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R3681 Series OPT59 IEEE802.11b/g Modulation Analysis Software User's Guide

MANUAL NUMBER FOE-8440137D01

Applicable Models
R3681
R3671

First printing October 1, 2003
Printed in Japan

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1. INTRODUCTION

This chapter describes the outline of this manual and the product overview of the R3681 series signal analyzer option 59 IEEE802.11b/g Modulation Analysis for effective use of this manual.

1.1 Outline of This Manual

The outline of each chapter is shown below:

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

Chapter 1. INTRODUCTION	Describes the outline of this manual and the product overview for effective use of this manual.
Chapter 2. PRE-OPERATION TIPS	Provides preliminary tips on using this instrument. Read this chapter before using this instrument.
Chapter 3. SETUP	Explains how to set up this instrument on delivery. After installing this instrument in position, switch it on to make sure that it starts up successfully.
Chapter 4. MEASUREMENT EXAMPLES	Describes representative examples of measurements.
Chapter 5. MENU MAP, FUNCTIONAL EXPLANATION	Explains the menu configuration and function of the soft keys.
Chapter 6. SCPI COMMAND REFERENCE	SCPI command reference. The command reference explains the commands in order of function. In explanation, the following items are explained: • Command format • Function explanation • Parameters • Query response • Use example • Related commands Sample programs are also provided.
Chapter 7. PERFORMANCE VERIFICATION	Shows the specifications of option 59.
Chapter 8. SPECIFICATIONS	Describes the performance verification test procedures for option 59.
APPENDIX	Describes operation principles and the error code table.

1.2 Product Overview

The IEEE802.11b/g modulation analysis option is software that conducts modulation analysis of IEEE802.11b/g.

This option has the following features.

- For the IEEE802.11b/g specification signal, the frequency error and the error vector magnitude which are determined by the specifications can be measured.
- There are two measurement modes: Single Frame mode and Multi Frame mode. In Single Frame mode, a time waveform of 40 msec at the longest can be taken in and modulation analysis of the frame specified by the user is possible. In Multi Frame mode, when an EVM larger than the EVM specified by the user is measured, measurement is stopped and the data of that point in time is left in the memory.
  It moves to Single Frame mode and detailed analysis of the remaining data is possible.

1.3 Other Manuals Pertaining to This Instrument

Available manuals pertaining to this instrument include:

- User's Guide (Part Code: {ER3681SERIES/U}, English)
  Contains information prerequisite to using the R3681 Series Signal Analyzer, ranging from setup to basic operation, applied measurement, functionality, specifications, and maintenance.
- Programming Guide (Part Code: {ER3681SERIES/P}, English)
  Covers programming information to use the R3681 Series Signal Analyzer to automate measurement sequences, including a remote control overview, SCPI command references, and sample application programs.
- Performance Test Guide (Part Code: {ER3681SERIES/T}, English)
  Covers information necessary to verify the performance of the R3681 Series Signal Analyzer, including performance test procedures and specifications.

1.4 Conventions of Notation Used in This Document

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

On-panel hard keys

Sample — Represents an on-panel hard key labeled "Sample."
Example: **START**, **STOP**

On-screen system menus

[Sample] — Represents an on-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

On-screen function buttons

{Sample} — Represents an on-screen function button labeled "Sample."
Example: **{FREQ}** button, **{SWEEP}** button

On-screen side menu

Sample — Represents an on-screen side menu key labeled "Sample."
Example: **Center** key, **Span** key

On-screen system menu key operation

[File]→[Save As...] — Indicates a touch on the **[File]** menu followed by a choice of **[Save As...]**.

Sequential key operation

{FREQ}, **Center** — Indicates a touch on the **{FREQ}** button followed by a touch on the **Center** key.

Toggle key operation

ΔMarker On/Off (On) — Indicates a touch on 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. PRE-OPERATION TIPS

This chapter provides preliminary tips on using this instrument. Read this chapter before using this instrument.

2.1 If Faults Should Occur

If this instrument is found to smoke or deliver offensive odors or abnormal noises, switch off the power breaker and remove the power cable from the AC power connector to power off this instrument. Then, contact your dealer or us immediately.

2.2 Removing of Case

The case should not be opened except by service personnel of our company.

WARNING: ***High-voltage and high-temperature parts inside. You may get electrical shocks or burnt if you touch them.***

2.3 Overcurrent Protection

This instrument is protected from overcurrent flow by a power breaker. Located on the rear panel, the power breaker automatically forces an interruption of the power supply when an overcurrent flows through this instrument. When the power breaker has turned off, remove the power cable from the AC power connector to power off this instrument. 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 impact or vibrate the hard disk drive.

  Damage to the disk on which data is stored could result, increasing the chances of malfunctioning or failing during operations.
- Do not switch off this instrument while the HDD access lamp is lit.

  The data being accessed might be damaged.

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

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 strong impacts or apply undue force to the screen. The glass could be cracked.
- Use the stylus pen included with this instrument to operate the screen. Use of a hard-pointed material (such as a mechanical pencil or ballpoint) could 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.
Furthermore, this instrument is not a data processor. Operate it only as described in this manual.

1. Non-permitted actions:
   - Installing other application programs.
   - Changing or deleting items in the control panel (except for "A.2 Installing the Printer Driver" and "A.3 Setting up the Network" of R3681 Series User's Guide).
   - Opening or operating the existing files on the C drive.
   - Operating other application programs during the measurement.
   - Upgrading the Windows operating system.
   - If this instrument does not function correctly due to any of the above, re-install the system using the system recovery disk.
     For more information on the system recovery method, refer to section 8.7, "System Recovery Procedure" of R3681 Series User's Guide.
2. Computer viruses

   Depending on the operating environment and method, the system can be contaminated by a computer virus. To use the system securely, it is recommended to take the following countermeasures:
   - Run a virus check before loading a file or media from an outside source.
   - Make sure that any network has safety measures against computer viruses before connecting.

   [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 method, refer to section 8.7, "System Recovery Procedure" of R3681 Series User's Guide.

