ADVANTEST

ADVANTEST CORPORATION

R3681 Series OPT83

AMP Measurement Software

User's Guide

MANUAL NUMBER FOE-8440170A00

Applicable Models
R3681
R3671

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LIST OF TABLES

1. INTRODUCTION

This chapter describes the contents of this guide and the product overview of the R3681 series signal analyzer option 83 AMP measurement software to help the user get the most out of this guide.

1.1 Outline of This Manual

The outline of each chapter is shown below:

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

Chapter 1. INTRODUCTION	Describes the outline of this manual and the product overview.
Chapter 2. BEFORE OPERATING	Provides preliminary tips on using this instrument. Read this chapter before using this instrument.
Chapter 3. SETUP	Describes how to set up this instrument. After installing this instrument in position, switch it on to make sure that it starts successfully.
Chapter 4. MEASUREMENT EXAMPLES	Describes example measurements.
Chapter 5. MENU MAP, FUNCTIONAL EXPLANATION	Describes the menu configuration and functions of the 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	Describes the performance verification test procedures for option 83.
Chapter 8. SPECIFICATIONS	Shows the specifications of option 83.
APPENDIX	Describes operation principles and the error code table.

1.2 Product Overview

The AMP measurement option is software that conducts the measurement of non-linear characteristic of AMP.

This option includes the following features.

- In the Two-Tone measurement mode, the amplitude and phase of the third and fifth distortion components are measured in the signal that is formed by adding sinusoidal waves of two different frequencies.
- In the AM/AM and AM/PM measurement modes, the output signal amplitude and phase to the input signal amplitude are measured in the modulating signal.
- In the CCDF measurement mode, the CCDF of the signal is measured.

1.3 Other Manuals Relating to This Instrument

Manuals which relate to this instrument include:

- 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 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 important information on using this instrument. Read this chapter before using this instrument.

2.1 If a Fault Should Occur

If smoke, strange smells, or strange noises are detected, switch off the power, disconnect the power cable and contact either your dealer or Advantest immediately.

2.2 Removing the Case

The case should not be opened except by qualified Advantest service personnel.

WARNING: ***This instrument contains high-voltage and high-temperature parts. Electrical shocks or burns may result if handled incorrectly.***

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.

CAUTION: ***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

This instrument has a touch screen. When handling the touch screen, take notice of these instructions.

- Do not give apply excessive force to the screen. The screen is made from glass and may crack.
- 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 Getting the Software Running with Stability

The R3681 Series Signal Analyzer has Microsoft Windows XP pre-installed.

The measuring function of this instrument is dependent on the Windows environment. Do not alter the Windows operating environment in any way other than as described in this manual.
This instrument is not a data processor. Operate it only as described in this manual.

1. Prohibited actions
   - Installing other application programs.
   - Changing or deleting items in the control panel (except as described in "A.2 Installing the Printer Driver" and "A.3 Setting up the Network" of R3681 Series User's Guide).
   - Creating new files or editing existing files on the C drive.
   - Operating other application programs during the measurement.
   - Upgrading the Windows operating system.
   - If this instrument functions incorrectly because of any of the above, re-install the system using the system recovery disk.
     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 the operating environment, the system may become infected by a computer virus. To protect the system, we recommended taking the following countermeasures:
   - Perform a virus check before loading any file or inserting any media from an outside source.
   - Make sure that any network used has safety measures against computer viruses before connecting this instrument.

   [If infected with a computer virus:]
   - Delete all files on the D drive. Re-install the system using the recovery disk.
     For more information on the system recovery procedure, refer to section 8.7, "System Recovery Procedure" of R3681 Series User's Guide.

2.7 Transporting

Extreme care as described below must be taken when carrying this instrument.

- This instrument is heavy and must be carried by two or more persons, or on a transportation cart.
- If using a cart to move this instrument, ensure the instrument is secure.

2.8 Electromagnetic Interference

This instrument may cause electromagnetic interference and affect television and radio reception.
If the electromagnetic interference is reduced when this instrument's is turned off, then this instrument is the cause of the problem.
Electromagnetic interference may be prevented by doing the following:

- 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 different lines power outlets for this instrument and the television or radio.

2.9 Before Turning On

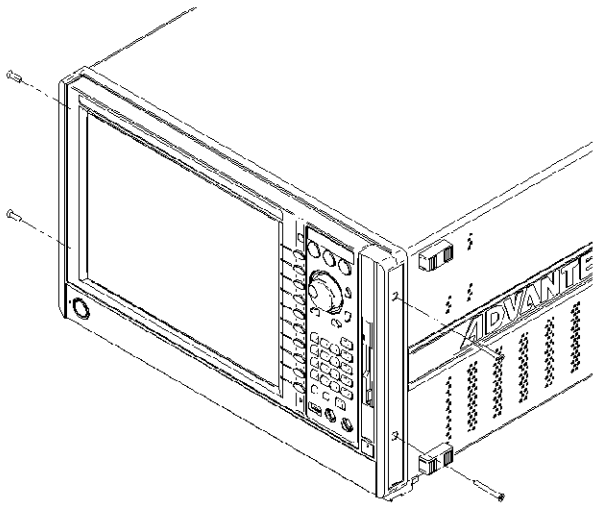
Do not connect a DUT to this instrument when turning on.

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 Limitations Imposed when Using Windows XP

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3. SETUP

This chapter describes how to set up this instrument. Topics included in this chapter are:

3.1 Unpacking Inspection

3.2 Locating This Instrument

3.3 Connecting Accessories

3.4 Supply Description

3.5 Operation Check

3.1 Unpacking Inspection

When the product is delivered, check the condition of it and its accessories included by following these steps:

1. Check that the box and the padding in which the product was shipped has not been damaged during transit.

   IMPORTANT: ***If the box or the padding is damaged, leave them in their original condition until the inspection described below is complete.***

2. Check the product surfaces for any damage.

   WARNING: ***Do not supply any power to this instrument if the cover, panels (front and rear), LCD display, power switch, connector or any other key component are damaged. Electrical shocks may result from using damaged components.***

3. Referring to the standard accessory list of the OPT83 in Table 3-1, check that all standard accessories have been supplied and that no accessories are damaged.

   Contact your dealer or Advantest in any of the following situations:

   - The box or the padding in which the product was shipped was damaged during transit.
   - The product surfaces are damaged.
   - Any of the standard accessories are missing or damaged.
   - Faults are detected in any subsequent product verification test.

Table 3-1 Standard Accessories

Name	Model	Quantity	Remarks
R3681 Series OPT83 User's Guide	ER3681OPT83	1	English version

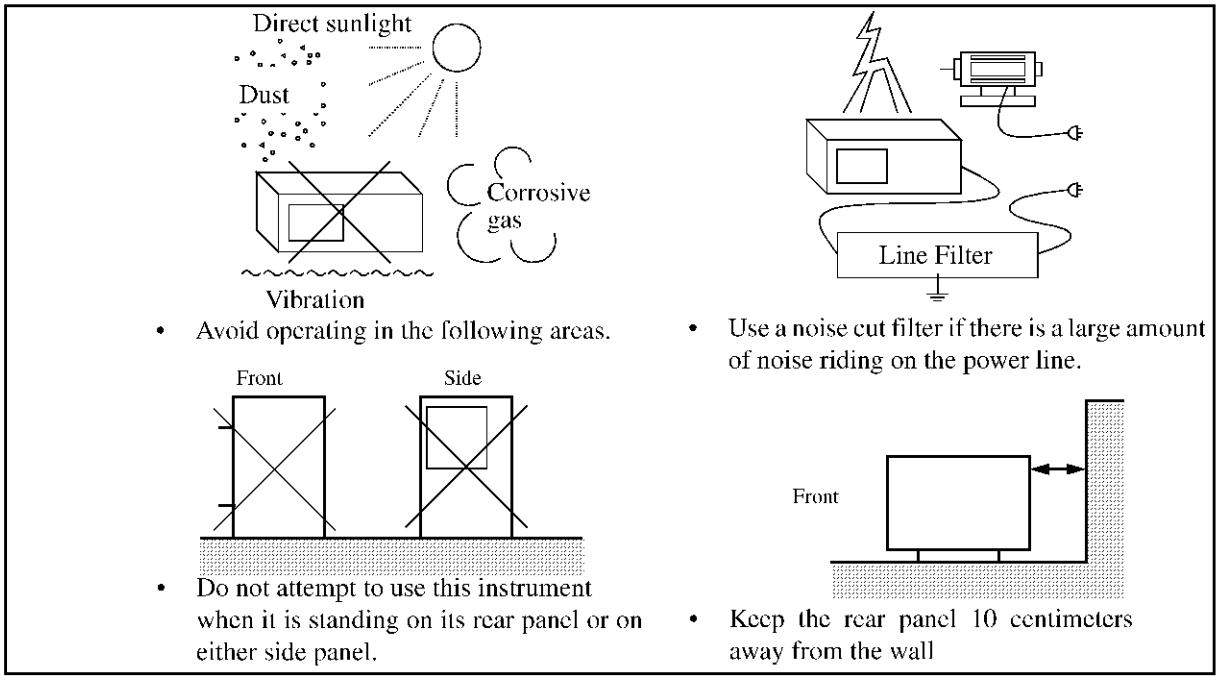
3.2 Locating This Instrument

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

3.2.1 Operating Environment

This instrument should only be used in an environment that satisfies the following conditions:

- Ambient temperature: +5 °C to +40 °C (operating temperature)
  -20 °C to +60 °C (Storage temperature range)
- Relative humidity: RH80% or less (no condensation)
- An area free from corrosive gas
- An area away from direct sunlight
- A area free from dust
- An area free from vibrations
- A low noise area
  Although this instrument has been designed to withstand a certain amount of noise riding on the AC power line, it should be used in an area of low noise. Use a noise filter if ambient noise is unavoidable.
- An area allowing unobstructed airflow
  There is an exhaust-cooling fan on the rear panel and exhaust vents on both sides and the bottom (toward the front) of this instrument. Do not block these vents. The resulting internal temperature rise will affect measurement accuracy. Keep the rear panel 10 centimeters away from the wall. In addition, do not attempt to use this instrument when it is standing on its rear panel or lying on either 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 rear panel or on either side panel.
- Keep the rear panel 10 centimeters away from the wall

Figure 3-1 Operating Environment

3.2.2 Prevention of Electrostatic Buildup

To prevent electrostatic discharge (ESD) from damaging components in this instrument, the precautions described below should be taken. We recommend that two or more countermeasures are combined to provide adequate protection from ESD.
(Static electricity can easily be generated when a person moves or an insulator is rubbed.)

Table 3-2 ESD Countermeasures

Operator	Use a wrist strap (see Figure 3-2).
Floor in the work area	Install a conductive mat, use conductive shoes, and connect both to ground (see Figure 3-3).
Workbench	Install a conductive mat and connect it to ground (see Figure 3-4).

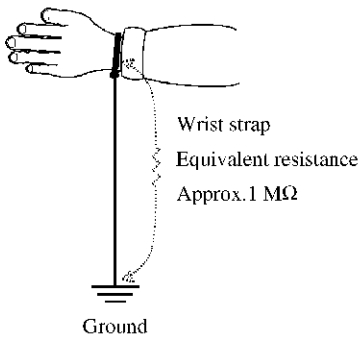


Figure 3-2 Countermeasures against Static Electricity from the Human Body

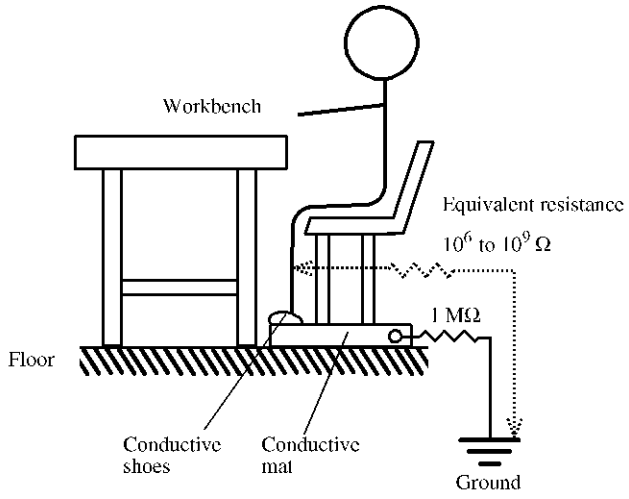


Figure 3-3 Countermeasures against Static Electricity from the Work Floor

3.2.2 Prevention of Electrostatic Buildup

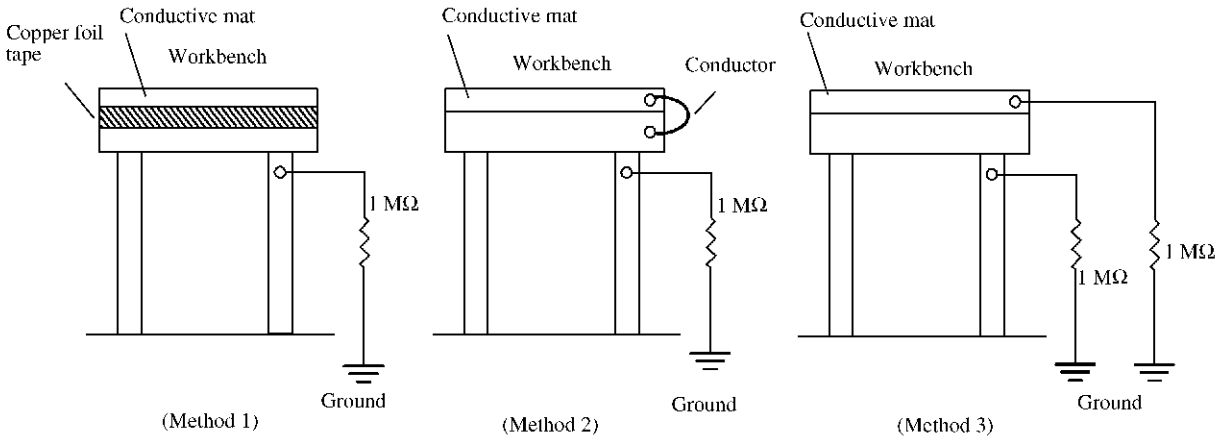


Figure 3-4 Countermeasures against Static Electricity from the Workbench

3.3 Connecting Accessories

This section describes how to connect accessories to this instrument and run it.

