]**.
3. Touch the **{FREQ}** button on the function bar.
4. Touch the **Center** key on the soft menu bar.
5. Press **8**, **7**, **0**, **.**, **4**, and **M/n** in this order on the keypad.
   The center frequency is set to 870.4 MHz.
6. Touch the **{TRIGGER}** button on the function bar.
7. Touch the **Trigger Source** key on the soft menu bar.
8. Touch the **Free Run** key on the soft menu bar.
   The trigger source is set to the internal trigger.
9. Touch the **{INPUT}** button on the function bar.
10. Touch the **Input Setup** key on the soft menu bar.
    The **[Input Setup]** dialog box appears.
11. Set **[Input]** in the **[Input Setup]** dialog box to **[RF]**.
12. Set the **[IQ Inverse]** option button in the **[Input Setup]** dialog box to **[OFF]**.

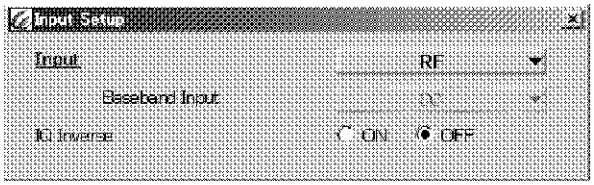


Figure 4-2 **[Input Setup]** Dialog Box

13. Touch the close button in the **[Input Setup]** dialog box to close the dialog box.
14. Touch the **{MEAS MODE}** button on the function bar.
15. Touch the **Modulation Analysis** key on the soft menu bar.
16. Touch the **{LEVEL}** button on the function bar.
17. Touch the **Auto Level Set** key on the soft menu bar.
    The Ref Level is automatically set to the optimum value.
18. Touch the **{MEAS SETUP}** button on the function bar.
19. Touch the **Meas Parameters** key on the soft menu bar.
    The **[Measurement Parameters Setup]** dialog box appears.
20. Touch the **[Meas Parameter]** tab in the **[Measurement Parameters Setup]** dialog box.
21. Set **[Modulation]** in the **[Meas Parameter]** tab to **[GMSK]**.

22. Set **[Meas Signal]** in the **[Meas Parameter]** tab to **[BURST]**.
23. Set the **[Burst Search]** option button in the **[Meas Parameter]** tab to **[ON]**.
24. Touch the **[Search Threshold]** text box in the **[Meas Parameter]** tab and press [-], [2], [0], and [ENT] on the keypad.
25. Set the **[Burst Type]** in the **[Meas Parameter]** tab to **[NORMAL BURST]**.
26. Set the **[Sync Type]** in the **[Meas Parameter]** tab to **[SYNC WORD]**.
27. Set **[TSC]** in the **[Meas Parameter]** tab to **[0]**.
    The training sequence code of TSC0 is displayed in **[Sync Sequence]**.
28. Set the **[Half Symbol Shift]** option button in the **[Meas Parameter]** tab to **[OFF]**.

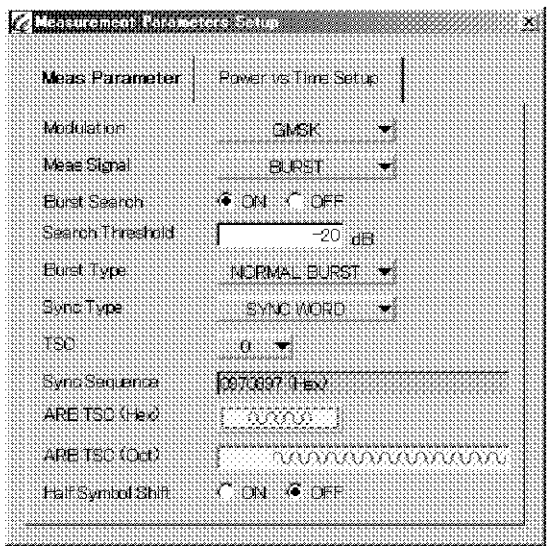


Figure 4-3 **[Measurement Parameters Setup]** Dialog Box - **Meas Parameter** Tab

29. Touch the close button [X] in the **[Measurement Parameters Setup]** dialog box to close the dialog box.
30. Press the [SINGLE] button on the front panel.
    The Single measurement is executed, and the measurement results are displayed.

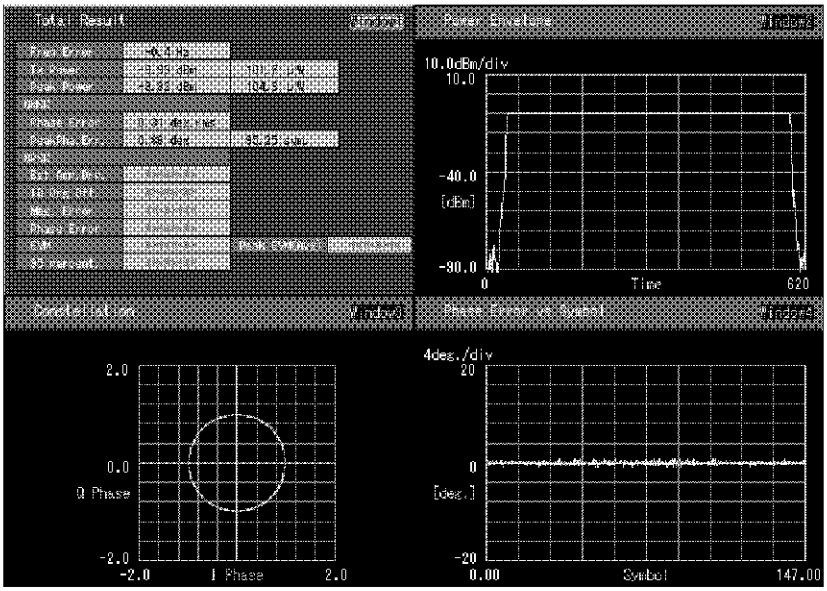


Figure 4-4 Modulation Accuracy Measurement Results

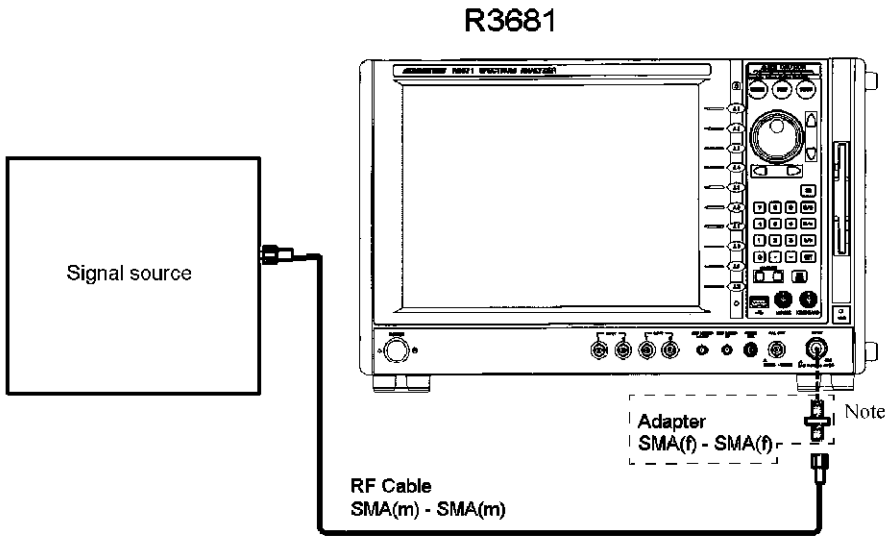
4.2 Power vs Time Measurement

The rising edge and falling edge characteristics of the burst waveforms can be measured by using Power vs Time Mode.

[Specifications of the measured signal]

Compliant standard:	GSM(GMSK modulation)
Center frequency:	870.4 MHz
Synchronous word:	TSC0

[Connections]



Note: The R3671 uses the N(m)-SMA(f) adapter.

Figure 4-5 Power vs Time Connection Diagram

[Setting the measurement conditions]

1. Touch **[Config]** on the menu bar and select **[Modulation Analyzer]**.
2. Touch **[Modulation]** on the menu bar and select **[GSM/EDGE]**.
3. Touch the **{FREQ}** button on the function bar.
4. Touch the **Center** key on the soft menu bar.

5. Press [8], [7], [0], [.], [4], and [M/n] in this order on the keypad.
   The center frequency is set to 870.4 MHz.
6. Touch the **{TRIGGER}** button on the function bar.
7. Touch the **Trigger Source** key on the soft menu bar.
8. Touch the **Free Run** key on the soft menu bar.
   The trigger source is set to the internal trigger.
9. Touch the **{INPUT}** button on the function bar.
10. Touch the **Input Setup** key on the soft menu bar.
    The **|Input Setup|** dialog box appears.
11. Set **[Input]** in the **[Input Setup]** dialog box to **[RF]**.
12. Set the **[IQ Inverse]** option button in the **|Input Setup|** dialog box to **|OFF|**.

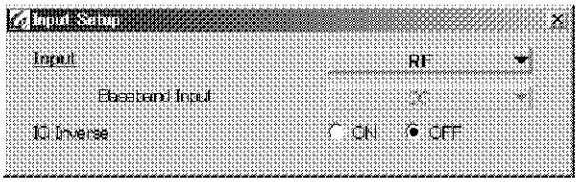


Figure 4-6 **[Input Setup]** Dialog Box

13. Touch the close button ✕ in the **[Input Setup]** dialog box to close the dialog box.
14. Touch the **{MEAS MODE}** button on the function bar.
15. Touch the **Power vs Time** key on the soft menu bar.
16. Touch the **{LEVEL}** button on the function bar.
17. Touch the **Auto Level Set** key on the soft menu bar.
    The Ref Level is automatically set to the optimum value.
18. Touch the **{MEAS SETUP}** button on the function bar.
19. Touch the **Meas Parameters** key on the soft menu bar.
    The **|Measurement Parameters Setup|** dialog box appears.
20. Touch the **[Meas Parameter]** tab in the **[Measurement Parameters Setup]** dialog box.
21. Set **[Modulation]** in the **|Meas Parameter|** tab to **[GMSK]**.
22. Set **[Meas Signal]** in the **[Meas Parameter]** tab to **[BURST]**.
23. Set the **[Burst Search]** option button in the **[Meas Parameter]** tab to **|ON|**.