2.7 Tip on Transportation

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

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

2.8 Electromagnetic Interference

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

- Change the direction of the antenna of the television or radio.
- Place this instrument on the other side of the television or radio.
- Place this instrument away from the television or radio.
- Use different lines for the power sources for the television or radio and this instrument.

2.9 Note for Power-on

At power-on, do not connect the DUT to this instrument.

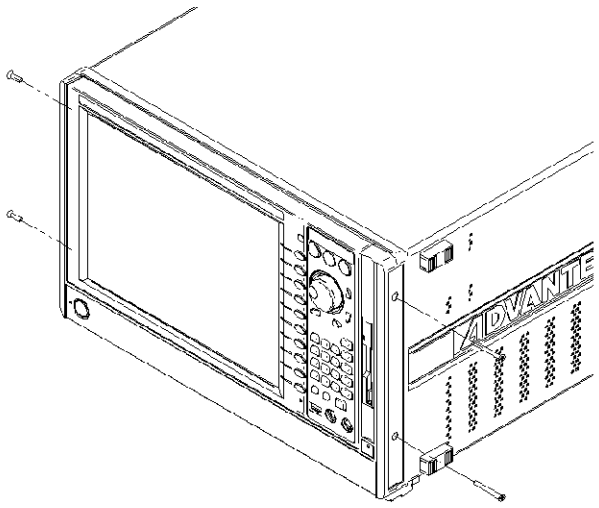
2.10 Notes for Removing and Attaching the Panel

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 separately sold connecting cable is required.***

- If this instrument's power is turned on, turn off the power, remove the power cable, and then make sure that the operation of this instrument is terminated.
- When removing or attaching the panel, take care not to jam your finger.
- Place this instrument on a level and steady table when removing or attaching the panel.
- Take out the four screws that are exposed on the side of the front panel of this instrument.
- When taking out the screws, put a hand on the panel so that the panel will not unexpectedly fall off.
- After all four screws have been taken out, pull the panel forward.
- Remove the cable connecting the panel and the body of this instrument.
- Replace the cable with another one that is suitable for your use condition.
- If you have lost screws, use the following screws.
- 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)

2.10 Notes for Removing and Attaching the Panel



2.11 Limitations Imposed when Using Windows XP

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3. SETUP

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

3.1 Unpacking Inspection

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

1. Check to see if the box or the cushioning material in which the product was shipped has been damaged during transit.

   IMPORTANT: ***If the box or the cushioning material is found damaged, leave them in their original condition until the inspection described below completes.***

2. Check the product surfaces for any damage.

   WARNING: ***Do not power on this instrument if the cover, panels (front and rear), LCD display, power switch, connector or any other key component is found damaged. Electrical shock hazards could result from using damaged components.***

3. Referring to the standard accessory list of the OPT59 in Table 3-1, please check whether all standard accessories exist and make sure that no accessories are damaged.

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

   - The box or the cushioning material in which the product was shipped was damaged during transit, or there is evidence of a massive force having been applied to the cushioning material.
   - The product surfaces are damaged.
   - One or more standard accessories are missing or damaged.
   - Defects have been detected in a subsequent product verification test.

Table 3-1 Standard Accessories

Name	Model	Quantity	Remarks
R3681 Series OPT59 User's Guide	ER3681OPT59	1	English version

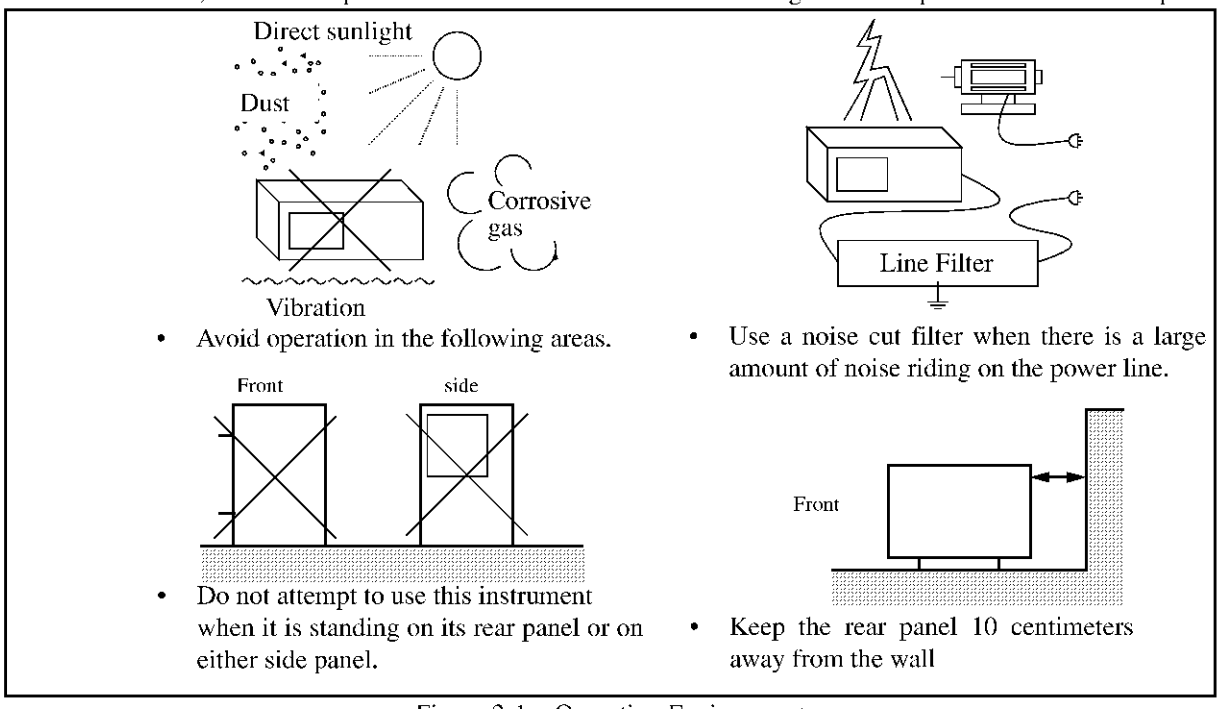
3.2 Locating This Instrument

This section describes the installation environment in which this instrument runs successfully.