3.3.1 Connecting the Keyboard and Mouse

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

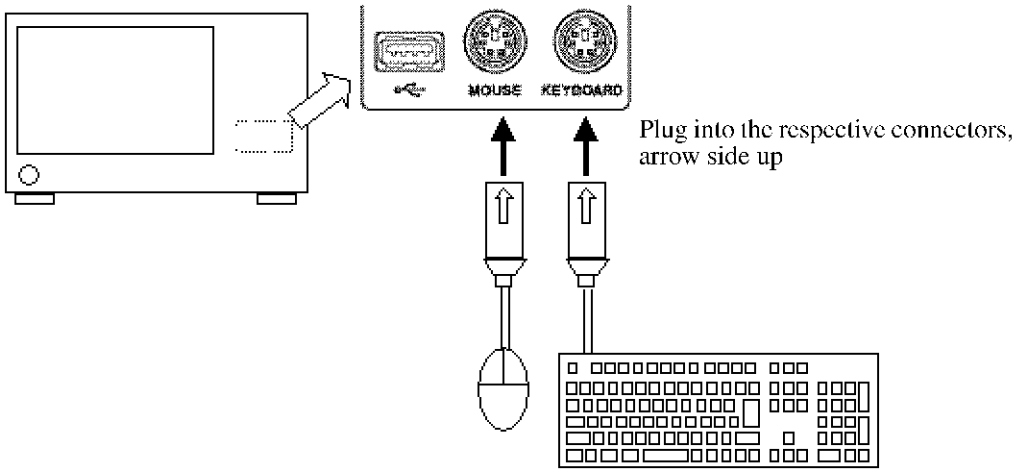


Figure 3-5 Connecting the Keyboard and Mouse

3.4 Supply Description

This section describes how to check the power supply specifications and connect the power cable.

3.4.1 Check the Supply Power

Table 3-3 summarizes the power supply specifications for this instrument. Make sure that the power supply available to this instrument meets these specifications.

Table 3-3 Power Supply Specifications

	100 V AC Operation	200 V AC Operation	Remarks
Input voltage range	90 V to 132 V	198 V to 250 V	Automatically switches between input levels of 100 V AC and 200 V AC.
Frequency range	47 Hz to 63 Hz		
Power consumption	450 VA or below		

WARNING: ***Be sure to provide a power supply that meets the specified power supply specifications for this instrument. Failure to meet the specifications could cause damage to this instrument.***

3.4.2 Connecting the Power Cable

This instrument comes with a three-core power cable with a ground conductor. To prevent electrical shock hazards, ground this instrument by plugging the power cable into a three-pole power outlet.

1. Check the power cable included with this instrument for any damage.

WARNING: ***Never use a damaged power cable. Electrical shock could result.***

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2. Plug one end of the power cable included with this instrument into the AC power connector on this instrument rear panel and the other into a three-pin power outlet that has a ground pin (see Figure 3-6).

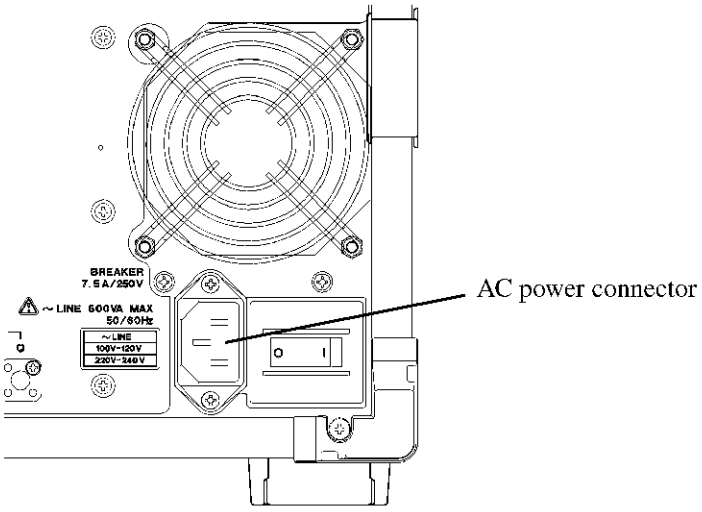

Figure 3-6 Connecting the Power Cable

WARNING:

1. ***Use a power cable rated for the voltage being used. Be sure, however, to use a power cable that conforms to the safety standards of your country when using this instrument (Refer to "Safety Summary").***
2. ***Plug the power cable into a three-pin power outlet that has a ground pin to prevent electrical shocks. Using an extension cable that has no ground pin would negate having a ground.***

3.5 Operation Check

This section describes how to make a simple operation check on this instrument by using its built-in autocalibration feature. To verify that this instrument runs correctly, follow these steps:

Starting up this instrument

1. Connect the power cable as instructed in 3.4.2 "Connecting the Power Cable."
2. Switch on the power breaker on the rear panel and wait for 3 seconds or more.
3. Press the **POWER** switch to switch on the power.

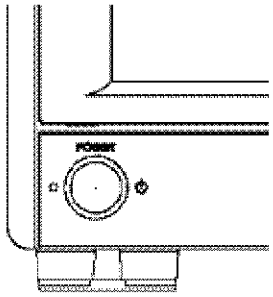

Figure 3-7 **POWER** Switch

CAUTION:

1. ***If the power to this instrument is suddenly interrupted while the unit is in operation, such as is the power cable is disconnected, the hard disk drive could be damaged. Even if the hard disk drive does not fail, Scandisk launches to check for possible data corruption the next time this instrument starts up.***
2. ***About Scandisk***
   If this instrument has been switched off without being shut down, Scandisk will automatically launch to check for any corrupt data. Do not abort Scandisk while it is running. If Scandisk locates any corrupt data, take appropriate action by following the displayed messages. The software in this instrument resumes automatically when Scandisk ends.

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4. The power-on diagnostic program launches to carry out self-diagnostics.
   The self-diagnostic program take about 1 minute to complete.
5. The initial screen shown in Figure 3-8 is displayed unless this instrument is faulty. The initial screen may give look differently from Figure 3-8, depending on the settings in effect the last time this instrument was switched off.

NOTE: ***Refer to Chapter 8, "MAINTENANCE" of R3681 Series User's Guide if any error messages are displayed as a result of the self-diagnostic program.***

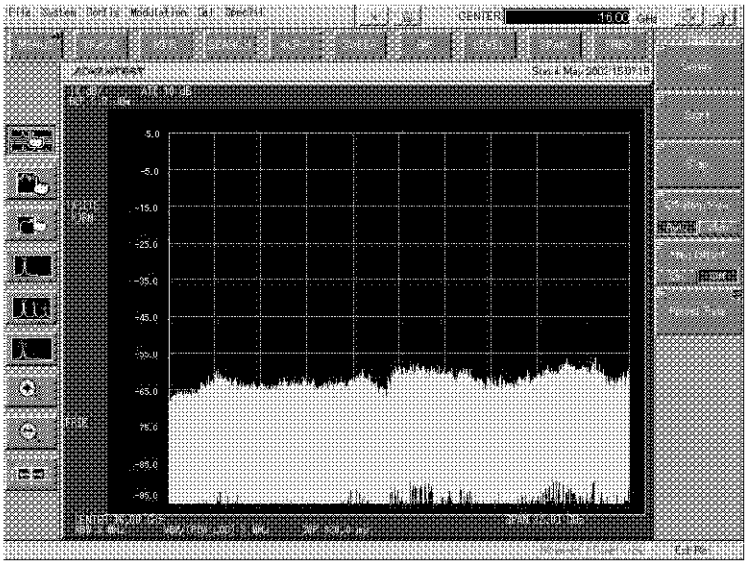


Figure 3-8 Initial Setup Screen

Running 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.

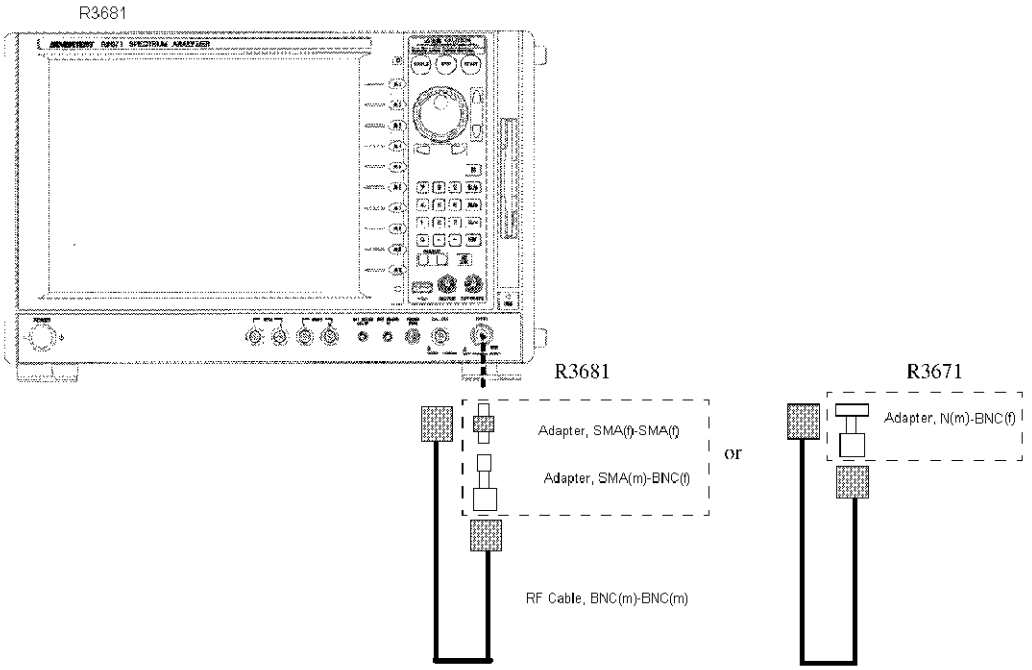


Figure 3-9 Autocalibration

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 runs.
   The autocalibration takes about 1 minute to complete.
9. Make sure that no error messages are 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.***

Switching off power

Press **POWER** to switch off this instrument.
The final procedure is complete and the power is automatically turned off.

4. MEASUREMENT EXAMPLES

Chapter 4 describes how to use this option, with the following Two Tone, AM/AM and AM/PM measurement examples.

4.1 Two Tone Measurement Example

In this measurement example, the IM (inter-modulation) is evaluated in the signal that is constructed by adding two sinusoidal waves of different frequencies.

Specifications of the measured signal

Signal 1:	
Type of signal:	Continuous wave
Center frequency:	999 MHz
Level:	-10 dBm
Signal 2:	
Type of signal:	Continuous wave
Center frequency:	1001 MHz
Level:	-10 dBm

Measurement conditions

Center Frequency:	1000 MHz
Level:	Auto Level Set
Trigger Source:	Free Run
INPUT:	IQ Inverse OFF
MEAS MODE:	Two Tone

Set the Two Tone Parameters Setup dialog box as follows:

Freq Separation:	2 MHz
Average:	OFF
Signal Source:	External

Setup for External Signal Source: Signal: CW

Single measurement

Connections

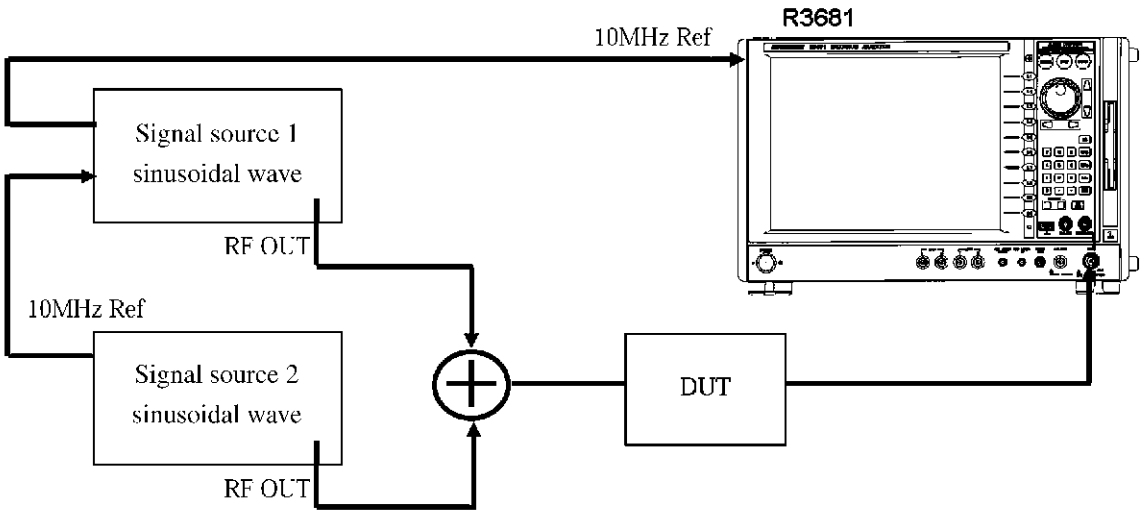


Figure 4-1 Connection Diagram for Two Tone Measurement by Using Two External SGs

Setting the measurement conditions

1. Touch **[Config]** on the menu bar and select **[Non-Linear Analysis]**.
2. Touch the **{MEAS MODE}** button on the function bar.
3. Touch the **Two Tone** key on the soft menu bar.
4. Touch the **{FREQ}** button on the function bar.
5. Touch the **Center** key on the soft menu bar.
6. Press **1** and **G/p** on the keypad.
   The center frequency is set to 1000 MHz (1 GHz).
7. Touch the **{LEVEL}** button on the function bar.
8. Touch the **Auto Level Set** key on the soft menu bar.
   The Ref Level is automatically set to the optimum value.
9. Touch the **{TRIGGER}** button on the function bar.
10. Touch the **Trigger Source** key on the soft menu bar.
11. Touch the **Free Run** key on the soft menu bar.
12. Touch the **{INPUT}** button on the function bar.
13. Touch the **IQ Inverse** key on the soft menu bar to set IQ Inverse to off.