24. Touch the **[Search Threshold]** text box in the **[Meas Parameter]** tab and press [-], [2], [0], and [ENT] on the keypad.
25. Set the **[Burst Type]** in the **[Meas Parameter]** tab to **[NORMAL BURST]**.
26. Set the **[Sync Type]** in the **[Meas Parameter]** tab to **[SYNC WORD]**.
27. Set **[TSC]** in the **[Meas Parameter]** tab to **[0]**.
    The code of TSC0 is displayed in **[Sync Sequence]**.
28. Set the **[Half Symbol Shift]** option button in the **[Meas Parameter]** tab to **[OFF]**.

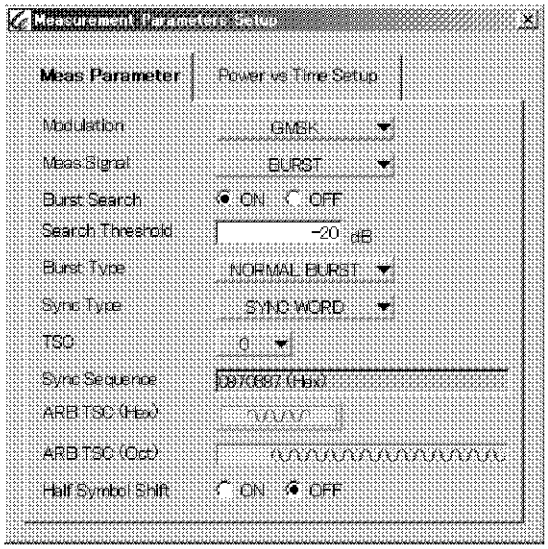


Figure 4-7 **[Measurement Parameters Setup]** Dialog Box - **Meas Parameter** Tab

29. Touch the **[Power vs Time Setup]** tab in the **[Measurement Parameters Setup]** dialog box.
30. Set **[Link]** in the **[Power vs Time Setup]** tab to **[DOWN LINK]**.
31. Set **[Freq Band]** in the **[Power vs Time Setup]** tab to **[GSM900]**.
32. Touch the **[Power Level]** text box in the **[Power vs Time Setup]** tab and press [0] and [ENT] on the keypad.
33. Set the **[Consecutive Template]** option button in the **[Power vs Time Setup]** tab to **[OFF]**.

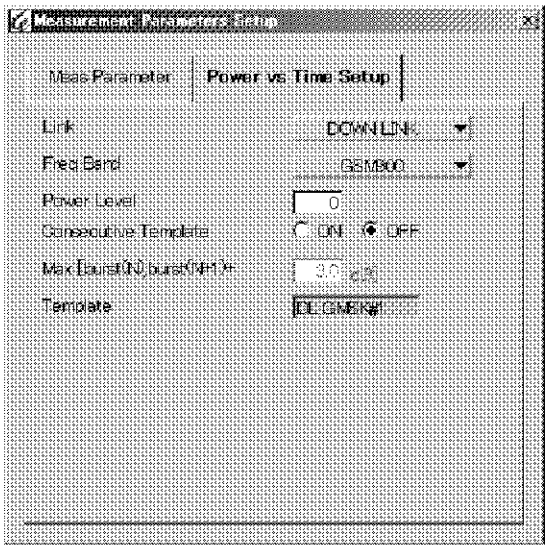


Figure 4-8 **[Measurement Parameters Setup]** Dialog Box - **Power vs Time Setup** Tab

34. Touch the close button ✕ in the **[Measurement Parameters Setup]** dialog box to close the dialog box.

35. Touch the **Template Entry** key on the soft menu bar.
    The **[Template Entry]** dialog box appears.

36. Touch the **[Set to Default]** button in the **[Template Entry]** dialog box.
    Template is set to the values which are defined by the standard.

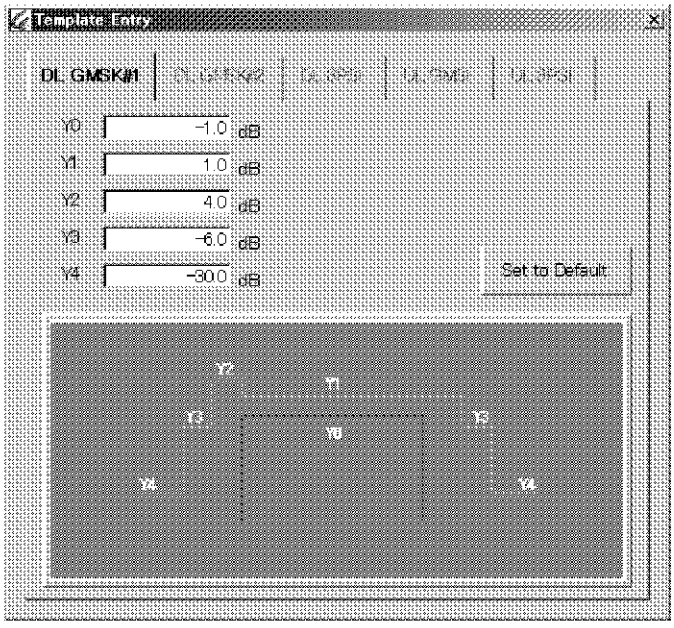


Figure 4-9 **[Template Entry]** Dialog Box

37. Touch the close button in the **[Template Entry]** dialog box to close the dialog box.

38. Press the **SINGLE** button on the front panel.
    The Single measurement is executed, and the measurement results are displayed.

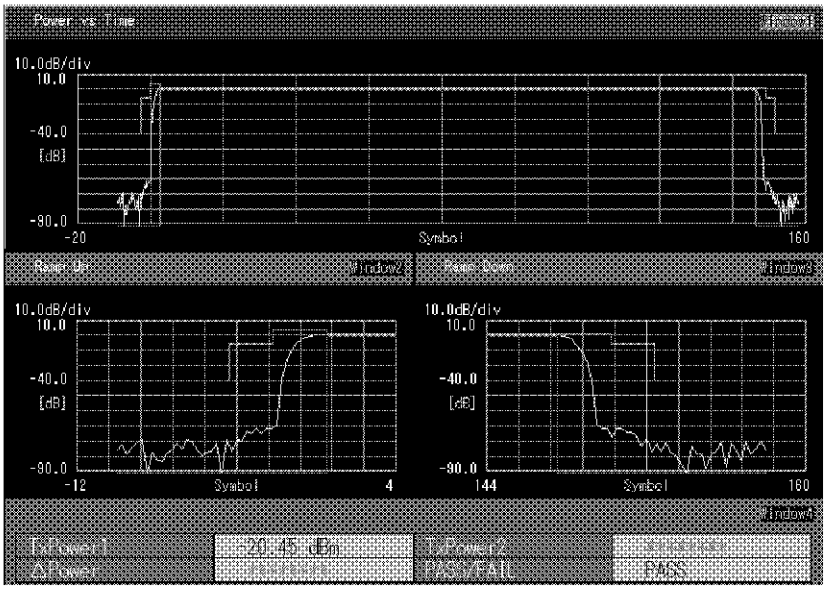


Figure 4-10 Power vs Time Measurement Results

5. MENU MAP, FUNCTION EXPLANATION

This chapter describes the configurations and functions of the soft keys displayed on the touch screen of the GSM/EDGE modulation analysis option.

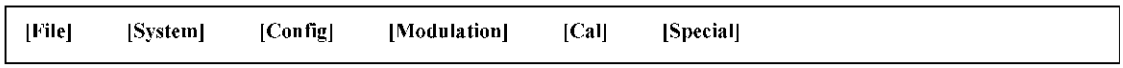
MEMO:

- ***|.....| Used to enclose a menu name, key name, item name in the dialog box, button name, or the name of selected items in lists and menus.***
- ***{....} Shows a function button on the function bar.***
- ***Shows a soft key on the soft menu bar.***
- ***A dialog box is surrounded by a broken line.***
- ***Operations are supposed to be made through the touch screen and "touch" means to press a button or a key.***

5.1 Menu Index

5.2 Switching Communication Systems

The menu bar of this option is arranged as follows:



The menu bar consists of the same items as those of Spectrum Analyzer.

Select **[Modulation Analyzer]** from **[Config]** on the menu bar to select a modulation analysis function.

Select **[GSM/EDGE]** from **[Modulation]** on the menu bar to select the GSM/EDGE modulation analysis function.

5.3 Function Bar

This section describes the functions of each function button displayed on the function bar. The configuration of the function buttons of this option is as follows:

If you click a function button on the function bar, the relevant soft keys are displayed on the soft menu bar.

5.4 Soft Menu Bar

The area located on the right-hand side of the screen and in which soft keys are displayed is called the soft menu bar.

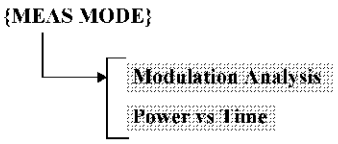
If you touch a button on the function bar, the relevant soft keys are displayed on the soft menu bar.

5.5 Function Description of Each Key

This section describes the function of each key.