3.2.1 Operating Environment

This instrument should only be used in a place 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 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 riding on the AC power line, it should be used in an area of low noise. Use a noise filter when 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. Never 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 on either side panel.



- Avoid operation in the following areas.
- Use a noise cut filter when 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 damage to semiconductor parts from electrostatic discharge (ESD), the precautions shown below should be taken. We recommend that two or more countermeasures are combined to provide adequate protection from ESD.
(Static electricity can easily be built up 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	Installation of a conductive mat, the use of conductive shoes, and grounding (see Figure 3-3).
Workbench	Installation of a conductive mat and grounding (see Figure 3-4).

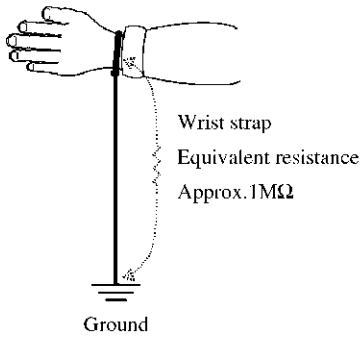


Figure 3-2 Countermeasures for Static Electricity of Human Body

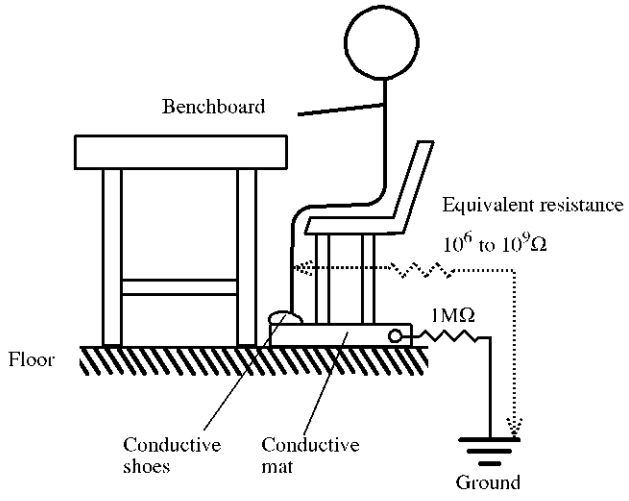


Figure 3-3 Countermeasures for Static Electricity on Work Floor

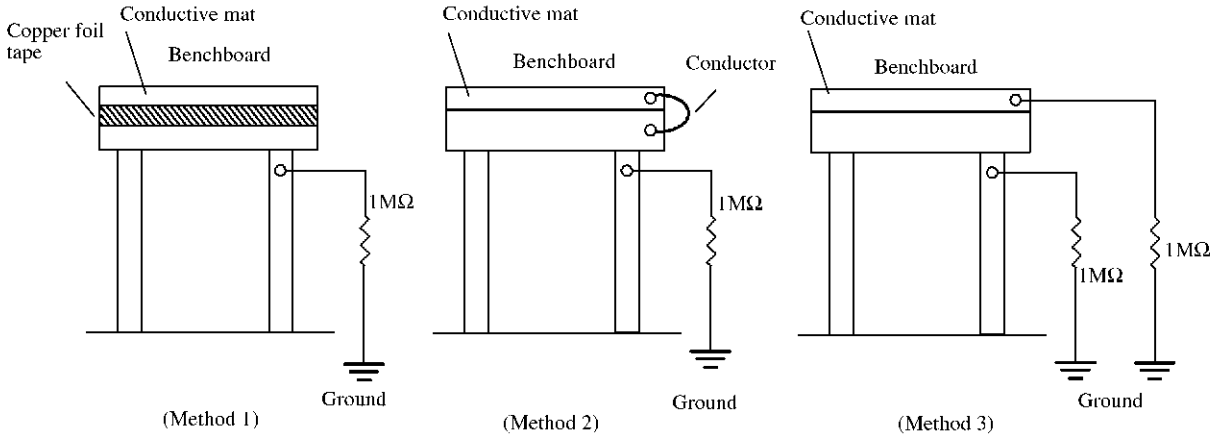


Figure 3-4 Countermeasures for Static Electricity on Work Bench

3.3 Connecting Accessories

This section explains how to connect accessories to this instrument to run it.

3.3.1 Connecting the Keyboard and Mouse

Plug the keyboard and mouse into their respective front-panel connectors (KEYBOARD and MOUSE connectors). The keyboard and mouse must be plugged before turning on this instrument.

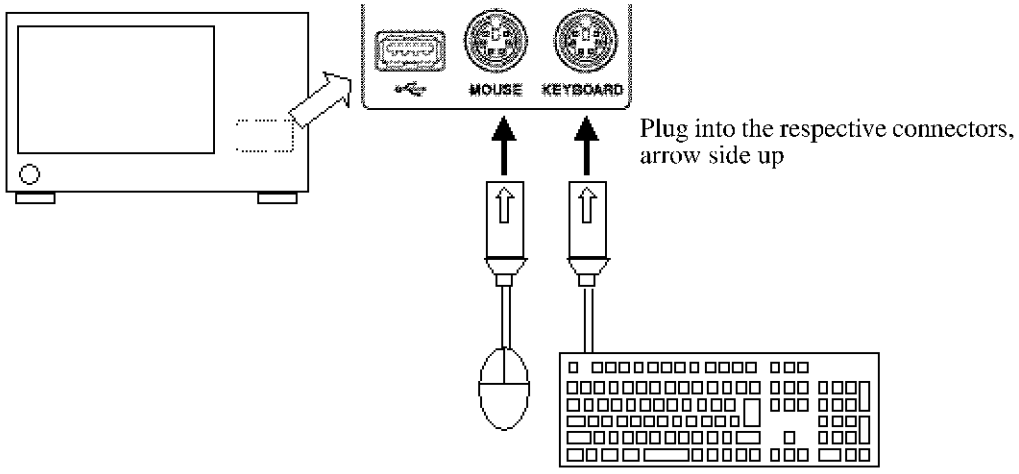


Figure 3-5 Connecting the Keyboard and Mouse

3.4 Supply Description

This section explains 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 VAC Operation	200 VAC Operation	Remarks
Input voltage range	90 V to 132 V	198 V to 250 V	Automatically switches between input levels of 100 VAC and 200 VAC.
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 grounding conductor. To guard against 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 hazards could result.***

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-pole power outlet having a protecting grounding terminal (see Figure 3-6).