14. Touch the **{MEAS CONTROL}** button on the function bar.

15. Touch the **Two Tone Parameters** key on the soft menu bar.
    The **[Two Tone Parameters Setup]** dialog box appears.

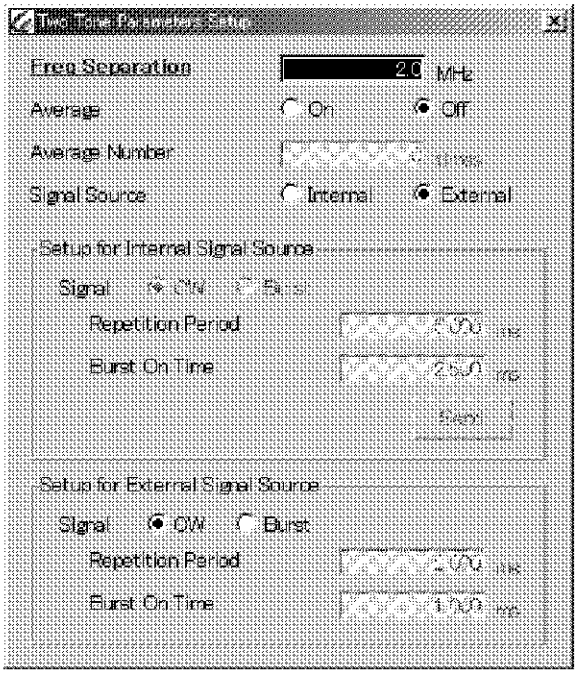


Figure 4-2 Two Tone Parameters Setup Dialog Box

16. Sets the frequency separation of the two signals.
    Touch the **[Freq Separation]** text box in the **[Two Tone Parameters Setup]** dialog box. The set value is highlighted. Input the numerical value either by touching **2** and **M/n** on the keypad or by turning the data knob until the numerical value, 2 MHz, is displayed.

17. Touch **[Off]** of the **[Average]** option button in the **[Two Tone Parameters Setup]** dialog box.

18. Touch **[External]** of the **[Signal Source]** option button in the **[Two Tone Parameters Setup]** dialog box.

19. Touch **[CW]** of the **[Signal]** option button in the **[Setup for External Signal Source]** field of the **[Two Tone Parameters Setup]** dialog box.

20. Touch the close button **X** in the **[Two Tone Parameters Setup]** dialog box to close the dialog box.

21. Touch the **Single Meas** key on the soft menu bar.
    Measurement is executed, and the measurement results are displayed.

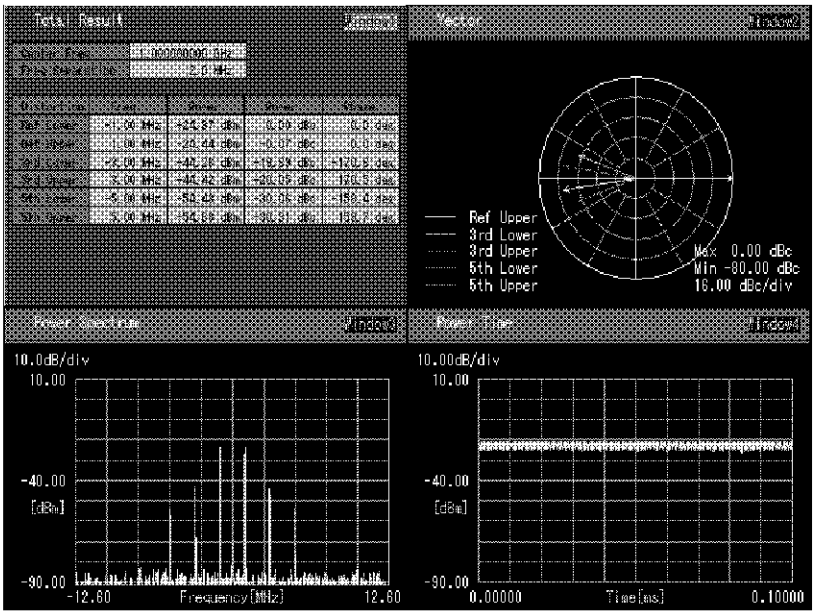


Figure 4-3 Two Tone Measurement Results

4.2 AM/AM and AM/PM Measurement Examples

The ratio of the output level to the input level of the DUT (AM/AM) and the output phase variation to the input level (AM/PM) of the DUT are measured.

In this example, the external SG is used.

Specifications of the measured signal

Measured signal:	3GPP Single Carrier
Center frequency:	2140 MHz
Level:	-10 dBm

Measurement conditions

Center Frequency:	2140 MHz
Level:	Auto Level Set
Trigger Source:	Ext1
INPUT:	IQ Inverse OFF
MEAS MODE:	AM/AM AM/PM

Set the AM/AM, AM/PM Parameters Setup dialog box as follows:

Average:	OFF
AM/AM Calculate Region:	-20 dB
AM/PM Calculate Region:	-20 dB
Signal:	CW

Single measurement

Connections

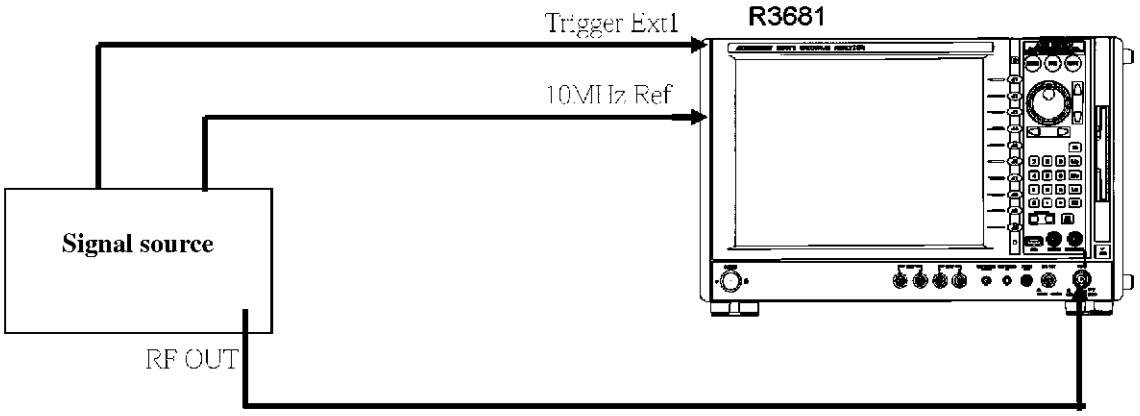


Figure 4-4 Connection Diagram when Acquiring Reference Data

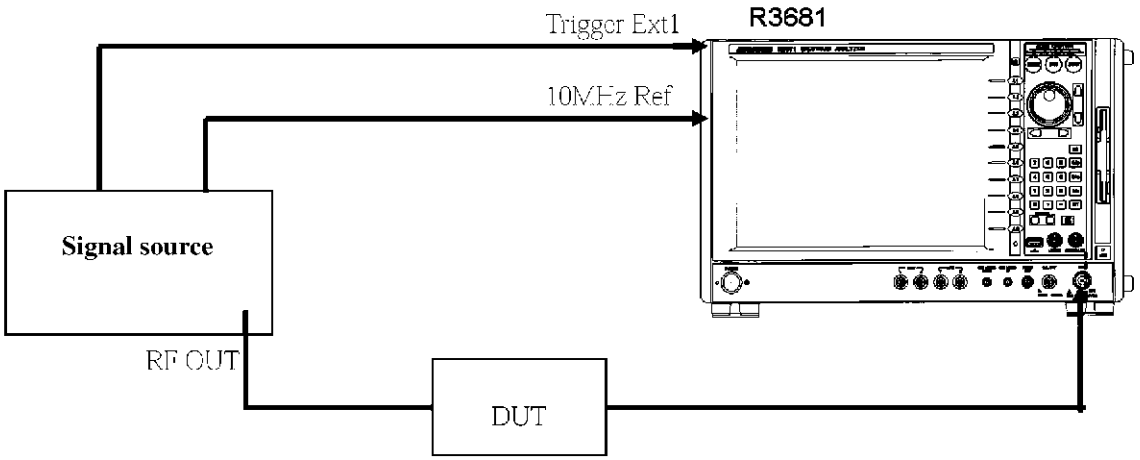


Figure 4-5 Connection Diagram when Executing Measurement

Setting the measurement conditions

1. Connect the R3681 directly to the signal source as shown in Figure 4-4 (Connection Diagram when Acquiring Reference Data).
2. Touch **[Config]** on the menu bar and select **[Non-Linear Analysis]**.
3. Touch the **{MEAS MODE}** button on the function bar.
4. Touch the **AM/AM AM/PM** key on the soft menu bar.
5. Touch the **{FREQ}** button on the function bar.
6. Touch the **Center** key on the soft menu bar.

7. Press [2], [1], [4], [0], and [M/n] in this order on the keypad.
   The center frequency is set to 2140 MHz.
8. Touch the **{LEVEL}** button on the function bar.
9. Touch the **Auto Level Set** key on the soft menu bar.
   The Ref Level is automatically set to the optimum value.
10. Touch the **{TRIGGER}** button on the function bar.
11. Touch the **Trigger Source** key on the soft menu bar.
12. Touch the **Ext 1** key on the soft menu bar.
13. Touch the **{INPUT}** button on the function bar.
14. Touch the **IQ Inverse** key on the soft menu bar to set IQ Inverse to off.
15. Touch the **{MEAS CONTROL}** button on the function bar.
16. Touch the **AM/AM AM/PM Parameters** key on the soft menu bar.
    The **[AM/AM AM/PM Parameters Setup]** dialog box appears.

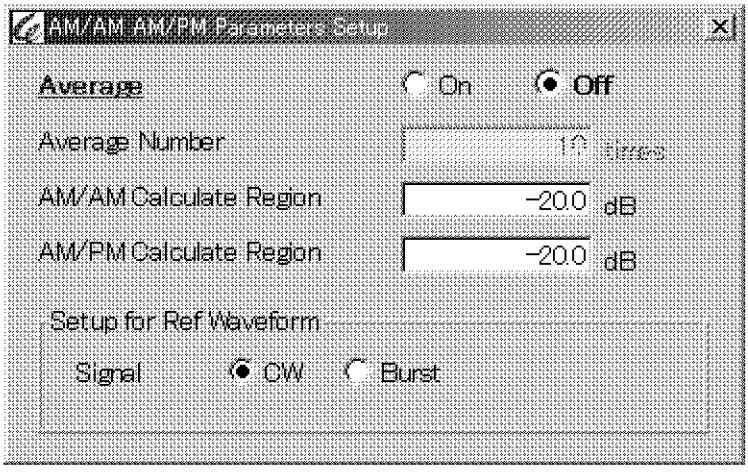


Figure 4-6 AM/AM AM/PM Parameters Setup Dialog Box

17. Touch **[Off]** of the **[Average]** option button in the **[AM/AM AM/PM Parameters Setup]** dialog box.
18. Touch the **[AM/AM Calculate Region]** text box in the **[AM/AM AM/PM Parameters Setup]** dialog box. The set value is highlighted. Input the numerical value either by pressing [-], [2], [0] and [ENT] on the keypad or by turning the data knob until the numerical value, -20 dB, is displayed.
19. Touch the **[AM/PM Calculate Region]** text box in the **[AM/AM AM/PM Parameters Setup]** dialog box. The set value is highlighted. Input the numerical value either by pressing [-], [2], [0] and [ENT] on the keypad or by turning the data knob until the numerical value, -20 dB, is displayed.

20. Touch **[CW]** of the **[Signal]** option button in the **[Setup for Ref Waveform]** field of the **[AM/AM AM/PM Parameters Setup]** dialog box.

21. Touch the close button ✕ in the **[AM/AM AM/PM Parameters Setup]** dialog box to close the dialog box.

22. Touch the **Capture Ref Data** key. The Reference data is acquired.

23. Connect the R3681, the signal source, and a DUT as shown in Figure 4-5 (Connection Diagram when Executing Measurement).

24. Touch the **{LEVEL}** button on the function bar.

25. Touch the **Auto Level Set** key on the soft menu bar.
    The Ref Level is automatically set to the optimum value.

26. Touch the **{MEAS CONTROL}** button on the function bar.

27. Touch the **Single Meas** key on the soft menu bar.
    Measurement is executed, and the measurement results are displayed.

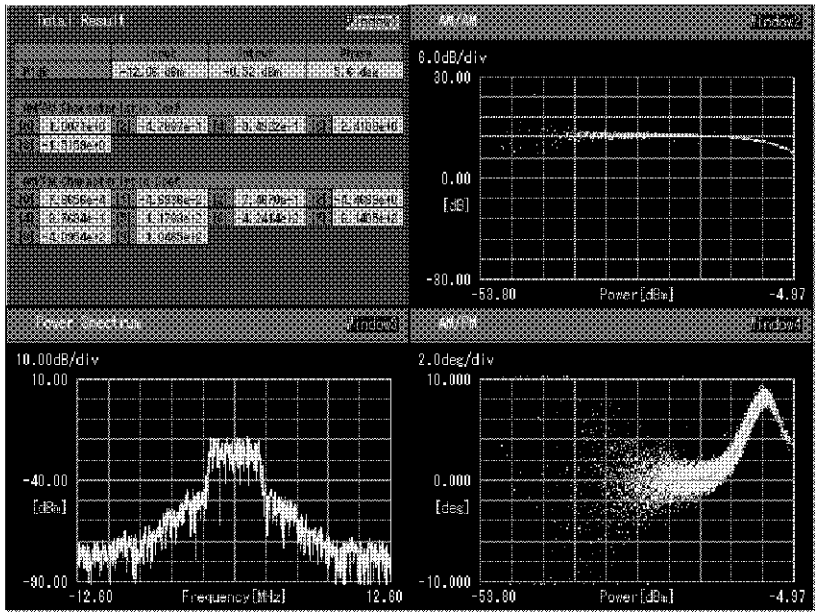


Figure 4-7 AM/AM and AM/PM Measurement Results

5. MENU MAP, FUNCTIONAL EXPLANATION

This chapter describes the configuration and functions of the soft keys displayed on the touch screen of the R3681 OPT83 AMP measurement option (hereafter referred to as this option.)