5.5.1 {MEAS MODE}

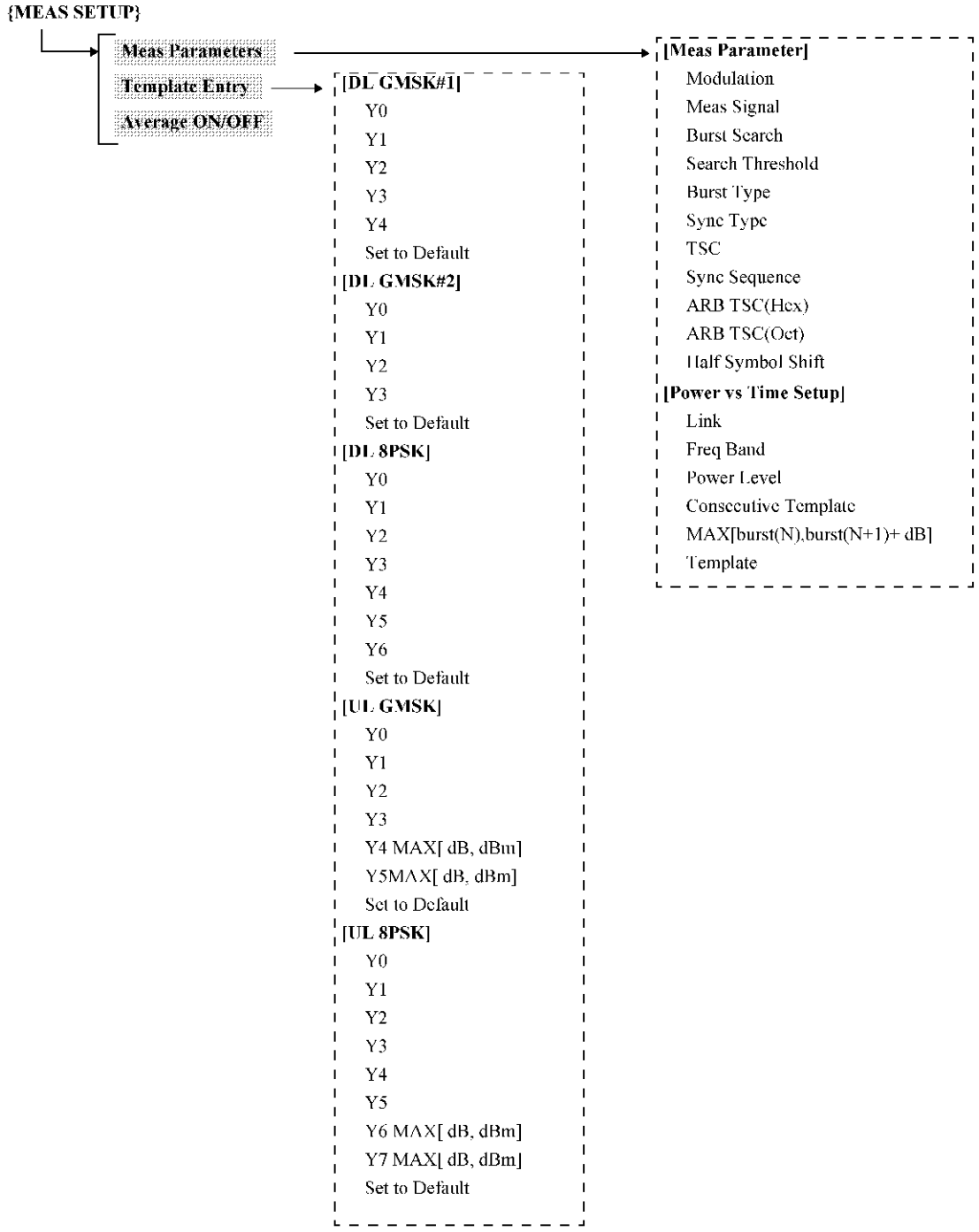
If you touch the **{MEAS MODE}** button, the soft keys related to the measurement mode switching are displayed on the soft menu bar.



Modulation Analysis	If you touch the **Modulation Analysis** key, the measurement mode enters to the modulation accuracy measurement mode.
Power vs Time	If you touch the **Power vs Time** key, the measurement mode enters to the rising edge and falling edge measurement mode.

5.5.2 {MEAS SETUP}

If you touch the **{MEAS SETUP}** button, the soft keys which are related to the analysis parameter setting are displayed on the soft menu bar.



Meas Parameters If you touch the **Meas Parameters** key, the dialog box used to set the measurement conditions appears.

[Meas Parameter] Sets the conditions of the signal.

[Modulation] Selects the modulation system of the signal.

GMSK: Selects the GMSK modulation system.

8PSK: Selects the 8PSK modulation system.

[Meas Signal] Selects the type of the signal.

BURST: Select BURST when measuring the burst signal.

CONTINUOUS:
Select CONTINUOUS when measuring the continuous signal.

[Burst Search] Select whether to search for the burst in the acquired data by the software.

ON: The software searches for the burst.

OFF: The software does not search for the burst.

MEMO: ***Even if Burst Search is set to OFF when TRIGGER is set to Free Run, the software searches for the burst automatically.***

[Search Threshold] Sets the threshold when the software searches for the burst.

|Burst Type| Selects the burst type when GMSK is selected in **|Modulation|**.

NORMAL BURST:
Selects the normal burst.

ACCESS BURST:
Selects the access burst.

|Sync Type| Sets whether to perform a measurement synchronized with SYNC WORD.

SYNC WORD:
Performs a measurement which is synchronized with SYNC WORD.

NO SYNC WORD:
Performs a measurement which is not synchronized with SYNC WORD.

MEMO: ***To detect the position of the burst that complies with the standard synchronize the measurement with SYNC WORD.***

[TSC] Sets Sync Word.

0/1/2/3/4/5/6/7:
Selects the training sequence code.

ALL If any of the training sequence codes of the acquired data are in the range of 0 and 7, perform a synchronized measurement.

ARB Synchronizes with the user-defined training sequence code.

[Sync Sequence] Displays the selected training sequence code.

[ARB TSC(Hex)] Enter the user-defined training sequence code in hexadecimal when GMSK is selected in **[Modulation]**. Valid only when ARB is selected in **[TSC]**.

[ARB TSC(Oct)] Enter the user-defined training sequence code in octal when 8PSK is selected in **[Modulation]**. Valid only when ARB is selected in **[TSC]**.

[Half Symbol Shift] Shifts the half symbol from the definition of the symbol point (bit point) to analyze. Available only for GMSK signal.

[Power vs Time Setup] Sets the conditions for the Power vs Time measurement.

[Link] Selects either UP LINK or DOWN LINK to set the template in the Power vs Time measurement.

UP LINK:
Selects UPLINK.

DOWN LINK:
Selects DOWNLINK.

[Freq Band] Selects the frequency band to set the template in the Power vs Time measurement.

GSM400/GSM700/GSM850/GSM900/DCS1800/PCS1900

[Power Level] Selects the power level to set the template in the Power vs Time measurement.

[Consecutive Template]
Measures the rising edge and falling edge characteristics of the continuous burst signal.

ON: Measures the rising edge and falling edge of the continuous burst signal.

OFF: Measures only one burst signal.

[MAX[burst(N),burst(N+1)+ dB]]
Sets the template of the guard period for two continuous bursts. The larger of either "the power of the first burst" or "the power of next burst + X" is selected as the template of the guard period. Sets the X value.
Valid only when **[Consecutive Template]** is set to ON.

[Template] Displays the selected template name.

Template Entry If you touch the **Template Entry** key, the dialog box used to set the template in the Power vs Time measurement appears. Only the template displayed in **[Template]** of **[Power vs Time Setup]** is valid.

[DL GMSK#1] Sets the DOWN LINK template of the GMSK modulation.

[Y0] Sets the Y0 value of the template.

[Y1] Sets the Y1 value of the template.

[Y2] Sets the Y2 value of the template.

[Y3] Sets the Y3 value of the template.

[Y4] Sets the Y4 value of the template.

[Set to Default] Sets the default values to Y0 to Y4.

[DL GMSK#2] Sets the DOWN LINK template of the GMSK modulation for PCS1900.

[Y0] Sets the Y0 value of the template.

[Y1] Sets the Y1 value of the template.

[Y2] Sets the Y2 value of the template.

[Y3] Sets the Y3 value of the template.

[Set to Default] Sets the default values to Y0 to Y3.

[DL 8PSK] Sets the DOWN LINK template of the 8PSK modulation.

[Y0] Sets the Y0 value of the template.

[Y1] Sets the Y1 value of the template.

[Y2] Sets the Y2 value of the template.

[Y3] Sets the Y3 value of the template.

[Y4] Sets the Y4 value of the template.

[Y5] Sets the Y5 value of the template.

[Y6] Sets the Y6 value of the template.

[Set to Default] Sets the default values to Y0 to Y6.

[UL GMSK] Sets the UP LINK template of the GMSK modulation.

[Y0] Sets the Y0 value of the template.

[Y1] Sets the Y1 value of the template.

[Y2] Sets the Y2 value of the template.

[Y3] Sets the Y3 value of the template.

[Y4 MAX[dB, dBm]] Sets the Y4 value of the template by the relative power in units of dB and the absolute power in units of dBm.

MEMO: ***The larger value of the power either calculated from the relative power (dB) or set by the absolute power (dBm), is used as the Y4 value of the template.***

[Y5 MAX[dB, dBm]] Sets the Y5 value of the template by the relative power in units of dB and the absolute power in units of dBm.

MEMO: ***The larger value of the power either calculated from the relative power (dB) or set by the absolute power (dBm), is used as the Y5 value of the template.***

[Set to Default] Sets the default values to Y0 to Y5.

[UL 8PSK] Sets the UP LINK template of the 8PSK modulation.

[Y0] Sets the Y0 value of the template.

[Y1] Sets the Y1 value of the template.

[Y2] Sets the Y2 value of the template.

[Y3] Sets the Y3 value of the template.

[Y4] Sets the Y4 value of the template.

[Y5] Sets the Y5 value of the template.

[Y6 MAX| dB, dBm]] Sets the Y6 value of the template by the relative power in units of dB and the absolute power in units of dBm.

MEMO: ***The larger value of the power either calculated from the relative power (dB) or set by the absolute power (dBm), is used as the Y6 value of the template.***

|Y7 MAX| dB, dBm]| Sets the Y7 value of the template by the relative power in units of dB and the absolute power in units of dBm.