3.4.2 Connecting the Power Cable

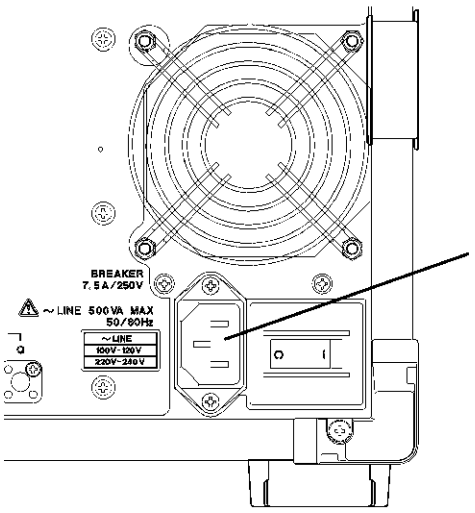


Figure 3-6 Connecting the Power Cable

WARNING:

1. ***Use a power cable rated for the voltage being used. Be sure however to use a power cable conforming to the safety standards of your country when using this instrument overseas (Refer to "Safety Summary").***
2. ***Plug the power cable into a three-pole power outlet having a protecting grounding terminal to guard against electrical shock hazards. Use of an extension cord without a protecting grounding terminal would override the protective grounding.***

3.5 Operation Check

This section explains 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.
   Then wait for 3 seconds or more.
3. Press the **POWER** switch to switch on the power.

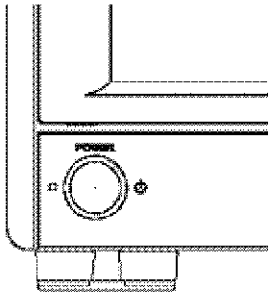


Figure 3-7 **POWER** Switch

CAUTION:

1. *If this instrument is abruptly powered off while in operation, such as by pulling the power cable out of position, the hard disk drive could fail. Even when the hard disk drive does not fail, Scandisk launches to check for possible corruptions in the data stored on it the next time this instrument starts up.*
2. *About Scandisk*
   If this instrument has been powered off without being shut down, Scandisk will launch to check for corruptions automatically. Do not abort Scandisk while it is running. If Scandisk locates corruptions, take appropriate remedial action as recommended by the display 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-diagnostics take about 1 minute to complete.
5. The initial screen shown in Figure 3-8 is displayed unless this instrument is tested faulty. The initial screen may give a different look from Figure 3-8, depending on the settings in effect the last time this instrument was powered off.

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

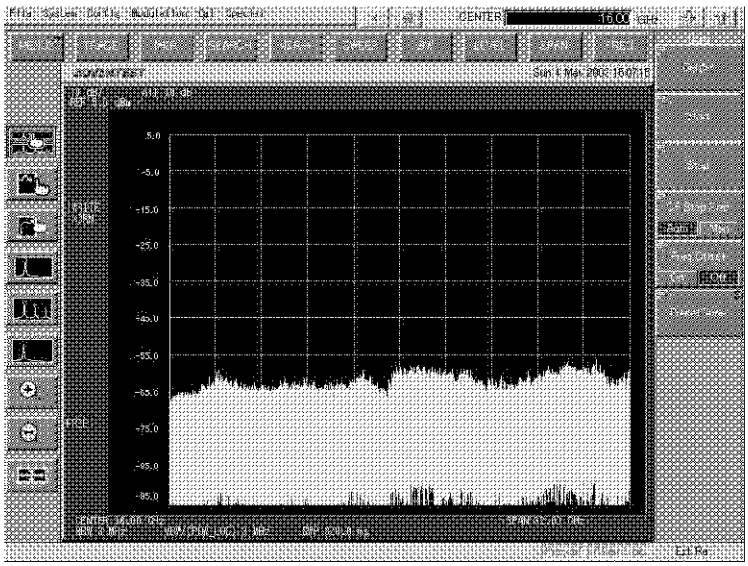

Figure 3-8 Initial Setup Screen

Running autocalibration

6. <R3681>
Hook up 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.

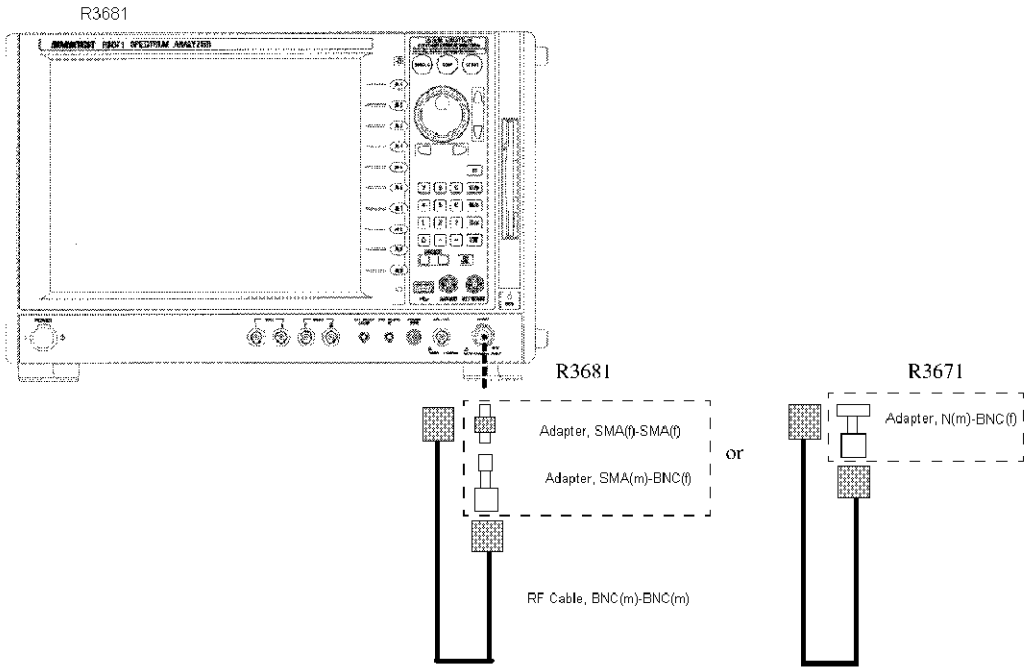

Figure 3-9 Autocalibration

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 R3681 Series User's Guide.