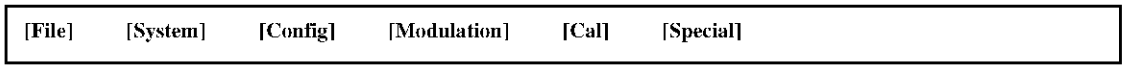
MEMO:

- [.....] *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 made by using a touch screen, and "touch" means pressing a button or a key.*

5.1 Menu Index

5.2 Switching Communication Systems

Select **[Non-Linear Analysis]** from **[Config]** on the menu bar to select this option.



The menu bar of this option is arranged as follows:

The menu bar consists of the same items as those of Spectrum Analyzer except that the additional item, Save Meas Data exists under the File menu when Non-Linear Analysis is selected.

{Save Meas Data} Saves the data displayed on the selected display.

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:

When you touch a function button on the function bar, the associated 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.

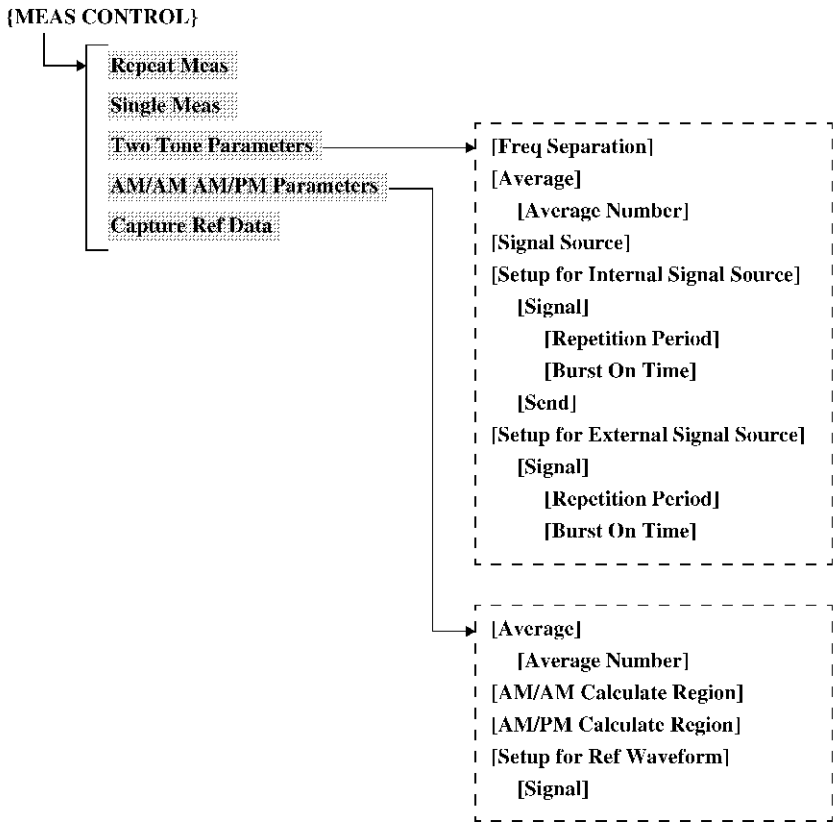
When you touch a button on the function bar, the associated soft keys are displayed on the soft menu bar.

5.5 Description of the Function of Each Key

This section describes the function of each key.

5.5.1 {MEAS CONTROL}

If the **{MEAS CONTROL}** button is touched, soft keys, which relate to the capture of Reference data and analysis from the measured signal, and the setup of measurement conditions, are displayed on the soft menu bar.



Repeat Meas — If the **Repeat Meas** button is touched, measurements are repeatedly performed.

Single Meas — If the **Single Meas** button is touched, measurement is performed once.

Two Tone Parameters — If the **Two Tone Parameters** button is touched, the dialog box that is used to set the conditions for two-signal distortion measurement is displayed. This function is available only when **Two Tone** is selected in **{MEAS MODE}**.

[Freq Separation] — Sets the frequency separation of two input signals.

[Average] Switches On or Off the mode that calculates the average of the measurement values that are obtained by repeating the measurement two or more times.

On: Calculates the average of the measurement values.

Off: Uses a single measurement as the result.

[Average Number] Sets the average number of times the measurement is performed.

[Signal Source] Specifies the measured signal.

Internal: Specifies the signal from the internal signal source.

External: Specifies the signal from the external signal source.

MEMO: Internal cannot be selected unless option 71 or option 72 is installed and option 83 is updated.

[Setup for Internal Signal Source]

This is set when Internal is specified in **[Signal Source]**.

[Signal] Selects the type of the measured signal.

CW: Specifies a continuous wave.

Burst: Specifies a burst wave.

[Repetition Period]

Sets the burst period when Burst is selected in **[Signal]**.

[Burst On Time]

Sets the burst ON interval when Burst is selected in **[Signal]**.

[Send] Generates the waveform data from the set values in the **[Setup for Internal Signal Source]** field and sends it to the internal signal source.

[Setup for External Signal Source]

This is set when External is specified in **[Signal Source]**.

[Signal] Selects the type of the measured signal.

CW: Specifies a continuous wave.

Burst: Specifies a burst wave.

[Repetition Period]

Sets the burst period when Burst is selected in **[Signal]**.

[Burst On Time]

Sets the burst ON interval when Burst is selected in **[Signal]**.

AM/AM AM/PM Parameters If the **AM/AM AM/PM Parameters** button is touched, the dialog box which is used to set AM/AM and AM/PM measurement conditions is displayed. This function is available only when **AM/AM AM/PM** is selected in **{MEAS MODE}**.

[Average] Switches On or Off the mode that calculates the average of the measurement values that are obtained by repeating the measurement two or more times.

On: Calculates the average of the measurement values.

Off: Uses a single measurement as the result.

[Average Number] Sets the average number of times the measurement is performed.

[AM/AM Calculate Region] Sets the region where the AM/AM characteristic is analyzed.

[AM/PM Calculate Region] Sets the region where the AM/PM characteristic is analyzed.

[Setup for Ref Waveform] Sets the measured signal.

[Signal] Selects the type of the measured signal.

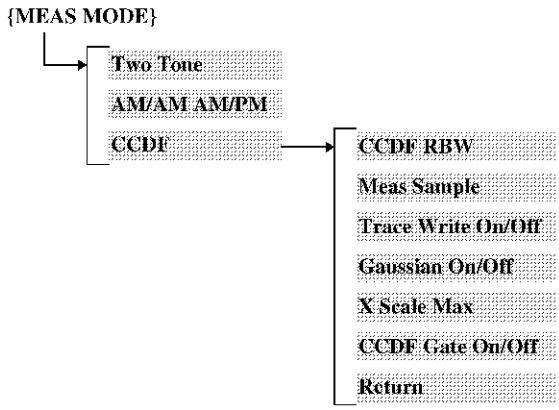
CW: Specifies a continuous wave.

Burst: Specifies a burst wave.

Capture Ref Data If the **Capture Ref Data** button is touched, the acquisition of Reference data from the measured signal starts. When the data acquisition is complete, measurements can be executed. This function is available only when **AM/AM AM/PM** is selected in **{MEAS MODE}**.

5.5.2 {MEAS MODE}

If the **{MEAS MODE}** button is touched, the soft keys which relate to the analysis parameter setting are displayed on the soft menu bar.



Two Tone

Measures the distortion which is caused by two different frequency signals.

AM/AM AM/PM

Measures the variation of the amplitude and phase in the output to the input level of the DUT and displays the AM/AM and AM/PM characteristics.

CCDF

Displays the CCDF menu.
The screen is switched to the CCDF measurement screen.

CCDF RBW

Sets RBW.
RBW can be set to 100 kHz to 20 MHz (1, 2, 3, and 5 sequence).

Meas Sample

Sets the number of measurement samples.

Trace Write On/Off

Switches the reference waveform display On and Off

On: Displays the currently displayed waveform as the reference waveform.

Off: Hides the reference waveform.

Gaussian On/Off

Switches the ideal Gaussian noise waveform display On and Off.

On: Displays the ideal Gaussian noise waveform.

Off: Hides the ideal Gaussian noise waveform.

X Scale Max

Sets the horizontal axis maximum value of the waveform display.

CCDF Gate On/Off

Switches the gate function of the CCDF measurement On and Off.

On: Sets a threshold level and performs the CCDF measurement in the period where the input signal is higher than the specified threshold level.

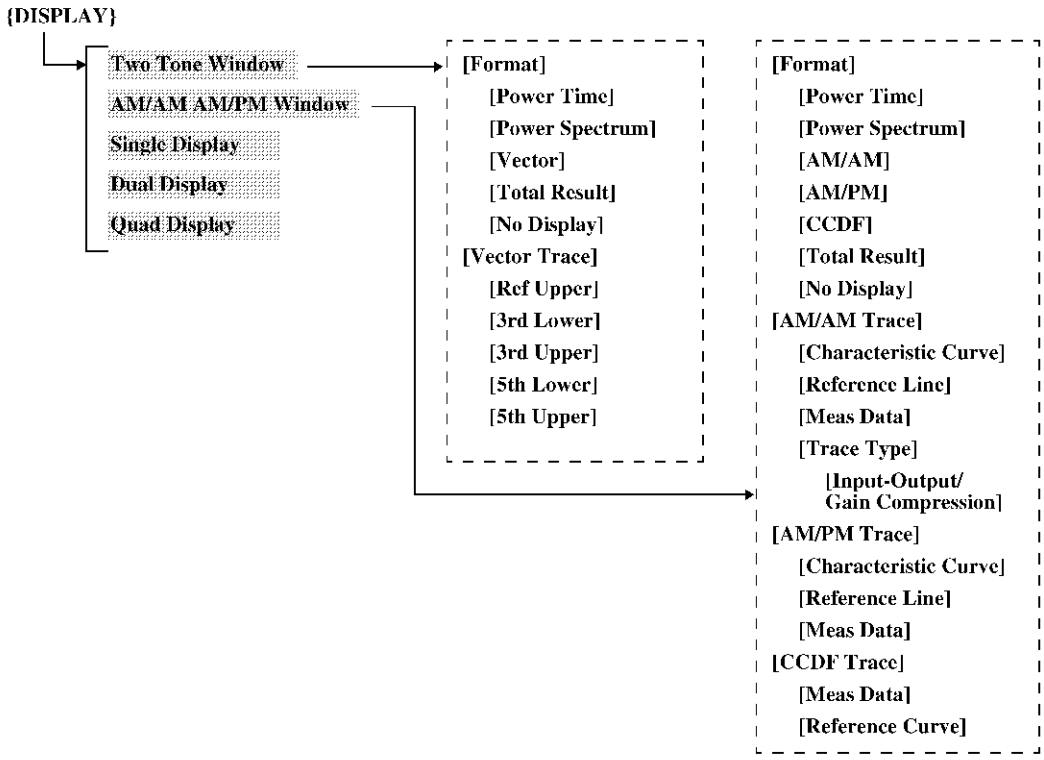
Off: Sets the gate function of the CCDF measurement to off.

Return

Returns to the previous menu.

5.5.3 {DISPLAY}

When you touch the **{DISPLAY}** button, the soft keys related to the display screen setup are displayed on the soft menu bar.



Two Tone Window — Displays the dialog box used to set the type of display result in the active window on the Two Tone result display screen.
Selects "Format" from the display result, and sets it in more detail if the selected "Format" is Vector.

[Format] — Selects the type of display result.

[Power Time] — Displays time waveform data. The burst status can be checked. On the graph, the vertical axis shows power (dBm) and the horizontal axis shows time (ms).

[Power Spectrum] — Displays the spectrum. On the graph, the vertical axis shows power (dBm) and the horizontal axis shows frequency (Hz).

[Vector] — Displays the phases and amplitude of two signals and the signal distortion in the vector graph (the power is displayed in dBc).

[Total Result] — Displays the numerical data of the measurement result.

Center Freq:
Center frequency

Freq Separation:
Frequency separation between two signals

Signal data:
Displays Freq, Power (dBm), Power (dBc) and Phase (deg) for each signal of Ref Lower, Ref Upper, 3rd Lower, 3rd Upper, 5th Lower and 5th Upper.

[No Display] Nothing is displayed.

[Vector Trace] Sets the display in detail when **[Format]** is Vector.

[Ref Upper] Turns on or off the vector display of a signal that contains the higher frequency of the two input signals.

[3rd Lower] Turns on or off the vector display of the third order distortion that appears in the lower side of the signal distortion that is generated by two input signals.

[3rd Upper] Turns on or off the vector display of the third order distortion that appears in the upper side of the signal distortion that is generated by two input signals.

[5th Lower] Turns on or off the vector display of the fifth order distortion that appears in the lower side of the signal distortion that is generated by two input signals.

[5th Upper] Turns on or off the vector display of the fifth order distortion that appears in the upper side of the signal distortion that is generated by two input signals.

AM/AM AM/PM Window Displays the dialog box that is used to set the type of display result in the active window on the AM/AM AM/PM result display screen.
Selects "Format" from the display result, and sets it in more detail by setting "AM/AM," "AM/PM," or "CCDF."

[Format] Selects the type of display result.

[Power Time] Displays time waveform data. The burst status can be checked. On the graph, the vertical axis shows power (dBm) and the horizontal axis shows time (ms).

[Power Spectrum] Displays the spectrum.
On the graph, the vertical axis shows power (dBm) and the horizontal axis shows frequency (Hz).

[AM/AM] Displays the graph that shows the amplitude variation in the output to the input level of the DUT by using the modulated signal. On the graph, the vertical axis setting is varied according to the setting in **[AM/AM Trace]**. The horizontal axis shows the input level (dBm).

[AM/PM] Displays the graph that shows the phase variation in the output to the input level of the DUT by using the modulated signal.
On the graph, the vertical axis shows the phase variation (deg) and the horizontal axis shows the input level (dBm).

[CCDF] Executes the CCDF measurement in the frequency range of 20 MHz. The number of data is fixed in the measurement.

[Total Result] Displays the numerical data of the measurement result.