MEMO: ***The larger value of the power either calculated from the relative power (dB) or set by the absolute power (dBm), is used as the Y7 value of the template.***

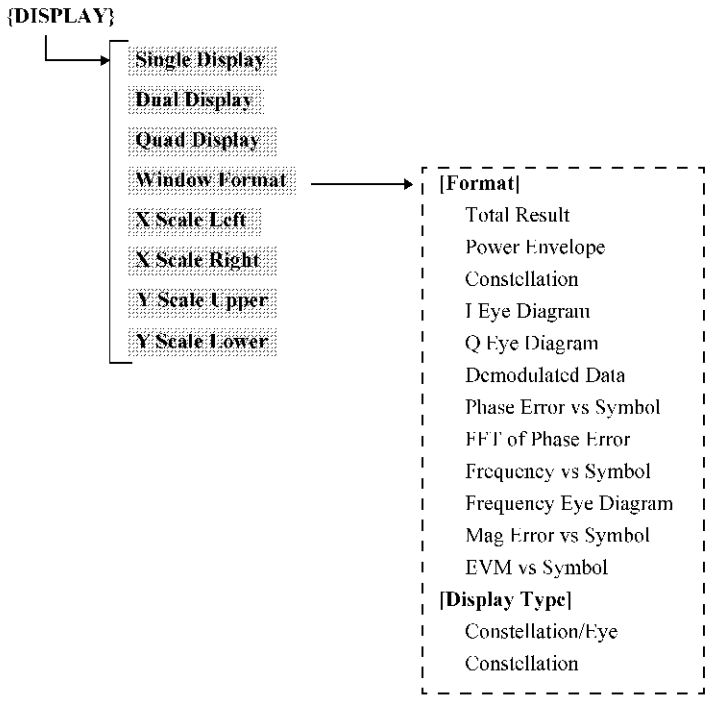
|Set to Default| Sets the default values to Y0 to Y7.

Average ON/OFF Sets Average to ON or OFF. If Average is set to ON, the dialog box used to set the number of times that averaging is performed is displayed.

MEMO: ***If Average is set to ON, the measurement results screen is renewed every 50th time that averaging is performed.***

5.5.3 {DISPLAY}

If you touch the **{DISPLAY}** button, the soft keys that relate to the display type, active display window format, and the X-axis and Y-axis scales in the active display window are displayed on the soft menu bar.



Single Display Zooms into the upper left window when four windows are displayed.

Dual Display Zooms into the upper two windows when four windows are displayed.

Quad Display Displays four windows.

Window Format When you touch the **Window Format** key, the dialog box used to set display data appears.

[Format] Selects display data.

[Total Result] Displays numerical results.

[Power Envelope] Displays the power-time graph.

[Constellation] Displays the constellation.

[I Eye Diagram] Displays the EYE pattern of the I signal.

[Q Eye Diagram] Displays the EYE pattern of the Q signal.

[Demodulated Data] Displays demodulated data.

[Phase Error vs Symbol] Displays the Phase Error vs Symbol graph.

[FFT of Phase Error] Displays FFT of phase error.

[Frequency vs Symbol] Displays the Frequency vs Symbol graph.

[Frequency Eye Diagram]
Displays the EYE pattern of the frequency data.

MEMO: ***FFT of Phase Error, Frequency vs Symbol, and Frequency Eye Diagram are enabled when Modulation is set to GMSK.***

[Mag Error vs Symbol] Displays the Mag Error vs Symbol graph.

[EVM vs Symbol] Displays the EVM vs Symbol graph.

MEMO: ***Mag Error vs Symbol and EVM vs Symbol are enabled when Modulation is set to 8PSK.***

[Display Type] Sets display details.

[Constellation/Eye] Selects the display data of Constellation/Eye when 8PSK is selected in **[Modulation]**.
Symbol points do not converge due to the transmitting and receiving filter characteristics of the standard when the 8PSK signal is analyzed.

Normal: Displays the graph in which symbol points do not converge.

8PSK: Displays the graph so that symbol points converge by using the inverse characteristic filter against the transmitting filter complied with the standard.

[Constellation] Sets constellation display details.

Trace & Dot:
Displays both symbol points and their loci.

Line: Displays symbol points which are connected by straight line.

Dot: Displays symbol points only.

X Scale Left Sets the minimum value on the X axis.

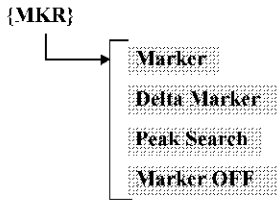
X Scale Right Sets the maximum value on the X axis.

Y Scale Upper Sets the maximum value on the Y axis.

Y Scale Lower Sets the minimum value on the Y axis.

5.5.4 {MKR}

If you touch the **{MKR}** button, the soft keys related to the marker setup are displayed on the side menu bar. Functions, which are enabled, depend on the type of the graph in an active window. If a window except for graph is active or if no graph data is given because the measurement has not been performed, these functions are unavailable.



Marker Sets the X-axis position of the normal marker.

Delta Marker Switches the delta marker display function ON and OFF.

ON: Displays a delta marker at the same position as a normal marker. Displays the relative value between a delta marker and a normal marker (measurement value such as EVM) in the marker area.

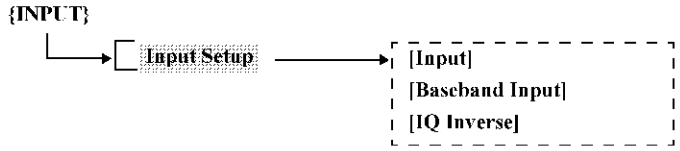
OFF: Hides a delta marker display.

Peak Search Performs a peak search.

Marker OFF Hides marker display.

5.5.5 {INPUT}

If the **{INPUT}** key is touched, the soft keys related to the setup of the input format to the instrument are displayed on the soft menu bar.



Input Setup If you touch the **Input Setup** key, the dialog box used to set the input format to the instrument appears. Set the input format in accordance with the measured signal.

[Input] Sets the input path of the signal.

RF: Sets the input path to the RF signal input.

Baseband(I&Q): Sets the input path to the IQ signal (baseband) input.

[Baseband Input] Sets the coupling when the IQ signal is input.

AC: Selects the AC coupling.

DC: Selects the DC coupling.

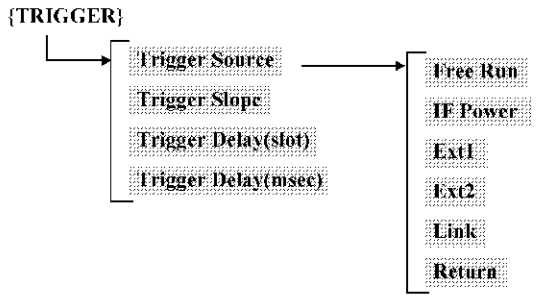
[IQ Inverse] Selects whether to invert the phase of the measured signal.

ON: Inverts.

OFF: Does not invert.

5.5.6 {TRIGGER}

If the **{TRIGGER}** button is touched, the soft keys related to the trigger setup are displayed on the soft menu bar.



Trigger Source

If the **Trigger Source** key is touched, the soft keys related to the trigger setup are displayed on the soft menu bar.

Free Run

Acquires data according to the internal timing of the instrument and analyzes.

IF Power

Acquires data in synchronization with the IF signal and analyzes.

Ext1

Acquires data in synchronization with the external signal entered into the EXT TRIG IN 1 connector and analyzes. The threshold level for Ext1 is fixed to the TTL level.

Ext2

Acquires data in synchronization with the external signal entered into the EXT TRIG IN 2 connector and analyzes. The threshold level for Ext2 can be set.

Link

Acquires data in synchronization with the trigger of an optional function and analyzes.

MEMO: ***For information on how to use the link trigger, refer to the manual of the option in which the link trigger is used.***

Return

Returns to the previous soft key array on the soft menu bar.

Trigger Slope

Switches the trigger slope polarity + and -.

Available only for IF Power, Ext1, Ext2, and Link.

+: Starts the sweep at the rising edge of a trigger.

-: Starts the sweep at the falling edge of a trigger.

Trigger Delay(slot)

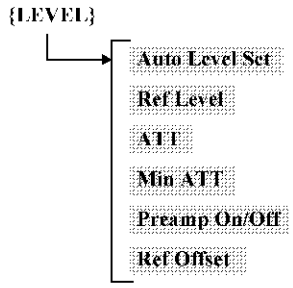
Sets the delay time from the trigger point in units of slot. The delay time, which is set in units of slot, is converted to the delay time in units of msec and set to Trigger Delay(msec). Available only for IF Power, Ext1, Ext2, and Link. The start position of acquiring A/D data, which is used to analyze, is shifted to the delay time.

Trigger Delay(msec)

Sets the delay time from a trigger point. Available only for IF Power, Ext1, Ext2, and Link. The start position of acquiring A/D data, which is used to analyze, is shifted to the delay time.

5.5.7 {LEVEL}

If the **{LEVEL}** button is touched, the soft keys related to the setup of the attenuator and reference level are displayed on the soft menu bar.



Auto Level Set

Sets the reference level to the optimum value according to the measured signal. When the key is pressed, Auto Level Set is executed.

IMPORTANT: ***While Auto Level Set is being executed, the level of the measured signal must remain constant.***

Ref Level

Sets the reference level.

ATT

Sets the attenuator.

Auto: Automatically sets the attenuator value based on the reference level.

Man: Sets the attenuator value.

Min ATT

Sets the Min ATT function to ON or OFF.

On: Sets the minimum attenuator value and restricts the attenuator regardless of whether ATT is Auto or Manual.

Off: Cancels the Min ATT restriction.

Preamp On/Off

Sets the preamplifier function to ON or OFF.

Ref Offset

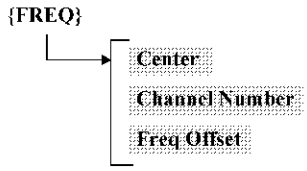
Switches the reference level offset function ON and OFF.

On: Sets the offset value and changes only the display of the reference level by the offset value.
(Displayed reference level = Set value + Offset value)

Off: Cancels the offset function.

5.5.8 {FREQ}

If the **{FREQ}** button is touched, the soft keys related to the measurement frequency setup are displayed on the soft menu bar.



Center Sets the center frequency of the measured signal.

IMPORTANT: ***Set the center frequency correctly. If it is set incorrectly, an error may occur in the center frequency error measurement and the measurement may be incorrect.***

Channel Number If the channel number is set, the center frequency is automatically set by using the following formula.