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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 R3681 Series User's Guide if error messages are displayed as a result of the autocalibration.

Switching off power

Press the **POWER** switch of this instrument.
The final processing of the system is performed and the power is automatically turned off.

4. MEASUREMENT EXAMPLES

This chapter describes the way to use this option with concrete examples of measurements.

4.1 Measurement of an IEEE802.11g (ERP-OFDM) Signal

This section describes the way to use this option, with the following example of measurement of an IEEE802.11g (ERP-OFDM) signal.

- 4.1.1 Measurement of an IEEE802.11g (ERP-OFDM) Signal Using the Multi Frame Mode
- 4.1.2 Measurement of an IEEE802.11g (ERP-OFDM) Signal Using the Single Frame Mode
- 4.1.3 Measurement of Frequency Characteristics of a DUT Using Equalizer

4.1.1 Measurement of an IEEE802.11g (ERP-OFDM) Signal Using the Multi Frame Mode

You can repeat measurement of various frames and OFDM symbols by using Multi Frame Mode. This mode is suitable for measurements based on the standards.

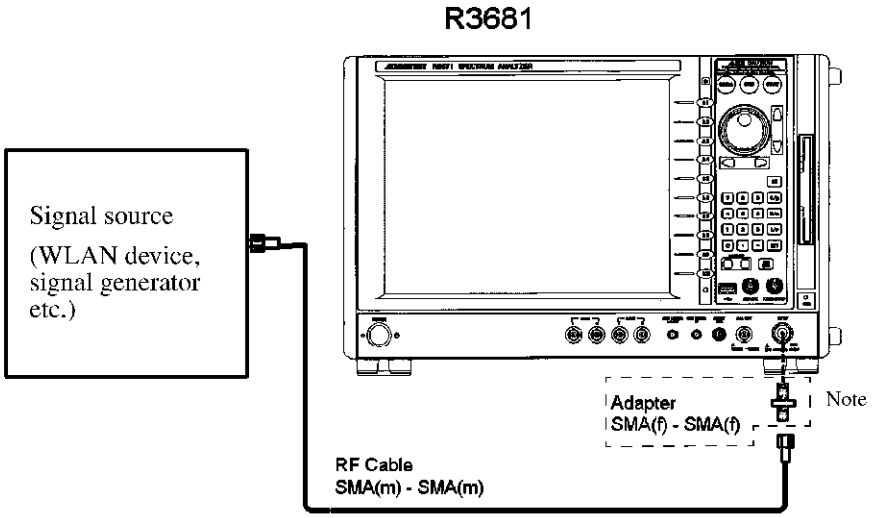
[Specifications of signal to be measured]

Conforming standards:	IEEE802.11g (ERP-OFDM) signal
Center frequency:	2457 MHz
Level:	-10 dBm
Data rate:	36 Mbps (Modulation system 16 QAM)
Number of OFDM symbols	100 (excluding SIGNAL)

[Measuring conditions]

A/D Capture Length:	10 ms
Threshold Level:	Auto
Symbol Timing:	0
Pilot Track(Phase):	ON
Pilot Track(Amplitude):	OFF
CH Estimation(Preamble):	ON
Meas Condition:	Frame & Min Symbol
Meas Frame Number:	20
Meas Min Symbol Length:	16
EVM Trigger:	ON
EVM Threshold:	-25 dB
Trigger Source:	Free Run
Single Measurement	

[Device connection]



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

Figure 4-1 Connection Diagram for Measurement Using Multi Frame Mode

[Setting the Measuring Conditions]

1. Touch **[Config]** on the menu bar and select **[Modulation Analyzer]**.
2. Touch **[Modulation]** on the menu bar and select **[IEEE802.11b/g]**.
3. Touch the **{FREQ}** button on the function bar.
4. Touch the **Center** key on the soft menu bar.
5. Press **2**, **4**, **5**, **7** and **M/n** in this order on the ten-key pad.
   The center frequency will be set at 2457 MHz.
6. Touch the **{LEVEL}** button on the function bar.
7. Touch the **Auto Level Set** key on the soft menu bar.
   The Ref Level will be set automatically at the optimum value.
8. Touch the **{STD}** button on the function bar.
9. Touch the **IEEE802.11g OFDM** key on the soft menu bar.
   The measuring parameters will be set to the IEEE802.11g standard.
10. Touch the **{TRIGGER}** button on the function bar.
11. Touch the **Trigger Source** key on the soft menu bar.
12. Touch the **Free Run** key on the soft menu bar.

13. Touch the **{INPUT}** button on the function bar.
14. Touch the **Input Setup** button on the soft menu bar.
    The **[Input Setup]** dialog box will be displayed.
15. Set the **[Input]** of the **[Input Setup]** dialog box to **[RF]**.
16. Touch the close button in the **[Input Setup]** dialog box to close the dialog box.