P1dB: The input level (dBm), output level (dBm), and phase variation (deg) are displayed at P1dB.

AM/AM Characteristic Coef:
Indicates coefficients in the polynomial approximation of the non-linear characteristic of AM/AM.

AM/AM Characteristic Coef:
Indicates coefficients in the polynomial approximation of the non-linear characteristic of AM/PM.

[No Display] Nothing is displayed.

[AM/AM Trace] Sets the display in detail when **[Format]** is AM/AM.

[Characteristic Curve]
Turns on or off the display of the AM/AM conversion characteristic curve that is calculated from the measurement result.

[Reference Line] Turns on or off the display of the reference line.

[Meas Data] Turns on or off the display of the measurement result.

[Trace Type] Selects the type of graph display. The Y-axis data is changed.

Input-Output:
Displays the graph with the measurement level in dBm.

Gain Compression:
Displays the graph with the ratio (dB) of the measurement level to the input level.

[AM/PM Trace] Sets the display in detail when [Format] is AM/PM.

[Characteristic Curve]
Turns on or off the display of AM/PM conversion characteristic curve that is calculated from the measurement result.

[Reference Line] Turns on or off the display of the reference line.

[Meas Data] Turns on or off the display of the measurement result.

[CCDF Trace] Sets the display in detail when **[Format]** is CCDF.

[Meas Data] Turns on or off the trace display of the measurement result.

[Reference Curve] Turns on or off the display of the reference curve.

Single Display Selects the single screen display.

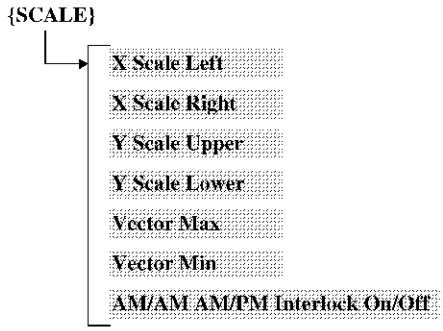
Dual Display Selects the dual screen display.

Quad Display Selects the quad screen display.

5.5.4 {SCALE}

If the **{SCALE}** button is touched, the soft keys which relate to the scale setup in the active display window are displayed on the soft menu bar.

This function is disabled if a window that displays no graph is active.



X Scale Left — Sets the minimum value on the X axis.
This setting is disabled on the Power Time and Vector graphs.

X Scale Right — Sets the maximum value on the X axis.
This setting is disabled on the Power Time and Vector graphs.

Y Scale Upper — Sets the maximum value on the Y axis.
This setting is disabled on the Vector graph.

Y Scale Lower — Sets the minimum value on the Y axis.
This setting is disabled on the Vector graph.

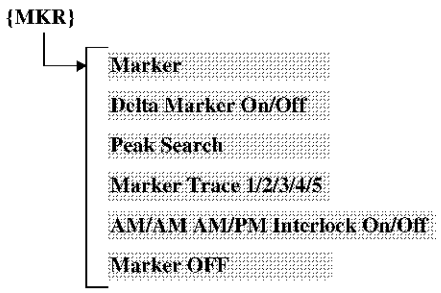
Vector Max — Sets the maximum value on the Vector graph.
This setting is disabled on other graphs.

Vector Min — Sets the minimum value on the Vector graph.
This setting is disabled on other graphs.

AM/AM AM/PM Interlock On/Off — Interlocks the X-Scale settings between the AM/AM and AM/PM graphs. This setting can be used on the AM/AM and AM/PM graphs.

5.5.5 {MKR}

When you touch the **{MKR}** button, the soft keys related to the marker setup are displayed on the side menu bar. Functions which are enabled vary according to the type of the graph in an active window. If a window where no graph is shown is active or if no graph data is given because no measurement has been performed, these functions are unavailable.



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

Delta Marker On/Off — Switches the delta marker display function On and Off.

- ON: Displays the delta marker and normal marker in the same position. Displays the relative value (measurement value such as EVM) to the normal marker in the marker area.
- OFF: Hides the delta marker.

Peak Search — Moves the marker to the maximum peak of the trace in the search range.

Marker Trace 1/2/3/4/5 — Moves the normal marker between traces when more than one trace exists. The marker moves between traces every time the key is pressed.

AM/AM AM/PM Interlock On/Off — Interlocks the marker settings between the AM/AM and AM/PM graphs. This setting can be used on the AM/AM and AM/PM graphs.

Marker OFF — Hides the normal marker.

5.5.6 {INPUT}

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

IQ Inverse On/Off

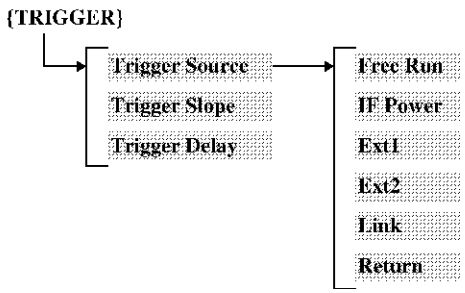
Selects whether or not to invert the phase of the signal to be measured.

ON: Inverts the signal.

OFF: Does not invert the signal.

5.5.7 {TRIGGER}

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



Trigger Source — If the **Trigger Source** button is touched, the soft keys, which relate to the trigger setup, are displayed on the soft menu bar.

Free Run — Obtains and analyzes data according to the internal timing of the instrument.

IF Power — Obtains and analyzes data in sync with the IF signal.

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

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

Link — Obtains and analyzes data in sync with the trigger of an optional function.

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

---

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

Trigger Slope — Switches the trigger slope polarity between + and -.
Available only for **[IF Power]**, **[Ext1]**, **[Ext2]** and **[Link]**.

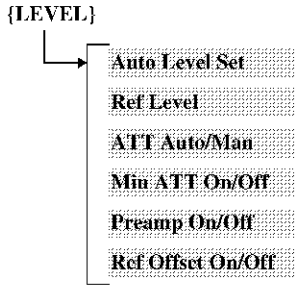
+: Starts the sweep at the rising edge of a trigger.

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

Trigger Delay — Sets the delay time. Synchronizes the measurement to when the delay time has passed after the trigger occurs

5.5.8 {LEVEL}

If the **{LEVEL}** button is touched, the soft keys, which relate 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 Auto/Man

Sets the attenuator.

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

Man: Sets the attenuator.

Min ATT On/Off

Sets the Min ATT function to On or Off.

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

Off: Cancels the Min ATT limitation.

Preamp On/Off

Sets the preamplifier function to on or off.

Ref Offset On/Off

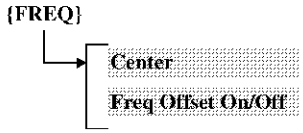
Switches the reference level offset function On and Off.

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.

5.5.9 {FREQ}

If the **{FREQ}** button is touched, the soft keys, which relate 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. Inaccurate measurements may be performed.

Freq Offset On/Off Switches On and Off the center frequency offset function.

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.

5.5.10 Measurement Tool Bar

This section describes the icons that are located in the left-hand column on the screen and the soft keys that are displayed below the icons.

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

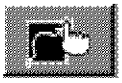
The following functions can be used by touching the icons:


:Active window switching icon:

Used to make one of the split windows active.

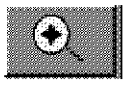

:Range specification icon (X-axis mode):

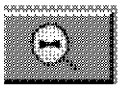
Used to specify a range in the window in which the waveform is displayed. After touching the icon, touch both sides of the range to be specified.

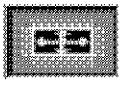

:Range specification icon (range mode):

Used to specify a range in the window in which the waveform is displayed. After touching the icon, touch the opposing corners 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 in the range specified by the range specification icon.


: Zoom in icon Used to zoom in on the waveform displayed in the window. The range specified by the range specification icon is zoomed in on by touching this icon.


: Zoom out icon: Used to zoom out from the waveform displayed in the window.


:Scroll 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|NLANalysis	SAN|NLAN	
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<ch=1|2>:ATTenuation	<real>	<real>	
ATT(Auto/Manual)	:INPut<ch=1|2>:ATTenuation:AUTO	OFF|ON	OFF|ON	
Min ATT setting (Manual)	:INPut<ch=1|2>:ATTenuation:MINimum	<real>	<real>	
Min ATT ON/OFF	:INPut<ch=1|2>:ATTenuation:MINimum:STATe	OFF|ON	OFF|ON	
Preamp ON/OFF	:INPut<ch=1|2>:GAIN:STATe	OFF|ON	OFF|ON	
Input Setup				
IQ Inverse ON/OFF	:INPut<ch=1|2>:IQ:INVerse	OFF|ON	OFF|ON	

6.3.3 Subsystem-CONFigure

Function description	SCPI command	Parameter	Query reply	Remarks
Meas Mode				
Two Tone mode setting	:CONFigure<ch=1|2>:TTONe	–	–	
AM/AM,AM/PM mode setting	:CONFigure<ch=1|2>:AM	–	–	
CCDF mode	:CONFigure<ch=1|2>:CCDF	–	–	

6.3.4 Subsystem-SENSe

Function description	SCPI command	Parameter	Query reply	Remarks
FREQuency				
Center Freq setting	[:SENSe<ch=1|2>]:FREQuency:CENTer	<real>	<real>	
Freq Offset setting	[:SENSe<ch=1|2>]:FREQuency:OFFSet	<real>	<real>	
Freq Offset ON/OFF	[:SENSe<ch=1|2>]:FREQuency:OFFSet:STATe	OFF|ON	OFF|ON	
Auto Level Set	[:SENSe<ch=1|2>]:POWer:LEVel:AUTO	–	–	
Measurement Parameter(Two Tone)				
Freq Separation	[:SENSe<ch=1|2>]:CONDition:TTONe:FREQuency:SEParation	<real>	<real>	
Average Number setting	[:SENSe<ch=1|2>]:CONDition:TTONe:AVERage:COUNt	<int>	<int>	
Average ON/OFF	[:SENSe<ch=1|2>]:CONDition:TTONe:AVERage[:STATe]	OFF|ON	OFF|ON	
External Signal Source CW/Burst	[:SENSe<ch=1|2>]:CONDition:TTONe:SOURce:EXTernal	CW|BURSt	CW|BURS	
External Signal Source Repetition Period	[:SENSe<ch=1|2>]:CONDition:TTONe:SOURce:EXTernal:RPERiod	<real>	<real>	
External Signal Source Burst On Time	[:SENSe<ch=1|2>]:CONDition:TTONe:SOURce:EXTernal:BURSt	<real>	<real>	
Measurement Parameter(AM/AM,AM/PM)				
Average Number setting	[:SENSe<ch=1|2>]:CONDition:AM:AVERage:COUNt	<int>	<int>	
Average ON/OFF	[:SENSe<ch=1|2>]:CONDition:AM:AVERage[:STATe]	OFF|ON	OFF|ON	
AM/AM Calculate Region	[:SENSe<ch=1|2>]:CONDition:AM:AMAM:CALCulate:REGion	<real>	<real>	
AM/PM Calculate Region	[:SENSe<ch=1|2>]:CONDition:AM:AMPM:CALCulate:REGion	<real>	<real>	
Setup for Ref Waveform CW/Burst	[:SENSe<ch=1|2>]:CONDition:AM:REFerence:WFM	CW|BURSt	CW|BURS	

Function description	SCPI command	Parameter	Query reply	Remarks
Measurement Parameter(CCDF)				
Meas Sample setting	[:SENSe<ch=1|2>]:CONDition:CCDF:POINt	<int>	<int>	
RBW setting	[:SENSe<ch=1|2>]:CONDition:CCDF:BANDwidth|BWIDth[:RESolution]	<real>	<real>	
CCDF Gate ON/OFF setting	[:SENSe<ch=1|2>]:CONDition:CCDF:GATE	OFF|ON	OFF|ON	
CCDF Gate Threshold setting	[:SENSe<ch=1|2>]:CONDition:CCDF:GATE:THReshold	<real>	<real>	

6.3.5 Subsystem-TRIGger

Function description	SCPI command	Parameter	Query reply	Remarks
SEQuence				
Trigger Source setting	:TRIGger<ch=1|2>[:SEQuence]:SOURce	IMMediate|IF|EXTernal1|EXTernal2|LINK	IMM|IF|EXT1|EXT2|LINK	
Trigger Slope setting	:TRIGger<ch=1|2>[:SEQuence]:SLOPe	POSitive|NEGative	POS|NEG	
IF Trigger Level setting	:TRIGger<ch=1|2>[:SEQuence]:LEVel:IF	<real>	<real>	
Ext Level setting	:TRIGger<ch=1|2>[:SEQuence]:LEVel:EXTernal	<real>	<real>	
Trigger Delay setting	:TRIGger<ch=1|2>[:SEQuence]:DELay	<real>	<real>	

6.3.6 Subsystem-INITiate

Function description	SCPI command	Parameter	Query reply	Remarks
INITiate				
Repeat Measurement execution	:INITiate<ch=1|2>:MEASure:REPeat	–	–	
Single Measurement execution	:INITiate<ch=1|2>:MEASure:SINGle	–	–	
Measurement stop	:INITiate<ch=1|2>:ABORt	–	–	

6.3.7 Subsystem-CALCulate

Function description	SCPI command	Parameter	Query reply	Remarks
MARKer				
Marker ON/OFF	:CALCulate<ch=1|2>:MARKer<screen=1|2|3|4>:FUNCtion[:STATe]	OFF|ON	OFF|ON	
Marker X setting	:CALCulate<ch=1|2>:MARKer<screen=1|2|3|4>:X	<real>	<real>	
Reading Marker Y	:CALCulate<ch=1|2>:MARKer<screen=1|2|3|4>:Y	–	<real> [,<real>] [,<real>]	
Executing Peak Search	:CALCulate<ch=1|2>:MARKer<screen=1|2|3|4>:MAXimum[:PEAK]	–	–	
AM/AM,AM/PM Interlock ON/OFF	:CALCulate<ch=1|2>:MARKer:ILOCk[:STATe]	OFF|ON	OFF|ON	
Marker Trace setting	:CALCulate<ch=1|2>:MARKer<screen=1|2|3|4>:TRACe	1|2|3|4|5	1|2|3|4|5	
ΔMarker ON/OFF	:CALCulate<ch=1|2>:DELTamarker<screen=1|2|3|4>[:STATe]	OFF|ON	OFF|ON	
Reading the absolute value of ΔMarker X	:CALCulate<ch=1|2>:DELTamarker<screen=1|2|3|4>:X	–	<real>	
Reading the absolute value of ΔMarker Y	:CALCulate<ch=1|2>:DELTamarker<screen=1|2|3|4>:Y	–	<real> [,<real>] [,<real>]	