(Center frequency) = (Channel interval) × (Channel number + Channel offset) + (Start frequency)

The parameters such as the channel interval, and the channel number setting range depend on the Standard selected by **|Special|→|STD...|**. For more information, refer to the R3681 Series User's Guide.

Freq Offset Switches the center frequency offset function ON and OFF.

On: Sets the offset value and changes only the display of the center frequency by the offset value.
(Displayed center frequency = Set value + Offset value)

Off: Cancels the offset function.

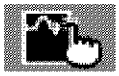
5.5.9 Measurement Tool Bar

Functions such as waveform range selection and active window selection are displayed as icons.

The following functions can be used by touching the icons.

 :Active window switching icon

Used to make one of the split windows active.

 :Range specification icon (X-axis mode)

Used to specify a range in the window in which the waveform is displayed. After touching the icon, touch both sides of the range to be specified.

 :Range specification icon (range mode)

Used to specify a range in the window in which the waveform is displayed. After touching the icon, touch the upper left corner and the lower right corner of the range to be specified.

 :Peak search icon

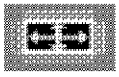
Used to place a marker on the peak after searching for the peak of the waveform.

 :Zoom in icon

Used to zoom in on the waveform displayed in the window. If you touch this icon after specifying the range by using the range specification icon, the range zooms in.

 :Zoom out icon

Used to zoom out from the waveform displayed in the window.

 :Range shift icon

Used to scroll the display without changing the scale.

6. SCPI COMMAND REFERENCE

This chapter describes the SCPI command reference for this instrument.

6.1 Command Reference Format

This section describes the format and layout used to describe commands in this chapter.

Each description includes the following items:

Function description

SCPI command

Parameter

Query reply

- [Function description]
  The usage of commands and operations in this instrument.
- [SCPI command]
  The SCPI command displays the syntax of a command sent from the external controller to this instrument. The syntax consists of a command and a number of parameters. The command and the parameters are separated by a space.
  If a command has multiple parameters, they are separated by commas (,). The three points (...) displayed between commas represent the parameter(s) omitted at that position.
  For example, the description <numeric value 1>,..., <numeric value 4> shows that four parameters, <numeric value 1>, <numeric value 2>, <numeric value 3>, and <numeric value 4>, are required.
  If the parameter is a character string type such as <character string>, <character string 1>, the parameter must be enclosed in double quotation marks (" "). If the parameter is <block>, it shows the block format data.
  Text written in lowercase alphabetic characters in the syntax can be omitted.
  For example, ":CALibration:CABLe" can be abbreviated to ":CAL:CABL."
  The marks used in the syntax are defined as follows:

< >:	Shows a parameter required for sending a command
[ ]:	Shows that the command is optional It can be omitted
{}:	Shows that only one item is required to be selected from multiple items
|:	Used as a delimiter for multiple items written in curly brackets {..}
<ch>:	Written in the command header and shows the target input channel number of the command The channel number can be omitted. However, when it is written, channel number 1 is selected
<screen>:	Written in the command header and shows the target screen number of the command The screen number can be omitted. However, when it is written, a value from 1 to 4 can be selected [{1|2|3|4}]

For example, If the syntax below is specified, :CALC:CORR:EDEL:TIME 0.1 and : CALCULATE1:SELECTED:CORR:EDEL:TIME 25E-3 are valid.

Syntax: CALCulate{[1]|2|3|4}[:SELected]:CORRection:EDELay:TIME <numeric value>

- [Parameter]

  Describes a parameter required for sending a command.

  If the parameter is numeric type or alphabetic, it is enclosed in angle brackets (< >).

  If the parameter is optional, it is enclosed in curly brackets ({ }).

  In this manual, parameter types are described in the following formats:

  < int >: A numeric value that can be input in the format NR1, NR2, or NR3 and rounded to an integer in this instrument

  < real >: A numeric value that can be input in the format NR1, NR2, or NR3 and rounded to a valid-digit real number in this instrument

  < bool >: Either OFF or ON can be entered.

  < str >: A character string enclosed in quotation (' ') or double quotation (" ") marks.

  <block>: Block data type
  The data content is an 8-bit binary data array

  < type >: Character data selected from multiple types

- [Query reply]

  When there is a query reply to the command, the data format used for reading the query is described.

  Each parameter to be read is enclosed in curly brackets ({ }). If multiple items, which are delimited by a vertical bar (|), exist in curly brackets ({ }), only one of those items is read out. If parameters are delimited by commas (,) multiple parameters can be read out. The three points (...) displayed between commas represent data omitted from that position. For example, the description {numeric value 1},..., {numeric value 4} shows that four parameters {numeric value 1}, {numeric value 2}, {numeric value 3}, and {numeric value 4} are read.

  If the parameter to be read is enclosed in square brackets ([ ]), the parameter may be omitted, depending on the measurement result, etc.

  If the parameter to be read is a value in a unit, a description such as "Unit: dBm" is added to display the unit of the parameter value. However, only when the parameter is described in a level unit "dBm", the level unit selected at that time will be applied to the parameter.

6.2 Common Commands

This section describes common IEEE commands.

Function description	SCPI Command	Parameter	Query reply	Remarks
Clears the status byte and related data	*CLS	-	-	
Macro definition for GET	*DDT	<block>	<block>	*1
Sets the standard event status enable register	*ESE	<int>	<int>	
Reads the standard event status register	*ESR?	-	<int>	
Device inquiry	*IDN?	-	<str>	*2
Notifies when all running operations are complete	*OPC	-	1	
Loads the device settings	*RCL	<int> | POFF	-	*3
Resets the device	*RST	-	-	
Saves the device settings	*SAV	<int>	<int>	
Sets the service request enable register	*SRE	<int>	<int>	
Reads the status byte register	*STB?	-	<int>	
Triggers the device	*TRG	-	-	
Waits until all running operations are complete	*WAI	-	-	

*1: If the *DDT? command is executed when the macro is undefined, a zero-length block data (#10) is returned.
*2: <str> is output in the following format: maker name, model name, serial number and version number.
*3: POFF indicates the parameter settings when the power was last switched off.

6.3 List of Commands

6.3.1 Subsystem-SYSTem

Function description	SCPI command	Parameter	Query reply	Remarks
Config				
Measurement system selection	:SYSTem:SELect	SANalyzer|MANalyzer	SAN|MAN	
Modulation				
Modulation analysis system selection	:SYSTem:SELect:MODulation	GSM	GSM	
Preset				
Each measurement system parameter initialization	:SYSTem:PRESet	–	–	
All measurement systems initialization	:SYSTem:PRESet:ALL	–	–	
Log				
Inquiry about the error that occurred last	:SYSTem:ERRor?	–	<int>,<str>	
Inquiry about the details of the error log	:SYSTem:ERRor:ALL?	–	<int>,<str>	

6.3.2 Subsystem-INPut

Function description	SCPI command	Parameter	Query reply	Remarks
ATT/Preamp				
ATT setting (Manual)	:INPut:ATTenuation	<real>	<real>	
ATT (Auto/Manual)	:INPut:ATTenuation:AUTO	OFF|ON	OFF|ON	
Min ATT setting	:INPut:ATTenuation:MINimum	<real>	<real>	
Min ATT ON/OFF	:INPut:ATTenuation:MINimum:STATe	OFF|ON	OFF|ON	
Preamp ON/OFF	:INPut:GAIN:STATe	OFF|ON	OFF|ON	
Input Setup				
Input Signal RF/Baseband	:INPut:SIGNal	RF|BASeband	RF|BAS	
Baseband Input AC/DC	:INPut:BASeband	AC|DC	AC|DC	
IQ Inverse ON/OFF	:INPut:IQ:INVerse	OFF|ON	OFF|ON	

6.3.3 Subsystem-SENSe

Function description	SCPI command	Parameter	Query reply	Remarks
FREQuency				
Center Freq setting	[:SENSe]:FREQuency:CENTer	<real>	<real>	
Freq Offset setting	[:SENSe]:FREQuency:OFFSet	<real>	<real>	
Freq Offset ON/OFF	[:SENSe]:FREQuency:OFFSet:STATe	OFF|ON	OFF|ON	
Channel Number setting	[:SENSe]:FREQuency:CHANnel:NUMBer	<int>	<int>	
Auto Level Set				
Auto Level Set execution	[:SENSe]:POWer:LEVel:AUTO	–	–	
Meas Parameters				
Modulation setting	[:SENSe]:CONDition:MODulation	GMSK|PSK8	GMSK|PSK8	
Meas Signal settings	[:SENSe]:CONDition:MSIGnal	BURSt|CONTinuous	BURS|CONT	
Burst Search ON/OFF	[:SENSe]:CONDition:BSEarch	OFF|ON	OFF|ON	
Search Threshold setting	[:SENSe]:CONDition:STHReshold	<int>	<int>	
Burst Type setting	[:SENSe]:CONDition:BTYPe	NORMal|ACCess	NORM|ACC	
Sync Type setting	[:SENSe]:CONDition:STYPe	SYNC|NO	SYNC|NO	
TSC setting	[:SENSe]:CONDition:TSC	TSC0|TSC1|TSC2| TSC3|TSC4|TSC5| TSC6|TSC7|ALL| ARB	TSC0|TSC1|TSC2| TSC3|TSC4|TSC5| TSC6|TSC7|ALL| ARB	
ARB TSC (HEX) settings	[:SENSe]:CONDition:TSC:ARB:HEX	#H***** (Hexadecimal)	#H***** (Hexadecimal)	
ARB TSC (OCT) settings	[:SENSe]:CONDition:TSC:ARB:OCT	<str>	<str>	Octal character string
Half Symbol Shift ON/OFF	[:SENSe]:CONDition:HSSHift	OFF|ON	OFF|ON	
Link setting	[:SENSe]:CONDition:LINK	DOWN|UP	DOWN|UP	
Freq Band setting	[:SENSe]:CONDition:FBANd	GSM400|GSM700|G SM850|GSM900|DC S1800|PCS1900	GSM400|GSM700|G SM850|GSM900|DC S1800|PCS1900	
Power Level setting	[:SENSe]:CONDition:PLEVel	<int>	<int>	
Consecutive Template ON/OFF	[:SENSe]:CONDition:CTEMPlate	OFF|ON	OFF|ON	
MAX[burst(N),burst(n+1)+dB] setting	[:SENSe]:CONDition:CTEMPlate:MAX	<real>	<real>	