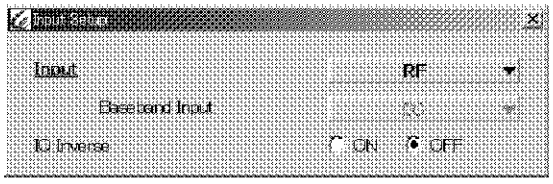


Figure 4-2 **[Input Setup]** Dialog Box

17. Touch the **{MEAS CONTROL}** button on the function bar.
18. Touch the **Multi Frame** key on the soft menu bar and select the multi frame mode.
19. Touch the **Meas Parameters** button on the soft menu bar.
    The **[Measurement Parameters Setup]** dialog box will be displayed.
20. Touch the **[AD Capture]** tab in the **[Measurement Parameters Setup]** dialog box. The screen is switched to the AD Capture Setup screen.

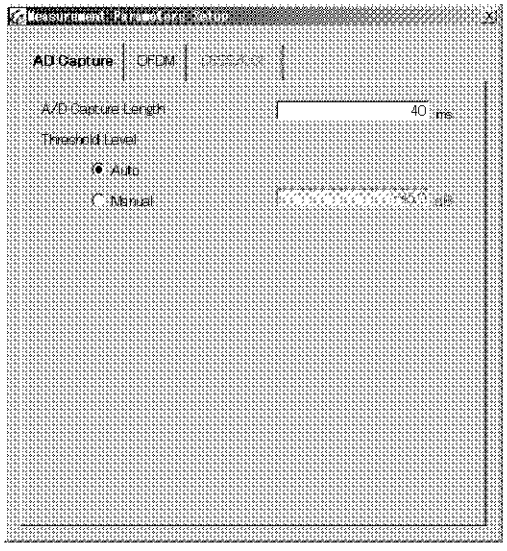


Figure 4-3 **[Measurement Parameters Setup]** Dialog Box - **AD Capture** Setup Tab

21. Set the length of the data to be taken into the memory for one data acquisition.

    Touch the **[A/D Capture Length]** text box in the [**AD Capture**] tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing **1**, **0** and **ENT** on the ten-key pad or by turning the data knob until the numerical value 10 is displayed.

22. Touch [**Auto**] under **[Threshold Level]** in the **[AD Capture]** tab.

    The setting of the threshold level to search for the frame signal (burst signal) is set to Auto.

    (Set the threshold level when the measuring instrument searches for the frame signal (burst signal) to Auto. If the signal level is unstable, select **[Manual]**.)

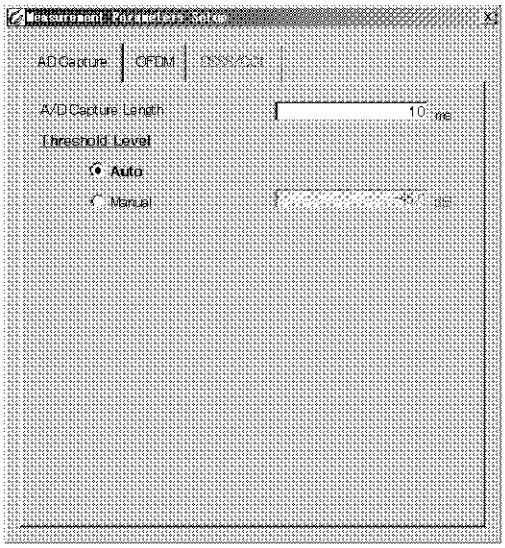


Figure 4-4 **[Measurement Parameters Setup]** Dialog Box - **AD Capture** Setup Tab

23. Touch the **[OFDM]** tab in the **[Measurement Parameters Setup]** dialog box. The screen is switched to the OFDM Setup screen.

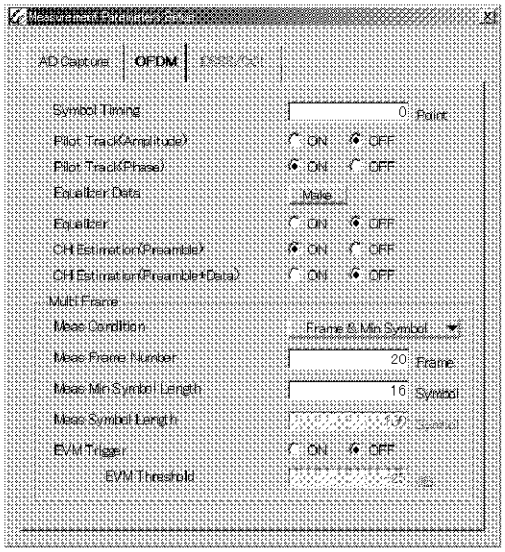


Figure 4-5 [**Measurement Parameters Setup**] Dialog Box - **OFDM** Setup Tab

24. Touch the **[Symbol Timing]** text box in the **[OFDM]** tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing **0**, **ENT** on the ten-key pad or by turning the data knob until the numerical value 0 is displayed. (Symbol Timing is set to the FFT process start position at the time of demodulation. The center of the guard interval is taken as 0.)

25. Touch the **[OFF]** option button of **[Pilot Track(Amplitude)]** in the **[OFDM]** tab.

    (Pilot Track (Amplitude) is a function which corrects the amplitude for each symbol by referring to the pilot signal of the signal to be measured.)

26. Touch the **[ON]** option button of **[Pilot Track(Phase)]** in the **[OFDM]** tab.

    (Pilot Track (Phase) is a function which synchronizes the phase for each symbol by referring to the pilot signal of the signal to be measured.)

27. Touch **[ON]** of the **[CH Estimation(Preamble)]** option button in the **[OFDM]** tab.

    The CH Estimation(Preamble) function is a function to estimate and correct the frequency characteristics of the signal to be measured using the preamble portion.

28. Set **[Meas Condition]** in the **[OFDM]** tab to **[Frame & Min Symbol]**.

29. Set the number of frames to be measured to 20.

    Touch the **[Meas Frame Number]** text box in the **[OFDM]** tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing **2**, **0** and **ENT** on the ten-key pad or by turning the data knob until the numerical value 20 is displayed.

    (The measuring instruments analyze frames until reaching the number of frames set here. The number of frames analyzed will be the number of frames set here.)

30. Make the setting so that frames containing 16 symbols or more are analyzed.

    Touch the **[Meas Min Symbol Length]** text box in the **[OFDM]** tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing [1], [6] and [ENT] on the ten-key pad or by turning the data knob until the numerical value 16 is displayed.