6.3.8 Subsystem-DISPlay

Function description	SCPI command	Parameter	Query reply	Remarks
Level				
Ref Level setting	:DISPlay<ch=1|2>[:WINDow]:TRACe:Y[:SCALe]:RLEVel	<real>	<real>	
Level Offset setting	:DISPlay<ch=1|2>[:WINDow]:TRACe:Y[:SCALe]:RLEVel:OFFSet	<real>	<real>	
Level Offset ON/OFF	:DISPlay<ch=1|2>[:WINDow]:TRACe:Y[:SCALe]:RLEVel:OFFSet:STATe	OFF|ON	OFF|ON	
Window				
Multi Screen setting	:DISPlay<ch=1|2>[:WINDow]	SINGle|DUAL|QUAD	SING|DUAL|QUAD	
Active Screen setting	:DISPlay<ch=1|2>[:WINDow<screen=1|2|3|4>]:ACTive	–	1|2|3|4	
Scale(Two Tone, AM/AM,AM/PM)				
X Scale Left setting	:DISPlay<ch=1|2>[:WINDow<screen=1|2|3|4>]:TRACe:X[:SCALe]:LEFT	<real>	<real>	
X Scale Right setting	:DISPlay<ch=1|2>[:WINDow<screen=1|2|3|4>]:TRACe:X[:SCALe]:RIGHt	<real>	<real>	
Y Scale Upper setting	:DISPlay<ch=1|2>[:WINDow<screen=1|2|3|4>]:TRACe:Y[:SCALe]:UPPer	<real>	<real>	
Y Scale Lower setting	:DISPlay<ch=1|2>[:WINDow<screen=1|2|3|4>]:TRACe:Y[:SCALe]:LOWer	<real>	<real>	
Setting Vector amplitude Max	:DISPlay<ch=1|2>[:WINDow<screen=1|2|3|4>]:TRACe:VECTor[:SCALe]:MAXmum	<real>	<real>	
Setting Vector amplitude Min	:DISPlay<ch=1|2>[:WINDow<screen=1|2|3|4>]:TRACe:VECTor[:SCALe]:MINmum	<real>	<real>	
AM/AM,AM/PM X Scale Interlock ON/OFF	:DISPlay<ch=1|2>[:WINDow]:TRACe:X[:SCALe]:ILOCk	OFF|ON	OFF|ON	
Scale(CCDF)				
CCDF X Scale Max setting	:DISPlay<ch=1|2>[:WINDow]:TRACe:X[:SCALe]:CCDF	<real>	<real>	
Display(Two Tone)				
Window Format setting	:DISPlay<ch=1|2>:TTONe[:WINDow<screen=1|2|3|4>]:TRACe:FORMat	OFF|PTIMe|PSPectrum|VECTor|TRESult	OFF|PTIME|PSP|VECT|TRES	
Vector Trace ON/OFF	:DISPlay<ch=1|2>:TTONe[:WINDow<screen=1|2|3|4>]:TRACe:FORMat:VECTor<trace=1|2|3|4|5>	OFF|ON	OFF|ON	*1
Display(AM/AM,AM/PM)				
Window Format setting	:DISPlay<ch=1|2>:AM[:WINDow<screen=1|2|3|4>]:TRACe:FORMat	OFF|PTIMe|PSPectrum|AMAM|AMPM|CCDF|TRESult	OFF|PTIM|PSP|AMAM|AMPM|CCDF|TRES	
AM/AM Trace Meas Data ON/OFF	:DISPlay<ch=1|2>:AM[:WINDow<screen=1|2|3|4>]:TRACe:FORMat:AMAM:MDATa	OFF|ON	OFF|ON	

*1: The contents of VECTor commands 1, 2, 3, 4 and 5 are as follows:
1:Ref Upper, 2:3rd Lower, 3:3rd Upper, 4:5th Lower, 5:5th Upper

Function description	SCPI command	Parameter	Query reply	Remarks
AM/AM Trace Characteristic Curve ON/OFF	:DISPlay<ch=1|2>:AM[:WINDow<screen=1|2|3|4>]:TRACe:FORMat:AMAM:CCURve	OFF|ON	OFF|ON	
AM/AM Trace Reference Line ON/OFF	:DISPlay<ch=1|2>:AM[:WINDow<screen=1|2|3|4>]:TRACe:FORMat:AMAM:RLINe	OFF|ON	OFF|ON	
AM/AM Trace type setting	:DISPlay<ch=1|2>:AM[:WINDow<screen=1|2|3|4>]:TRACe:FORMat:AMAM:TYPE	INOutput|GCOMpression	INO|GCOM	
AM/PM Trace Meas Data ON/OFF	:DISPlay<ch=1|2>:AM[:WINDow<screen=1|2|3|4>]:TRACe:FORMat:AMPM:MDATa	OFF|ON	OFF|ON	
AM/PM Trace Characteristic Curve ON/OFF	:DISPlay<ch=1|2>:AM[:WINDow<screen=1|2|3|4>]:TRACe:FORMat:AMPM:CCURve	OFF|ON	OFF|ON	
AM/PM Trace Reference Line ON/OFF	:DISPlay<ch=1|2>:AM[:WINDow<screen=1|2|3|4>]:TRACe:FORMat:AMPM:RLINe	OFF|ON	OFF|ON	
CCDF Trace Meas Data ON/OFF	:DISPlay<ch=1|2>:AM[:WINDow<screen=1|2|3|4>]:TRACe:FORMat:CCDF:MDATa	OFF|ON	OFF|ON	
CCDF Trace Reference Curve ON/OFF	:DISPlay<ch=1|2>:AM[:WINDow<screen=1|2|3|4>]:TRACe:FORMat:CCDF:RCURve	OFF|ON	OFF|ON	
Display(CCDF)				
Gaussian ON/OFF	:DISPlay<ch=1|2>[:WINDow]:TRACe:CCDF:GAUSsian:STATe	OFF|ON	OFF|ON	
Trace Write ON/OFF	:DISPlay<ch=1|2>[:WINDow]:TRACe:CCDF:STATe	OFF|ON	OFF|ON	

6.3.9 Subsystem-MMEMory

Function description	SCPI command	Parameter	Query reply	Remarks
Save/Load				
Saving the settings of this instrument	:MMEMory:STORe:STATe	<int>	–	*2
Loading the settings of this instrument	:MMEMory:LOAD:STATe	<int>	–	*2
Measurement condition Save selection	:MMEMory:SELect:ITEM:NLANalysis:SETup	OFF|ON	OFF|ON	
Save Meas Data				
Saving the measurement result	:MMEMory:STORe:MEASure:STATe	<int>	–	*2

*2: 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
Total Result(Two Tone)				
Total Result	:MEASure<ch=1|2>:TTONe:TRESult[:NUMBer <dist=1|2|3|4|5|6>]	–	<real>,<real>, <real>,<real>	*3
Total Result(AM/AM,AM/PM)				
P1dB In	:MEASure<ch=1|2>:AM:TRESult:PONedb:IN	–	<real>	
P1dB Out	:MEASure<ch=1|2>:AM:TRESult:PONedb:OUT	–	<real>	
P1dB Phase	:MEASure<ch=1|2>:AM:TRESult:PONedb:PHASe	–	<real>	
AM/AM Characteristic Coef	:MEASure<ch=1|2>:AM:TRESult:AMAM: CCOef[:NUMBer<coef=1|2|3|4|5>]	–	<real>	*4
AM/PM Characteristic Coef	:MEASure<ch=1|2>:AM:TRESult:AMPM: CCOef[:NUMBer<coef=1|2|3|4|5|6|7|8|9|10>]	–	<real>	*5
CCDF				
CCDF	:MEASure<ch=1|2>:CCDF[:NUMBer <per=1|2|3|4|5|6>]	–	<real>,<real>, <real>	*6
CCDF(Average Power)	:MEASure<ch=1|2>:CCDF:APOWer	–	<real>	
CCDF(Peak Factor)	:MEASure<ch=1|2>:CCDF:PFACtor	–	<real>	
CCDF(Power Ratio X %)	:MEASure<ch=1|2>:CCDF:PRATio[:NUMBer <per=1|2|3|4|5|6>]	–	<real>	*7

*3: If the NUMBer command is omitted, all measurement results are output.
(<real>,<real>,<real>,<real>) × 6

The contents of NUMBer commands 1, 2, 3, 4, 5 and 6 are as follows:
1:Ref Lower, 2:Ref Upper, 3:3rd Lower, 4:3rd Upper, 5:5th Lower, 6:5th Upper

*4: If the NUMBer command is omitted, all Characteristic Coefs are output.
<real> × 5

The contents of NUMBer commands 1, 2, 3, 4 and 5 are as follows:
1:[0], 2:[2], 3:[4], 4:[6], 5:[8]

*5: If the NUMBer command is omitted, all Characteristic Coefs are output.
<real> × 10

The contents of NUMBer commands 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 are as follows:
1:[0], 2:[1], 3:[2], 4:[3], 5:[4], 6:[5], 7:[6], 8:[7], 9:[8], 10:[9]

*6: If the NUMBer command is omitted, all Power Ratios are output.
<real>,<real>,<real> × 6

The contents of NUMBer commands 1, 2, 3, 4, 5 and 6 are as follows:
1:10%, 2:1%, 3:0.1%, 4:0.01%, 5:0.001%, 6:0.0001%

*7: If the NUMBer command is omitted, all Power Ratios are output.
<real> × 6

The contents of NUMBer commands 1, 2, 3, 4, 5 and 6 are as follows:
1:10%, 2:1%, 3:0.1%, 4:0.01%, 5:0.001%, 6:0.0001%

6.3.11 Subsystem-READ

Function description	SCPI command	Parameter	Query reply	Remarks
Total Result(Two Tone)				
Total Result	:READ<ch=1|2>:TTONe:TRESult[:NUMBer <dist=1|2|3|4|5|6>]	–	<real>,<real>, <real>,<real>	*3
Total Result(AM/AM,AM/PM)				
P1dB In	:READ<ch=1|2>:AM:TRESult:PONedb:IN	–	<real>	
P1dB Out	:READ<ch=1|2>:AM:TRESult:PONedb:OUT	–	<real>	
P1dB Phase	:READ<ch=1|2>:AM:TRESult:PONedb:PHASe	–	<real>	
AM/AM Characteristic Coef	:READ<ch=1|2>:AM:TRESult:AMAM: CCOef[:NUMBer<coef=1|2|3|4|5>]	–	<real>	*4
AM/PM Characteristic Coef	:READ<ch=1|2>:AM:TRESult:AMPM:CCOef [:NUMBer<coef=1|2|3|4|5|6|7|8|9|10>]	–	<real>	*5
CCDF				
CCDF	:READ<ch=1|2>:CCDF[:NUMBer<per=1|2|3|4|5|6>]	–	<real>,<real>, <real>	*6
CCDF(Average Power)	:READ<ch=1|2>:CCDF:APOWer	–	<real>	
CCDF(Peak Factor)	:READ<ch=1|2>:CCDF:PFACtor	–	<real>	
CCDF(Power Ratio X %)	:READ<ch=1|2>:CCDF:PRATio[:NUMBer <per=1|2|3|4|5|6>]	–	<real>	*7

*3: If the NUMBer command is omitted, all measurement results are output.
(<real>,<real>,<real>,<real>) × 6

The contents of NUMBer commands 1, 2, 3, 4, 5 and 6 are as follows:
1:Ref Lower, 2:Ref Upper, 3:3rd Lower, 4:3rd Upper, 5:5th Lower, 6:5th Upper

*4: If the NUMBer command is omitted, all Characteristic Coefs are output.
<real> × 5

The contents of NUMBer commands 1, 2, 3, 4 and 5 are as follows:
1:[0], 2:[2], 3:[4], 4:[6], 5:[8]

*5: If the NUMBer command is omitted, all Characteristic Coefs are output.
<real> × 10

The contents of NUMBer commands 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 are as follows:
1:[0], 2:[1], 3:[2], 4:[3], 5:[4], 6:[5], 7:[6], 8:[7], 9:[8], 10:[9]

*6: If the NUMBer command is omitted, all Power Ratios are output.
<real>,<real>,<real> × 6

The contents of NUMBer commands 1, 2, 3, 4, 5 and 6 are as follows:
1:10%, 2:1%, 3:0.1%, 4:0.01%, 5:0.001%, 6:0.0001%

*7: If the NUMBer command is omitted, all Power Ratios are output.
<real> × 6

The contents of NUMBer commands 1, 2, 3, 4, 5 and 6 are as follows:
1:10%, 2:1%, 3:0.1%, 4:0.01%, 5:0.001%, 6:0.0001%

6.3.12 Subsystem-FETCh

Function description	SCPI command	Parameter	Query reply	Remarks
Total Result(Two Tone)				
Total Result	:FETCh<ch=1|2>:TTONe:TRESult[:NUMBer <dist=1|2|3|4|5|6>]	–	<real>,<real>, <real>,<real>	*3
Total Result(AM/AM,AM/PM)				
P1dB In	:FETCh<ch=1|2>:AM:TRESult:PONedb:IN	–	<real>	
P1dB Out	:FETCh<ch=1|2>:AM:TRESult:PONedb:OUT	–	<real>	
P1dB Phase	:FETCh<ch=1|2>:AM:TRESult:PONedb:PHASe	–	<real>	
AM/AM Characteristic Coef	:FETCh<ch=1|2>:AM:TRESult:AMAM: CCOef[:NUMBer<coef=1|2|3|4|5>]	–	<real>	*4
AM/PM Characteristic Coef	:FETCh<ch=1|2>:AM:TRESult:AMPM: CCOef[:NUMBer<coef=1|2|3|4|5|6|7|8|9|10>]	–	<real>	*5
CCDF				
CCDF	:FETCh<ch=1|2>:CCDF[:NUMBer<per=1|2|3|4|5|6>]	–	<real>,<real>, <real>	*6
CCDF(Average Power)	:FETCh<ch=1|2>:CCDF:APOWer	–	<real>	
CCDF(Peak Factor)	:FETCh<ch=1|2>:CCDF:PFACtor	–	<real>	
CCDF(Power Ratio X %)	:FETCh<ch=1|2>:CCDF:PRATio[:NUMBer <per=1|2|3|4|5|6>]	–	<real>	*7