6.3.3 Subsystem-SENSe

Function description	SCPI command	Parameter	Query reply	Remarks
Template Entry				
DL GMSK#1 template setting	[:SENSe]:CONDition:DL:TEMPlate:GMSKA	<real>,<real>,<real>,<real>,<real>	<real>,<real>,<real>,<real>,<real>	Set parameters in the order of Y0, Y1, Y2, Y3, and Y4.
DL GMSK#1 Set to Default execution	[:SENSe]:CONDition:DL:TEMPlate:GMSKA:DEFault	-	-	
DL GMSK#2 template setting	[:SENSe]:CONDition:DL:TEMPlate:GMSKB	<real>,<real>,<real>,<real>	<real>,<real>,<real>,<real>	Set parameters in the order of Y0, Y1, Y2, and Y3.
DL GMSK#2 Set to Default execution	[:SENSe]:CONDition:DL:TEMPlate:GMSKB:DEFault	-	-	
DL 8PSK template setting	[:SENSe]:CONDition:DL:TEMPlate:PSK	<real>,<real>,<real>,<real>,<real>,<real>,<real>	<real>,<real>,<real>,<real>,<real>,<real>,<real>	Set parameters in the order of Y0, Y1, Y2, Y3, Y4. Y5, and Y6
DL 8PSK Set to Default execution	[:SENSe]:CONDition:DL:TEMPlate:PSK:DEFault	-	-	
UL GMSK template setting	[:SENSe]:CONDition:UL:TEMPlate:GMSK	<real>,<real>,<real>,<real>,<real>,<real>,<real>	<real>,<real>,<real>,<real>,<real>,<real>,<real>	Set parameters in the order of Y0, Y1, Y2, Y3, Y4(dB), Y4(dBm), Y5(dB), and Y5(dBm)
UL GMSK Set to Default execution	[:SENSe]:CONDition:UL:TEMPlate:GMSK:DEFault	-	-	
UL 8PSK template setting	[:SENSe]:CONDition:UL:TEMPlate:PSK	<real>,<real>,<real>,<real>,<real>,<real>,<real>,<real>,<real>,<real>	<real>,<real>,<real>,<real>,<real>,<real>,<real>,<real>,<real>,<real>	Set parameters in the order of Y0, Y1, Y2, Y3, Y4, Y5, Y6(dB), Y6(dBm), Y7(dB), and Y7(dBm)
UL 8PSK Set to Default execution	[:SENSe]:CONDition:UL:TEMPlate:PSK:DEFault	-	-	
Average ON/OFF	[:SENSe]:CONDition:AVERage[:STATe]	OFF|ON	OFF|ON	
Average setting	[:SENSe]:CONDition:AVERage:COUNt	<int>	<int>	

6.3.4 Subsystem-CONFigure

Function description	SCPI command	Parameter	Query reply	Remarks
CONFigure				
Modulation Analysis mode setting	:CONFigure:MANalysis	-	-	
Power vs Time mode setting	:CONFigure:PVSTime	-	-	

6.3.5 Subsystem-TRIGger

Function description	SCPI command	Parameter	Query reply	Remarks
SEQuence				
Trigger Source	:TRIGger[:SEQuence]:SOURce	IMMediate|IF| EXTernal1| EXTernal2|LINK	IMM|IF|EXT1| EXT2|LINK	
Trigger Slope	:TRIGger[:SEQuence]:SLOPe	POSitive| NEGative	POS|NEG	
Trigger Delay (Slot) setting	:TRIGger[:SEQuence]:DELay:SLOT	<int>	<int>	
Trigger Delay (msec) setting	:TRIGger[:SEQuence]:DELay	<real>	<real>	
IF Power setting	:TRIGger[:SEQuence]:LEVel:IF	<real>	<real>	
Ext2 Trigger Level setting	:TRIGger[:SEQuence]:LEVel:EXTernal	<real>	<real>	

6.3.6 Subsystem-INITiate

Function description	SCPI command	Parameter	Query reply	Remarks
INITiate				
Single measurement execution	:INITiate:MEASure:SINGle	–	–	
Repeat measurement execution	:INITiate:MEASure:REPeat	–	–	
Stop execution (measurement stop)	:INITiate:ABORt	–	–	

6.3.7 Subsystem-CALCulate

Function description	SCPI command	Parameter	Query reply	Remarks
MARKer				
Marker ON/OFF	:CALCulate:MARKer<scrn=1|2|3|4>[:STATe]	OFF|ON	OFF|ON	
Marker X setting	:CALCulate:MARKer<scrn=1|2|3|4>:X	<real>	<real>	
Marker Y reading	:CALCulate:MARKer<scrn=1|2|3|4>:Y	–	<real>	
Constellation Marker Plot setting	:CALCulate:MARKer<scrn=1|2|3|4>:SYMBol	<int>	<int>	
Constellation I reading	:CALCulate:MARKer<scrn=1|2|3|4>:I	–	<real>	
Constellation Q reading	:CALCulate:MARKer<scrn=1|2|3|4>:Q	–	<real>	
Delta Marker ON/OFF	:CALCulate:DELTamarker<scrn=1|2|3|4>[:STATe]	OFF|ON	OFF|ON	
Peak Search execution	:CALCulate:MARKer<scrn=1|2|3|4>:MAXimum	-	-	

6.3.8 Subsystem-DISPlay

Function description	SCPI command	Parameter	Query reply	Remarks
Level				
Ref Level setting	:DISPlay:TRACe:Y[:SCALe]:RLEVel	<real>	<real>	
Level Offset setting	:DISPlay:TRACe:Y[:SCALe]:RLEVel:OFFSet	<real>	<real>	
Level Offset ON/OFF	:DISPlay:TRACe:Y[:SCALe]:RLEVel:OFFSet:STATe	OFF|ON	OFF|ON	
Window Format				
Analysis format selection	:DISPlay:WINDow<scrn=1|2|3|4>:FORMat	TRESult|POWer|CONStellation|EYE|QEYE|DDATa|PERRor|FPERror|FSYMbol|FEYE|MERRor|EVM	TRES|POW|CONS|EYE|QEYE|DDAT|PERR|FPER|FSYM|FEYE|MERR|EVM	
Display setting for the 8PSK Constellation/EYE graph	:DISPlay:WINDow<scrn=1|2|3|4>:CEYE:TYPE	NORMal|PSK8	NORM|PSK8	
Display setting for the constellation: Trace&Dot/Line/Dot	:DISPlay:WINDow<scrn=1|2|3|4>:CONStellation:TYPE	TDOT|LINE|DOT	TDOT|LINE|DOT	
SCALe				
Multi Screen setting	:DISPlay	SINGle|DUAL|QUAD	SING|DUAL|QUAD	
X Scale Left setting	:DISPlay[:WINDow<scrn=1|2|3|4>]:TRACe:X[:SCALe]:LEFT	<real>	<real>	
X Scale Right setting	:DISPlay[:WINDow<scrn=1|2|3|4>]:TRACe:X[:SCALe]:RIGHt	<real>	<real>	
Y Scale Upper setting	:DISPlay[:WINDow<scrn=1|2|3|4>]:TRACe:Y[:SCALe]:UPPer	<real>	<real>	
Y Scale Lower setting	:DISPlay[:WINDow<scrn=1|2|3|4>]:TRACe:Y[:SCALe]:LOWer	<real>	<real>	

6.3.9 Subsystem-MMEMory

Function description	SCPI command	Parameter	Query reply	Remarks
Save/Recall				
Saving the settings of this instrument	:MMEMory:STORe:STATe	<int>	–	*1
Loading the settings of this instrument	:MMEMory:LOAD:STATe	<int>	–	*1
Measurement condition Save selection	:MMEMory:SELect:ITEM:GSM:SETup	OFF|ON	OFF|ON	

*1: A number, which is a maximum of 4-digit and is added to the file name of the data to be saved or loaded, must be specified in <int>.

6.3.10 Subsystem-MEASure

Function description	SCPI command	Parameter	Query reply	Remarks
MEASure				
Frequency Error reading	:MEASure:TRESult:FERRor	–	<real>	
Tx Power reading	:MEASure:TRESult:POWer	–	<real>,<real>	*2
Peak Power reading	:MEASure:TRESult:PPOWer	–	<real>,<real>	*3
Phase Error reading (GMSK)	:MEASure:TRESult:GMSK:PERRor	–	<real>	
Peak Phase Error reading (GMSK)	:MEASure:TRESult:GMSK:PPERror	–	<real>,<real>	*4
Burst Amplitude Droop reading (8PSK)	:MEASure:TRESult:PSK:BADRoop	–	<real>	
IQ Origin Offset reading (8PSK)	:MEASure:TRESult:PSK:IQOFfset	–	<real>	
Magnitude Error reading (8PSK)	:MEASure:TRESult:PSK:MERRor	–	<real>	
Phase Error reading (8PSK)	:MEASure:TRESult:PSK:PERRor	–	<real>	
EVM reading (8PSK)	:MEASure:TRESult:PSK:EVM	–	<real>	
95:th percentile reading (8PSK)	:MEASure:TRESult:PSK:PERCentile	–	<real>	
Peak EVM(Avg) reading (8PSK)	:MEASure:TRESult:PSK:PEVM	–	<real>	

*2: Outputs the Tx Power in order of [dBm] and [W].
*3: Outputs the Peak Power in order of [dBm] and [W].
*4: Outputs the Peak Phase Error in order of [deg] and [symbol].