    (The measuring instruments will not analyze frames containing less than the number of symbols set here.)

31. Touch **[ON]** of the **[EVM Trigger]** option button in the **[OFDM]** tab.

32. Touch the **[EVM Threshold]** text box in the **[OFDM]** tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing [-], [2], [5] and [ENT] on the ten-key pad or by turning the data knob until the numerical value -25 is displayed.

    (If a frame exceeding the EVM set here is analyzed, the measuring instruments will end measurements at that frame.)

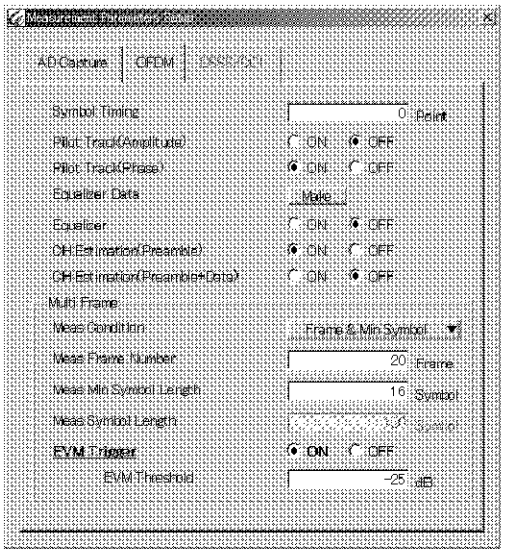


Figure 4-6 **[Measurement Parameters Setup]** Dialog Box - **OFDM** Setup Tab

33. Touch the close button [X] in the **[Measurement Parameters Setup]** dialog box to close the dialog box.

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

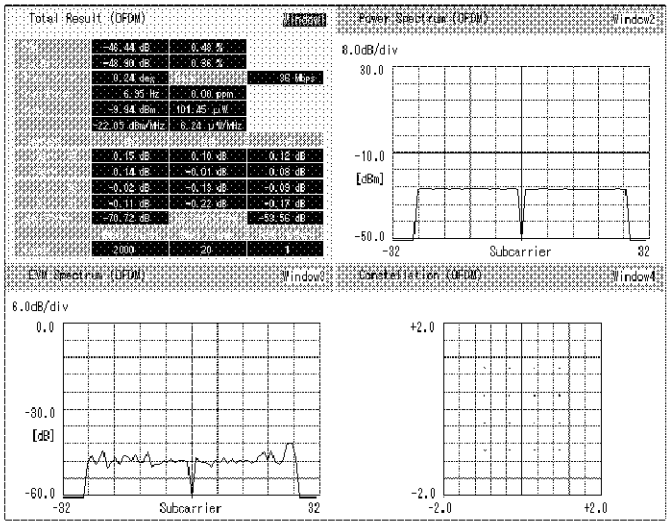


Figure 4-7 Measurement Results of Multi Frame Mode

4.1.2 Measurement of an IEEE802.11g (ERP-OFDM) Signal Using the Single Frame Mode

You can select and measure any one frame by using Single Frame Mode. This mode is suitable for detailed verification.

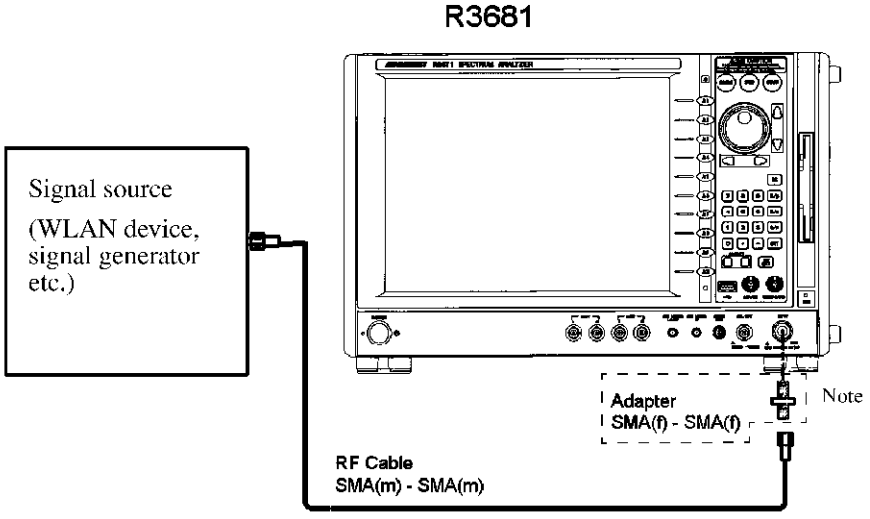
[Specifications of signal to be measured]

Conforming standards:	IEEE802.11g (ERP-OFDM) signal
Center frequency:	2457 MHz
Level:	-10 dBm
Data rate:	36 Mbps (Modulation system 16 QAM)
Number of OFDM symbols:	100 (excluding SIGNAL)

[Measuring conditions]

A/D Capture Length:	10 ms
Threshold Level:	Auto
Symbol Timing:	0
Pilot Track(Phase):	ON
Pilot Track(Amplitude):	OFF
CH Estimation(Preamble):	ON
Trigger Source:	Free Run

[Device connection]



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

Figure 4-8 Connection Diagram for Measurement Using Single Frame Mode

[Setting the Measuring Conditions]

1. Touch **[Config]** on the menu bar and select **[Modulation Analyzer]**.
2. Touch **[Modulation]** on the menu bar and select **[IEEE802.11b/g]**.
3. Touch the **{FREQ}** button on the function bar.
4. Touch the **Center** key on the soft menu bar.
5. Press **2**, **4**, **5**, **7** and **M/n** in this order on the ten-key pad.
   The center frequency will be set at 2457 MHz.
6. Touch the **{LEVEL}** button on the function bar.
7. Touch the **Auto Level Set** key on the soft menu bar.
   The Ref Level will be set automatically at the optimum value.
8. Touch the **{STD}** button on the function bar.
9. Touch the **IEEE802.11g OFDM** key on the soft menu bar.
   The measuring parameters will be set to the IEEE802.11g standard.
10. Touch the **{TRIGGER}** button on the function bar.
11. Touch the **Trigger Source** key on the soft menu bar.
12. Touch the **Free Run** key on the soft menu bar.
13. Touch the **{INPUT}** button on the function bar.
14. Touch the **Input Setup** button on the soft menu bar.
    The **[Input Setup]** dialog box will be displayed.
15. Set the **[Input]** of the **[Input Setup]** dialog box to **[RF]**.
16. Touch the close button ✕ in the **[Input Setup]** dialog box to close the dialog box.