*3: If the NUMBer command is omitted, all measurement results are output.
(<real>,<real>,<real>,<real>) × 6

The contents of NUMBer commands 1, 2, 3, 4, 5 and 6 are as follows:
1:Ref Lower, 2:Ref Upper, 3:3rd Lower, 4:3rd Upper, 5:5th Lower, 6:5th Upper

*4: If the NUMBer command is omitted, all Characteristic Coefs are output.
<real> × 5

The contents of NUMBer commands 1, 2, 3, 4 and 5 are as follows:
1:[0], 2:[2], 3:[4], 4:[6], 5:[8]

*5: If the NUMBer command is omitted, all Characteristic Coefs are output.
<real> × 10

The contents of NUMBer commands 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 are as follows:
1:[0], 2:[1], 3:[2], 4:[3], 5:[4], 6:[5], 7:[6], 8:[7], 9:[8], 10:[9]

*6: If the NUMBer command is omitted, all Power Ratios are output.
<real>,<real>,<real> × 6

The contents of NUMBer commands 1, 2, 3, 4, 5 and 6 are as follows:
1:10%, 2:1%, 3:0.1%, 4:0.01%, 5:0.001%, 6:0.0001%

*7: If the NUMBer command is omitted, all Power Ratios are output.
<real> × 6

The contents of NUMBer commands 1, 2, 3, 4, 5 and 6 are as follows:
1:10%, 2:1%, 3:0.1%, 4:0.01%, 5:0.001%, 6:0.0001%

6.3.13 Subsystem-CALibration

Function description	SCPI command	Parameter	Query reply	Remarks
Cal				
AM Capture Reference Data	:CALibration:AM:RDATa	–	–	

6.4 Status Register

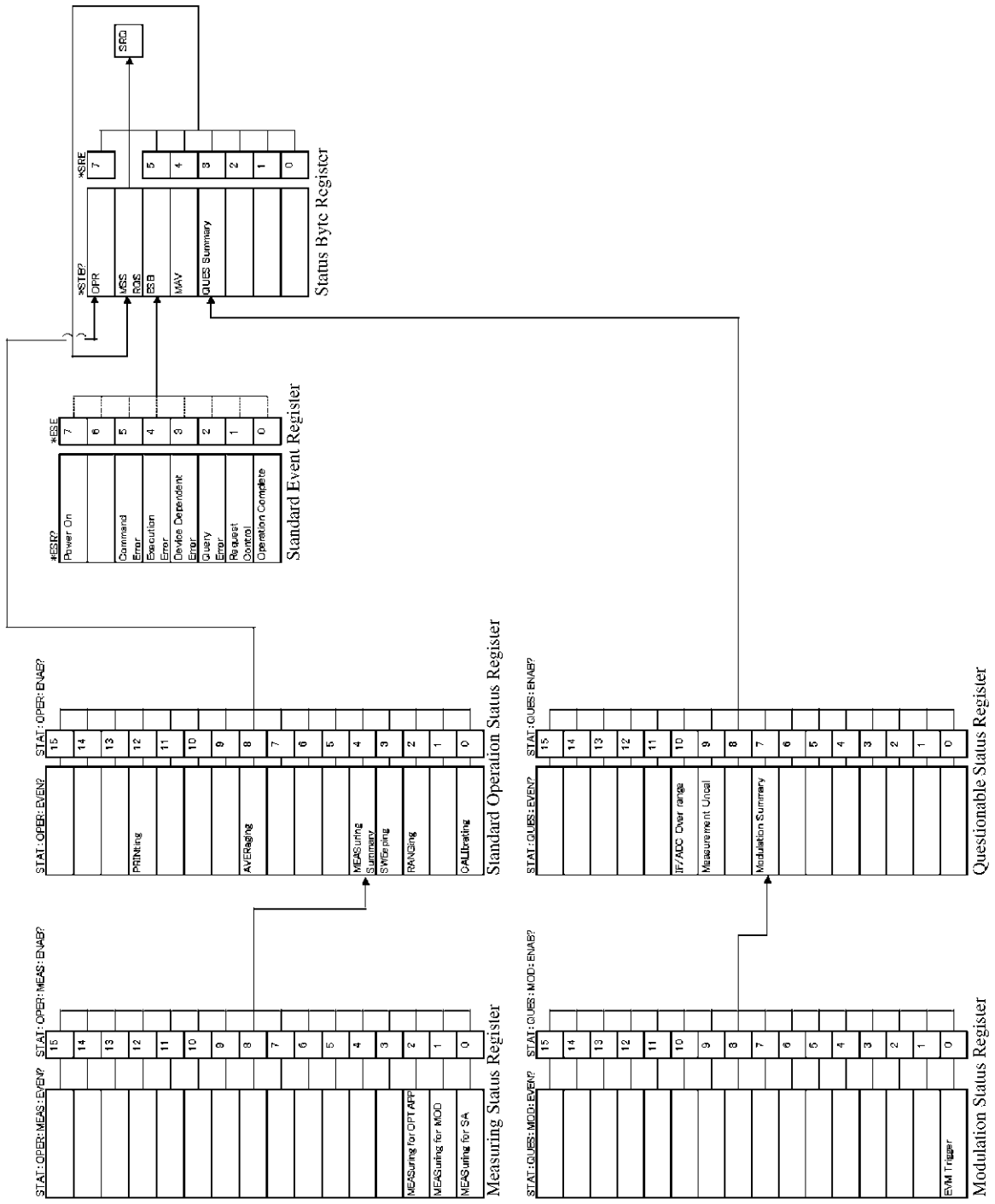


Figure 6-1 Status Registers

7. PERFORMANCE VERIFICATION

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

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

IMPORTANT: Before checking the performance, warm-up and completely calibrate the instrument.

7.1 Test Signal Specifications

The test signals used for checking the performance are shown below:

Table 7-1 Test Signal Specifications

No.	Test-signal name	Signal specifications	Test item
1	Two-Tone signal	Signal source 1: 999 MHz Signal source 2: 1001 MHz Power: -10 dBm	Power measurement
2	Two-Tone signal	Signal source 1: 999 MHz Signal source 2: 1001 MHz Signal source 3: 1003 MHz Power: -10 dBm	Phase measurement

7.2 Test Procedures

7.2.1 Two-Tone Power Measurement

Connect the signal source as shown below:

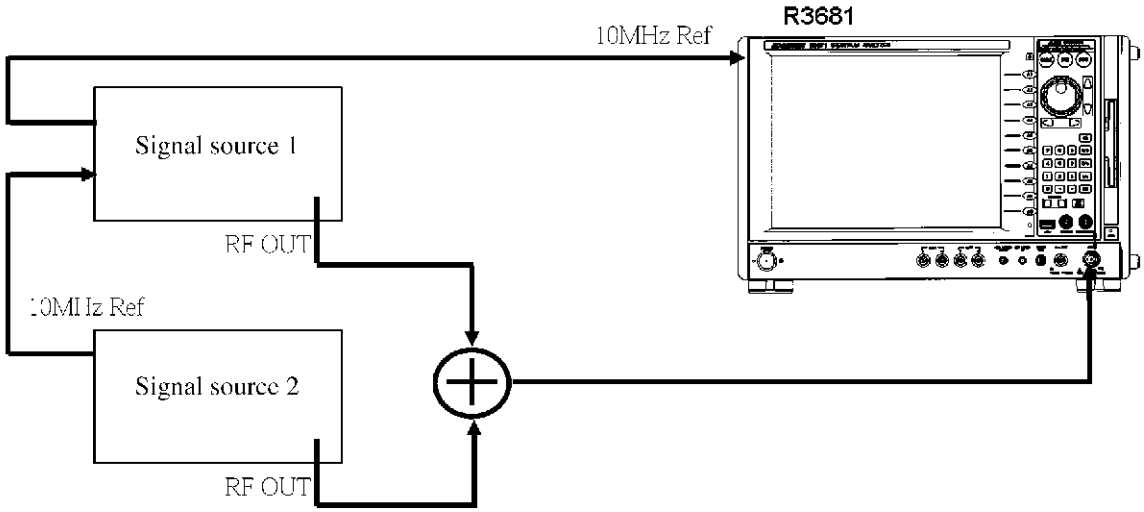


Figure 7-1 Connection Diagram of Signal Source

7.2.1.1 Power Measurement

1. Before conducting the test, set this instrument in advance as follows:

   FREQ: 1000 MHz
   LEVEL: Execute Auto Level Set.
   MEAS MODE: Two Tone
   DISPLAY: Set to display Total Result.
   TRIGGER: Trigger Source Free Run
   INPUT: IQ Inverse OFF
   MEAS CONTROL: Two Tone Meas Parameters
   Set the Two Tone Meas Parameters dialog box as follows:
   Freq Separation: 2 MHz
   Average: ON
   Average Number: 100
   Signal Source: External
   Setup for External Signal Source:
   Signal: CW

2. Press the **SINGLE** button on this unit to perform measurement.
3. Enter the Ref Lower Power [dBm] of the Total Result in the test data record sheet.

7.2.2 Two-Tone Phase Measurement

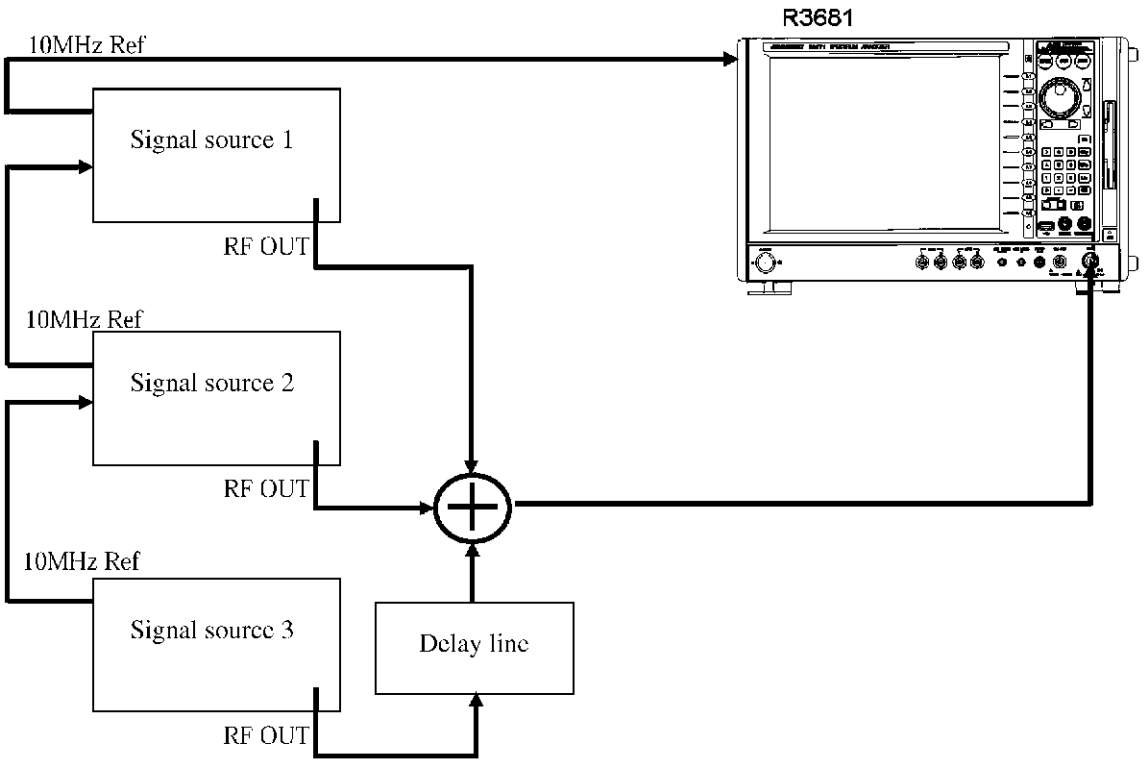


Figure 7-2 Connection Diagram of Signal Source

7.2.2.1 Phase Measurement

1. Before conducting the test, set this instrument in advance as follows:

FREQ:	1000 MHz
LEVEL:	Execute Auto Level Set.
MEAS MODE:	Two Tone
DISPLAY:	Set to display Total Result.
TRIGGER:	Trigger Source Free Run
INPUT:	IQ Inverse OFF
MEAS CONTROL:	Two Tone Meas Parameters

Set the Two Tone Meas Parameters dialog box as follows:

Freq Separation:	2 MHz
Average:	ON
Average Number:	100
Signal Source:	External
Setup for External Signal Source:	
Signal:	CW

2. Press the **SINGLE** button on this unit to perform measurement.

3. Record the 3rd Upper phase [deg] of Total Result.
4. Change the delay line by +180 deg.
5. Press the **SINGLE** button on this unit to perform measurement.
6. Record the 3rd Upper phase [deg] of Total Result.
7. Enter the difference between the measurement results of steps 6 and 3 in the test data record sheet.