6.3.11 Subsystem-READ

Function description	SCPI command	Parameter	Query reply	Remarks
READ				
Frequency Error reading	:READ:TRESult:FERRor	–	<real>	
Tx Power reading	:READ:TRESult:POWer	–	<real>,<real>	*2
Peak Power reading	:READ:TRESult:PPOWer	–	<real>,<real>	*3
Phase Error reading (GMSK)	:READ:TRESult:GMSK:PERRor	–	<real>	
Peak Phase Error reading (GMSK)	:READ:TRESult:GMSK:PPERror	–	<real>,<real>	*4
Burst Amplitude Droop reading (8PSK)	:READ:TRESult:PSK:BADRoop	–	<real>	
IQ Origin Offset reading (8PSK)	:READ:TRESult:PSK:IQOFfset	–	<real>	
Magnitude Error reading (8PSK)	:READ:TRESult:PSK:MERRor	–	<real>	
Phase Error reading (8PSK)	:READ:TRESult:PSK:PERRor	–	<real>	
EVM reading (8PSK)	:READ:TRESult:PSK:EVM	–	<real>	
95:th percentile reading (8PSK)	:READ:TRESult:PSK:PERCentile	–	<real>	
Peak EVM(Avg) reading (8PSK)	:READ:TRESult:PSK:PEVM	–	<real>	

*2: Outputs the Tx Power in order of [dBm] and [W].
*3: Outputs the Peak Power in order of [dBm] and [W].
*4: Outputs the Peak Phase Error in order of [deg] and [symbol].

6.3.12 Subsystem-FETCh

Function description	SCPI command	Parameter	Query reply	Remarks
FETCh				
Frequency Error reading	:FETCh:TRESult:FERRor	–	<real>	
Tx Power reading	:FETCh:TRESult:POWer	–	<real>,<real>	*2
Peak Power reading	:FETCh:TRESult:PPOWer	–	<real>,<real>	*3
Phase Error reading (GMSK)	:FETCh:TRESult:GMSK:PERRor	–	<real>	
Peak Phase Error reading (GMSK)	:FETCh:TRESult:GMSK:PPERror	–	<real>,<real>	*4
Burst Amplitude Droop reading (8PSK)	:FETCh:TRESult:PSK:BADRoop	–	<real>	
IQ Origin Offset reading (8PSK)	:FETCh:TRESult:PSK:IQOFfset	–	<real>	
Magnitude Error reading (8PSK)	:FETCh:TRESult:PSK:MERRor	–	<real>	
Phase Error reading (8PSK)	:FETCh:TRESult:PSK:PERRor	–	<real>	
EVM reading (8PSK)	:FETCh:TRESult:PSK:EVM	–	<real>	
95:th percentile reading (8PSK)	:FETCh:TRESult:PSK:PERCentile	–	<real>	
Peak EVM(Avg) reading (8PSK)	:FETCh:TRESult:PSK:PEVM	–	<real>	
Inquiry of GMSK/8PSK analysis result	:FETCh:MODulation	–	GMSK|PSK8	

*2: Outputs the Tx Power in order of [dBm] and [W].
*3: Outputs the Peak Power in order of [dBm] and [W].
*4: Outputs the Peak Phase Error in order of [deg] and [symbol].

6.4 Status Register

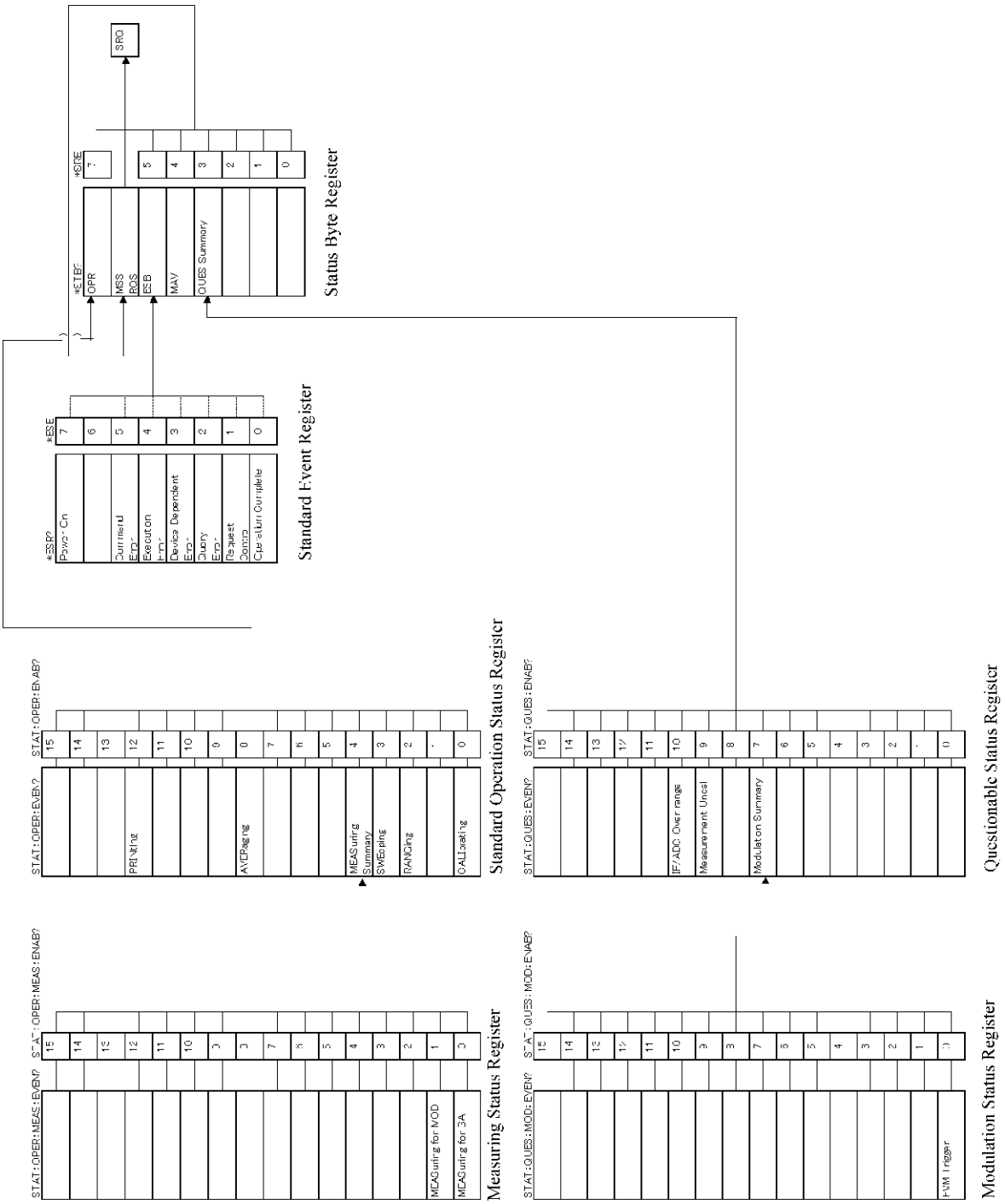


Figure 6-1 Status Registers

7. PERFORMANCE VERIFICATION

This chapter describes how to verify whether this instrument meets the specified performance.

It is recommended that you copy the test data record sheet included in the last of this chapter and save it as a record of the performance test.

IMPORTANT: Before executing the performance verification, execute warm-up and all calibrations.

7.1 Test Procedures

Connect this instrument as shown below:

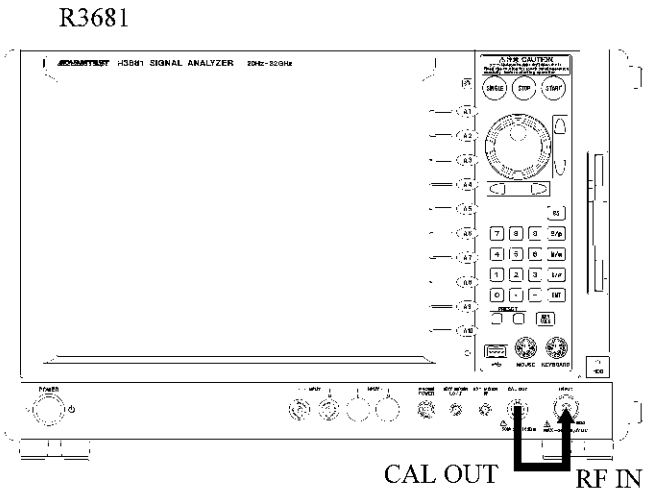


Figure 7-1 Connection Diagram of Signal Source

7.1.1 Phase Error Measurement (GSM)

1. Set this instrument as follows:

{MEAS MODE}:	**Modulation Analysis**		
{MEAS SETUP}:	**Meas Parameter**		
	[Modulation]:		GMSK
	[Meas Signal]:		CONTINUOUS
	[Half Symbol Shift]:		OFF
{INPUT}:	**Input**	RF	
	IQ Inverse	OFF	
{TRIGER}:	**Trigger Source**	Free Run	
{FREQ}:	**Center**	50.067708 MHz	
{LEVEL}:	Execute **Auto Level Set**.		

2. Press the **SINGLE** button on this instrument to perform measurements.
3. Write the measurement results in the test data record sheet.

7.1.2 Modulation Accuracy Measurement (EDGE)

1. Set this instrument as follows:

{MEAS MODE}:	**Modulation Analysis**		
{MEAS SETUP}:	**Meas Parameter**		
	[Modulation]:		8PSK
	[Meas Signal]:		CONTINUOUS
{INPUT}:	**Input**	RF	
	IQ Inverse	OFF	
{TRIGER}:	**Trigger Source**	Free Run	
{FREQ}:	**Center**	50.050781 MHz	
{LEVEL}:	Execute **Auto Level Set**.		

2. Press the **SINGLE** button on this instrument to perform measurements.
3. Write the measurement results in the test data record sheet.

7.2 Test Data Record Sheet

Test Data Record Sheet

Model name:

Serial number:

7.2.1 Phase Error Measurement (GSM)

Test item	Specifications			Determination Pass / Fail
	Minimum value	Measured value	Maximum value	
Carrier frequency error	-5 Hz		5 Hz	
Phase error (rms)	None		1°	
Phase error (peak)	-5°		5°	
Power	-10.4 dBm		-9.6 dBm	

7.2.2 Modulation Accuracy Measurement (EDGE)

Test item	Specifications			Determination Pass / Fail
	Minimum value	Measured value	Maximum value	
Carrier frequency error	-10 Hz		10 Hz	
Modulation accuracy (rms)	None		1.2%rms	
Power	-10.4 dBm		-9.6 dBm	

8. SPECIFICATIONS

8.1 GSM Modulation Analysis Performance

Item	Specifications
Temperature range	+20°C ~ +30°C
Carrier frequency error	
Measurement range	<±10 kHz
Measurement accuracy	<± (Reference frequency accuracy × Carrier frequency + 5 Hz)
Phase Error measurement	
Phase error measurement range	≤±30° (Peak)
Accuracy	≤±5° (Peak) ≤± 1° (rms)
Power measurement	
Accuracy	<± (0.4 + Frequency response + calibration signal level accuracy) dB Frequency response 50 MHz ~ 2.5 GHz <±0.4 dB 20 Hz ~ 3.5 GHz <±1.0 dB Calibration signal level accuracy<±0.2 dB

8.2 EDGE Modulation Analysis Performance

Item	Specifications
Temperature range	+20°C ~ +30°C
Carrier frequency error	
Measurement range	<±10 kHz
Measurement accuracy	<± (Reference frequency accuracy × Carrier frequency + 10 Hz)
Modulation accuracy measurement	
Residual vector error	≤1.2%rms
Power measurement	
Accuracy	<± (0.4 + Frequency response + calibration signal level accuracy) dB
	Frequency response
	50 MHz ~ 2.5 GHz <±0.4 dB
	20 Hz ~ 3.5 GHz <±1.0 dB
	Calibration signal level accuracy<±0.2 dB

APPENDIX

This section describes the following supplemental information:

A.1 Technical Notes

A.2 Error Message List

A.1 Technical Notes

A.1.1 How to Calculate Measurement Values

EVM, Magnitude Error, and Phase Error are calculated by the following equation after the frequency error is corrected.

Error Vector Magnitude (EVM)

EVM is defined by Figure A-1 and calculated by the following equation.

$$EVM = \sqrt{\frac{\sum_{i}^{K}\left\{(Im(i)-Ir(i))^2+(Qm(i)-Qr(i))^2\right\}}{\sum_{i}^{K}\left\{Ir(i)^2+Qr(i)^2\right\}}}\times 100$$

Im(i),Qm(i):	Measurement value
Ir(i),Qr(i):	Reference value
i:	Symbol number
K:	Measurement length

Magnitude Error

Magnitude Error is defined by Figure A-1 and calculated by the following equation.

$$MagnitudeError = \sqrt{\frac{\sum_{i}^{K}\left\{\sqrt{Im(i)^2+Qm(i)^2}-\sqrt{Ir(i)^2+Qr(i)^2}\right\}^2}{\sum_{i}^{K}\left\{Ir(i)^2+Qr(i)^2\right\}}}\times 100$$

Im(i),Qm(i):	Measurement value
Ir(i),Qr(i):	Reference value
i:	Symbol number
K:	Measurement length

Phase Error

Phase Error is defined by Figure A-1 and calculated by the following equation.

$$PhaseError = \sqrt{\frac{\sum_{i}^{K} \left\{ \tan^{-1}\left(Qm(i)/Im(i)\right) - \tan^{-1}\left(Qr(i)/Ir(i)\right) \right\}^2}{K}} \times 180/\pi$$

Im(i),Qm(i):	Measurement value
Ir(i),Qr(i):	Reference value
i:	Symbol number
K:	Measurement length

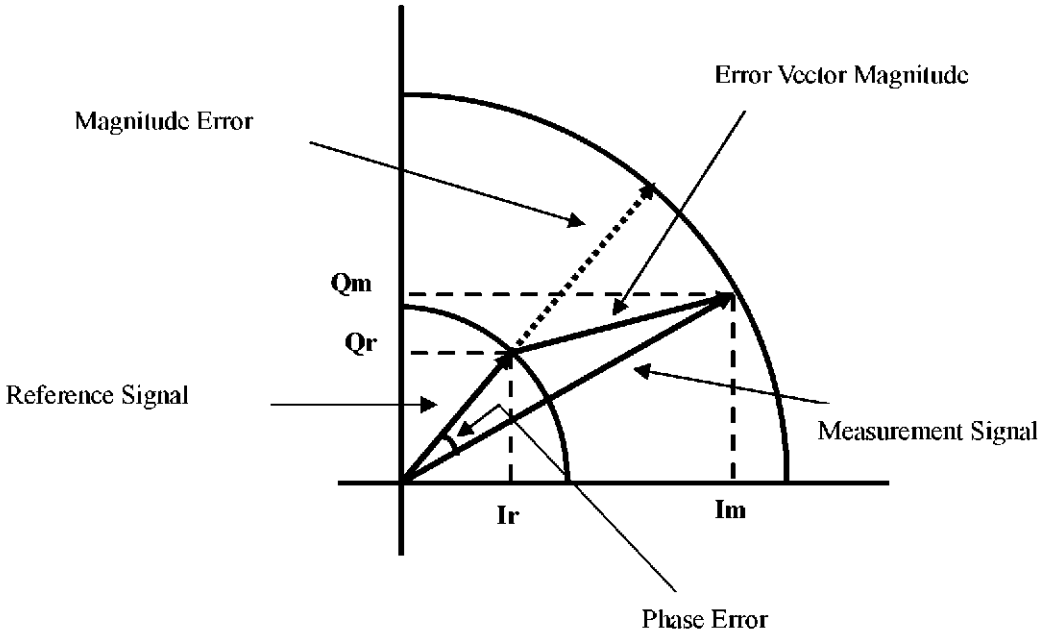


Figure A-1 Error Vector Magnitude, Magnitude Error, Phase Error

A.1.2 Sync Type Setting

When you perform the modulation analysis of a burst signal, the modulation may deteriorate at the rising edge and falling edge of the burst. We recommend that the measurement is performed after the measurement point is determined by synchronizing with Sync Word (training sequence code).

If Sync Word is set, measurement software searches Sync Word as follows:

1. When TSC0 to TSC7 or ARB is selected.

   The software imports the signal during a frame, demodulates from the top of the signal for each slot, and searches the selected Sync Word in the period of a frame. If Sync Word cannot be found, an error is displayed and measurement stops.

   This measurement method is enabled to analyze the slot which includes the specified Sync Word.

2. When ALL is selected.

   The software imports the signal during a slot and checks whether to accord with Sync Word of TSC0 to TSC7. If the signal accords with any Sync Word of TSC0 to TSC7, the modulation analysis is performed by synchronizing with the accordant Sync Word.

   According to the GSM standard, the measurement must be averaged over 200 bursts. When the signal, which includes TSC0 to TSC7, is transmitted from the transmitter, the high-speed measurement can be performed by setting TSC to ALL.

The signal including Tail Bit must comply with the standard.

A.1.3 GMSK Phase Error measurement

Graph Display Range

The GSM standard specifies that the Phase Error measurement must be performed in Useful Part. Useful Part is defined as the range of a half-symbol inside from the both side of the burst, and the length of Useful Part is 147 symbols in a normal burst and 87 symbols in an access burst. Because Useful Part starts at a half-symbol late point apart from the Symbol point that is the convergent point in constellation display the graph displays the range from (Useful Part - half symbol) to (Useful Part + half symbol).

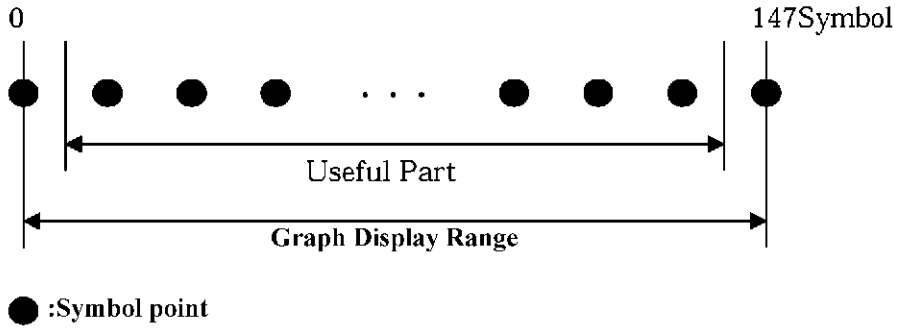


Figure A-2 Relationship between Useful Part and Graph Display Range

The Phase Error value and the Peak Phase Error value of GMSK are displayed for Useful Part only.

Because the GSM standard specifies that the EVM, Peak EVM, and 95th percentile of 8PSK must be measured excluding tail bits, the values are displayed excluding the tail bits.

A.2 Error Message List

This section describes error messages displayed on this instrument.

The following information is included.

- Error number
- Displayed message
- Cause of the error and action to be taken

Table A-1 Error Message List

Error number	Displayed message	Description
-1250	No such file or directory.	The file or directory does not exist. Check the file name or directory name.
-1251	Permission denied.	File operation is forbidden. Check the drive name, file name, or directory name.
-1252	Not enough space on the disk.	Not enough space is available. Delete all unnecessary files.
-1253	File read/write error.	A file I/O error occurred. Check if there is sufficient disk space or the disk is write-protected.
-1300	Device is not ready.	No disk is inserted.
-1400	There is no data in the effective state.	The requested data is uncertain.
-1500	Option required.	The appropriate option function is required.
-3210	Input Level is out of range. Check the Ref. Level.	The input signal level is outside the permitted range. Check the reference level or input signal level.
-3211	Auto Level Set cannot be succeed. Signal level is not stable.	Auto Level Set is not complete. Check to see if the input signal level is not constant or if the attenuator is set to manual
-3242	Cannot find out Burst.	Burst cannot be detected in A/D data.
-3246	Cannot detect Sync Word.	Sync Word cannot be found. Check the Sync Word number.

ALPHABETICAL INDEX

[Symbol]

[A]

[B]

[C]

[D]

[E]

[F]

[G]

[H]

[I]

[L]

[M]

[N]

[O]

[P]

[Q]

[R]

[S]

[T]

[W]

[X]

[Y]

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