7.3 Test Data Record Sheet

Test data record sheet

Model name:

Serial number:

Test signal	Test item	Specifications			Judgment
		Minimum value	Measurement value	Maximum value	Pass/Fail
Two-Tone	Power measurement	-11.4 dBm		-8.6 dBm	
	Phase measurement	170 deg		190 deg	

8. SPECIFICATIONS

8.1 Two-Tone Signal to be Analyzed

- Frequency separation (the third-order distortion):

1 kHz – 10 kHz	1 kHz step
10 kHz – 100 kHz	10 kHz step
100 kHz – 24 MHz	100 kHz step (Signal Source: Internal)
100 kHz – 12 MHz	100 kHz step (Signal Source: External)

- Frequency separation (the fifth-order distortion):

1 kHz – 10 kHz	1 kHz step
10 kHz – 100 kHz	10 kHz step
100 kHz – 10 MHz	100 kHz step (Signal Source: Internal)
100 kHz – 7 MHz	100 kHz step (Signal Source: External)

8.2 Two-Tone Signal Analysis Performance

Item	
Temperature range	Ambient temperature: +20 °C – +30 °C
Amplitude measurement	(After automatic calibration, the following are set: preamp OFF, input attenuator 10 dB, CW signal, Frequency separation: 10 MHz or lower, Average ON and Average Number 100, Signal Source External, Amplitude -45 dBc or more)
Frequency response	
50 MHz – 2.5 GHz	< ± 0.4 dB
20 Hz – 3.5 GHz	< ± 1.0 dB
3.5 GHz – 6.0 GHz	< ± 1.5 dB
Power measurement accuracy	< ± (1.0 dB + Frequency response)
Phase Measurement	(After automatic calibration, the following are set: preamp OFF, input attenuator 10 dB, CW signal, Frequency separation: 10 MHz or lower, Average ON and Average Number 100, Signal Source External, Amplitude -45 dBc or more)
Phase measurement accuracy	< ± 10 deg

8.3 AM/AM and AM/PM Signal Analysis Functions

- AM/AM(Gain-Compression, Input-Output)
- AM/PM
- CCDF
- Power Spectrum
- Power Time
- P1dB
- The polynomial coefficient of the AM/AM or AM/PM characteristic

8.4 AM/AM and AM/PM Signals to be Analyzed

- Measured signal
  Signal period is within 600 µsec
  For the burst signal, the power output time is 2 ms or more.
  For the burst signal, the burst period is 20 ms or less.

  MEMO: ***Even if the above conditions of signal and burst periods are not met, measurement can be performed by using a trigger and synchronizing. However, Delay, which is caused by the DUT, should be 600 µsec or less. If the delay is more than 600 µsec, adjust Trigger Delay.***

- Recommended signals to be measured
  3GPP
  cdma
  OFDM

APPENDIX

This section describes the following supplemental information:

A.1 Technical Data (Two Tone)

A.2 Technical Data (AM/AM and AM/PM)

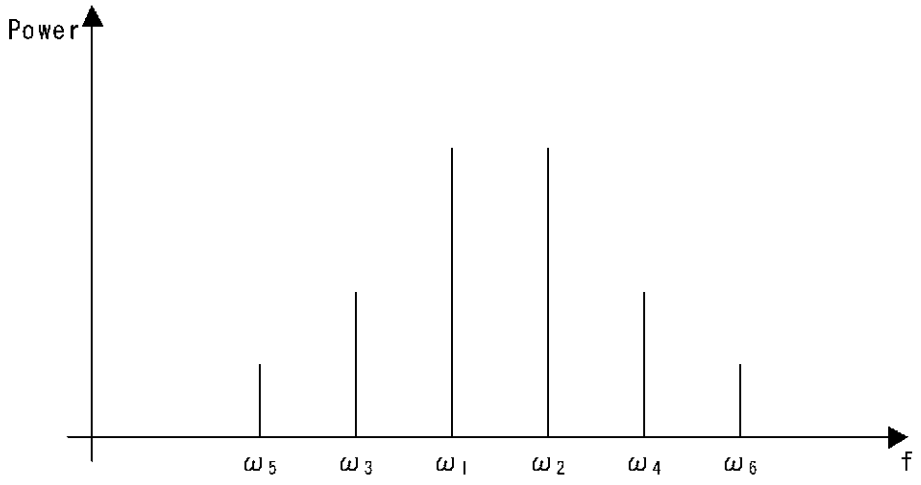
A.3 Measurement Data Save Function

A.4 Error Message List

A.1 Technical Data (Two Tone)

A.1.1 Two Tone Distortion

When the signal, which consists of two different frequency components, is input to the non-linear circuit, inter-modulation occurs in the circuit, and the third order, fifth order and other order distortions are generated.



ω_1 and ω_2 indicate two frequencies that were included in the input signal. ω_3 through ω_6 indicate four frequencies that were included in the distortion signal. Up to fifth order distortion is shown here. Where ω_3 through ω_6 are represented by the following equation:

$\omega_3 = 2\omega_1 - \omega_2$

$\omega_4 = 2\omega_2 - \omega_1$

$\omega_5 = 3\omega_1 - 2\omega_2$

$\omega_6 = 3\omega_2 - 2\omega_1$

The distortion components are generated by the internal modulation, as described above. The phase of each distortion component is measured with reference to the phases of ω_1 and ω_2.

A.2 Technical Data (AM/AM and AM/PM)

A.2.1 Coefficient in Characteristic Curve

The AM/AM Characteristic Coef and AM/PM Characteristic Coef of Total Result are the coefficients in the polynomial approximation of the non-linear characteristic. They are represented by the following equations:

AM/AM

$y_{am}(x)=A_0+A_2x^2+A_4x^4+A_6x^6+A_8x^8$

AM/PM

$y_{pm}(x)=A_0+A_1x+A_2x^2+A_3x^3+A_4x^4+A_5x^5+A_6x^6+A_7x^7+A_8x^8+A_9x^9$

where

- The x is the input amplitude ($0.0 \le x \le 1.0$) that is normalized when the maximum input amplitude [Volt] is 1.0.
- The y_{am} is the linear value of the amplitude variation ratio to the input amplitude.
- The y_{pm} is the phase variation [radian] to the input amplitude.

A.2.2 Pre-distortion

Pre-distortion of the measured data can be performed by using the following procedure:

1. Represent the non-linear characteristic as complex data

$$C(x) = Y_{am}(x) \times \{\cos(Y_{pm}(x)) + j \times \sin(Y_{pm}(x))\} \qquad 0.0 \le x \le 1.0$$

2. Calculate the inverse characteristics of $C(x)$.

$$R(x) = Inv\{C(x)\}$$

3. Normalize the I and Q data.

$$p(t) = \frac{\sqrt{I(t)^2 + Q(t)^2}}{\max\left(\sqrt{I(n)^2 + Q(n)^2}\right)}$$

4. Perform the pre-distortion of I and Q data by using the inverse characteristics according to the amplitude.

$$I_{pred}(t) = real[\{I(t) + j \times Q(t)\} \cdot R(p(t))], \quad Q_{pred}(t) = imag[\{I(t) + j \times Q(t)\} \cdot R(p(t))]$$

An example of pre-distortion is shown below:

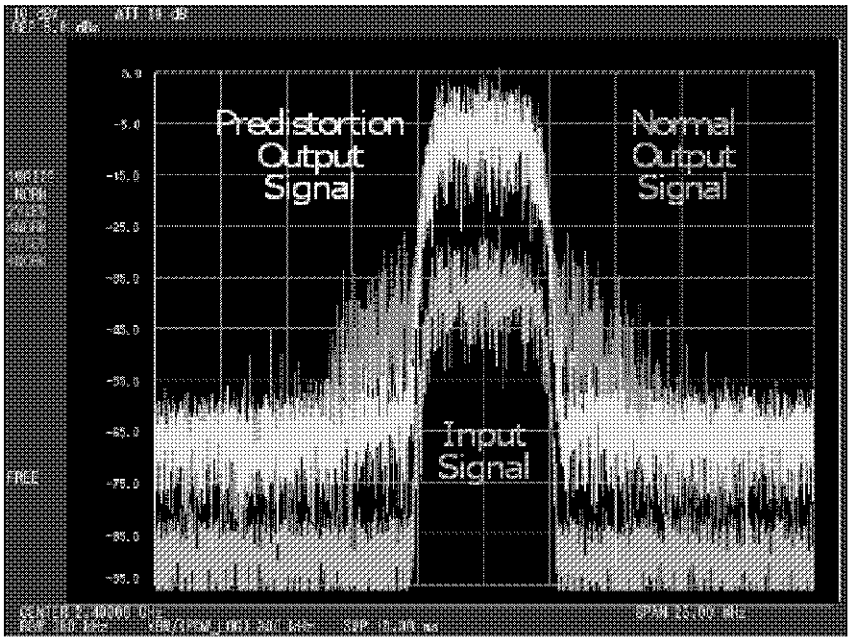


Figure A-1 Example of Pre-distortion

A.3 Measurement Data Save Function

This function is used to save numeric data that is used in tables of measurement results and to plot graphs in a CSV format file.

Only data that is displayed in the active window is saved. To save all displayed data of the four measurement result windows, select each window to activate it and save the results in turn.

In the beginning of the file, the measurement parameters that are set by the user interface are written.

The measurement results are written following this portion.

A.3.1 Measurement Result Save Format (Two Tone)

A.3.1.1 Vector

The measurement results of Vector are saved in the following format:

***** Result *****
Measurement result name
Title line
The order of distortion, frequency, power [dBm], power [dBc], phase [degree]

Example of Vector
***** Result *****
<<< Vector >>>
Distortion, Freq[Hz], Power[dBm], Power[dBc], Phase[deg]
Ref Upper, -1000000, -1.2, 0.00, 0.0
:
:

A.3.1.2 Power Spectrum

The measurement results of Power Spectrum are saved in the following format:

***** Result *****
Measurement result name
Title line
Frequency, power [dBm], power [dBc]

Example of Power Spectrum
***** Result *****
<<< Power Spectrum >>>
Freq[Hz], Power[dBm], Power[dBc]
-12600000, -63.5, -65.5
:
:

A.3.1.3 Power Time

The measurement results of Power Time are saved in the following format:

***** Result *****
Measurement result name
Time of waveform data start position
Time of waveform data stop position
Waveform data length
Title line
Sample number, power [dBm]

Sample numbers are obtained by counting from the beginning of the waveform data in chronological order.

Example of Power Time
***** Result *****
<<< Power Time >>>
Start Time[s], 0.000000
Stop Time[s], 0.040000
Length, 25000
No., Power[dBm]
0, -63.5
:
:

A.3.2 Measurement Result Save Format (AM/AM and AM/PM)

A.3.2.1 AM/AM

The measurement results of AM/AM are saved in the following format:

***** Result *****
Measurement result name
Title line
Characteristic input power [dBm], characteristic output power [dB(m)], reference output power [dB(m)], measurement input power [dBm], measurement output power [dB(m)]

Example of AM/AM
***** Result *****
<<< AM/AM Gain-Compression>>>
Character & Reference Power Input [dBm], Character Power Output[dB], Reference Power Output[dB], Meas Power Input[dBm], Meas Power Output[dB]
-62.21, 32.32, 32.32, -60.10, 30.23
:
:

A.3.2.2 AM/PM

The measurement results of AM/PM are saved in the following format:

***** Result *****
Measurement result name
Title line
Characteristic input power [dBm], characteristic output phase [deg], reference output phase [deg],
measurement input power [dBm], measurement output phase [deg],

Example of AM/PM
***** Result *****
<<< AM/PM >>>
Character & Reference Power Input [dBm] , Character Phase Output[deg], Reference Phase Output[deg],
Meas Power Input[dBm], Meas Phase Output[deg],
-62.21, 0.00, 0.00, -60.10, 32.46
:
:

A.3.2.3 CCDF

The measurement results of CCDF are saved in the following format:

***** Result *****
Measurement result name
Title line
Relative power [dB], CCDF [%], Ref relative power [dB], Ref CCDF [%]

Example of CCDF
***** Result *****
<<< CCDF >>>
Power[dB], CCDF[%], Ref Power[dB], Ref CCDF[%]
0.00, 59.0021, 0.00, 59.0010
:
:

A.3.2.4 Power Spectrum

The measurement results of Power Spectrum are saved in the following format:

***** Result *****
Measurement result name
Title line
Frequency, power [dBm]

Example of Power Spectrum
***** Result *****
<<< Power Spectrum >>>
Freq[Hz], Power[dBm]
-12600000, -63.5
:
:

A.3.2.5 Power Time

The measurement results of Power Time are saved in the following format:

***** Result *****
Measurement result name
Time of waveform data start position
Time of waveform data stop position
Waveform data length
Title line
Sample number, power [dBm]

Sample numbers are obtained by counting from the beginning of the waveform data in chronological order.

Example of Power Time
***** Result *****
<<< Power Time >>>
Start Time[s], 0.000000
Stop Time[s], 0.040000
Length, 25000
No., Power[dBm]
0, -63.5
:
:

A.4 Error Message List

This section describes the error messages displayed on this instrument.

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.	The file operation is prohibited. Check the drive name, file, or directory name.
-1252	Not enough space on the disk.	Not enough free space. Delete all unnecessary files.
-1253	File read/write error.	An error occurred during file I/O. 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 not defined.
-1500	Option required.	The specified 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.
-3227	Not available while analyzing.	The requested operation cannot be accepted during measurement (or analysis).
-3242	Cannot find out Burst.	Burst cannot be found in the A/D data.
-3243	Not available in this mode.	Not available in this mode.

ALPHABETICAL INDEX

[Symbol]

[A]

[B]

[C]

[D]

[E]

[F]

[U]

[V]

[X]

[Y]

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In order to maintain safe and trouble-free operation of the Product and to prevent the incurrence of unnecessary costs and expenses, Advantest recommends a regular preventive maintenance program under its maintenance agreement.

Advantest's maintenance agreement provides the Purchaser on-site and off-site maintenance, parts, maintenance machinery, regular inspections, and telephone support and will last a maximum of ten years from the date the delivery of the Product. For specific details of the services provided under the maintenance agreement, please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest 's sales representatives.

Some of the components and parts of this Product have a limited operating life (such as, electrical and mechanical parts, fan motors, unit power supply, etc.). Accordingly, these components and parts will have to be replaced on a periodic basis. If the operating life of a component or part has expired and such component or part has not been replaced, there is a possibility that the Product will not perform properly. Additionally, if the operating life of a component or part has expired and continued use of such component or part damages the Product, the Product may not be repairable. Please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest's sales representatives to determine the operating life of a specific component or part, as the operating life may vary depending on various factors such as operating condition and usage environment.

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