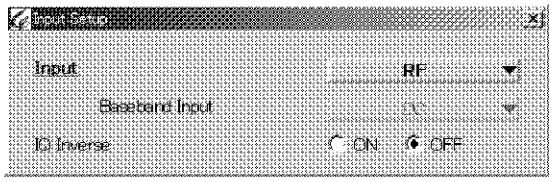


Figure 4-9 **[Input Setup]** Dialog Box

17. Touch the **{MEAS CONTROL}** button on the function bar.
18. Touch the **Single Frame** key on the soft menu bar and select the single frame mode.

19. Touch the **Meas Parameters** button on the soft menu bar.
    The **[Measurement Parameters Setup]** dialog box will be displayed.

20. Touch the **[AD Capture]** tab in the **[Measurement Parameters Setup]** dialog box. The screen is switched to the AD Capture Setup screen.

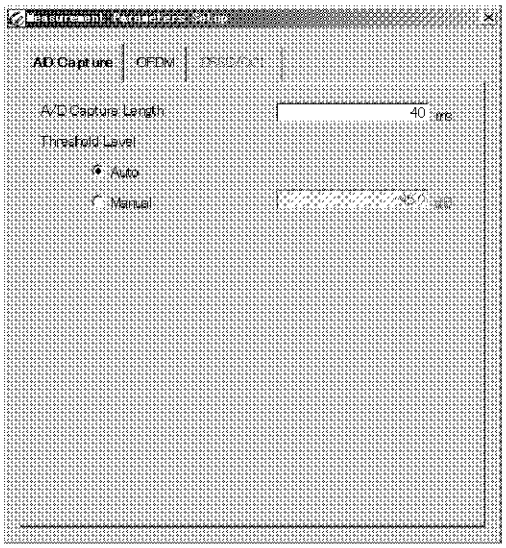


Figure 4-10 **[Measurement Parameters Setup]** Dialog Box - **AD Capture** Setup Tab

21. Set the length of the data to be taken into the memory for one data acquisition.
    Touch the **[A/D Capture Length]** text box in the **[AD Capture]** tab.
    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing **1**, **0** and **ENT** on the ten-key pad or by turning the data knob until the numerical value 10 is displayed.

22. Touch **[Auto]** under **[Threshold Level]** in the **[AD Capture]** tab.

    The setting of the threshold level to search for the frame signal (burst signal) is set to Auto.

    (Set the threshold level when the measuring instrument searches for the frame signal (burst signal) to Auto. If the signal level is unstable, select **[Manual]**.)

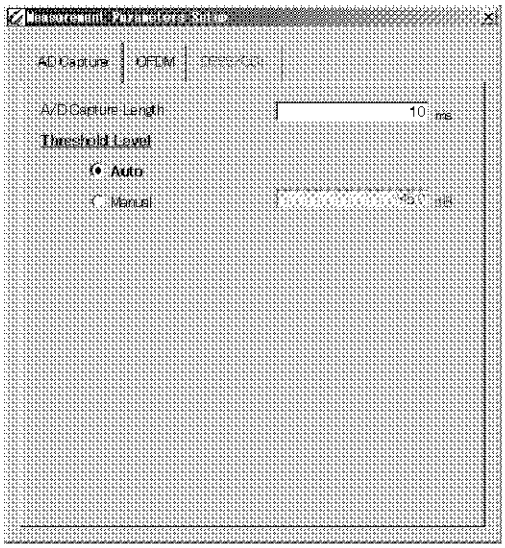


Figure 4-11 **[Measurement Parameters Setup]** Dialog Box - **AD Capture** Setup Tab

23. Touch the **[OFDM]** tab in the **[Measurement Parameters Setup]** dialog box. The screen is switched to the OFDM Setup screen.

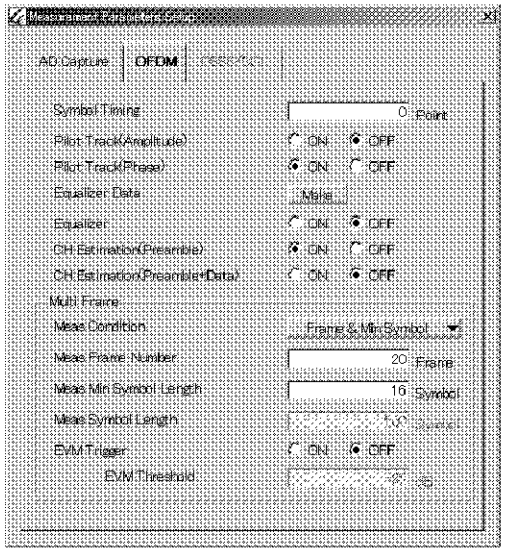


Figure 4-12 **[Measurement Parameters Setup]** Dialog Box - **OFDM** Setup Tab

24. Touch the **[Symbol Timing]** text box in the **[OFDM]** tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing **0**, **ENT** on the ten-key pad or by turning the data knob until the numerical value 0 is displayed. (Symbol Timing is set to the FFT process start position at the time of demodulation. The center of the guard interval is taken as 0.)

25. Touch the **[OFF]** option button of **[Pilot Track(Amplitude)]** in the **[OFDM]** tab.

    (Pilot Track (Amplitude) is a function which corrects the amplitude for each symbol by referring to the pilot signal of the signal to be measured.)

26. Touch the **[ON]** option button of **[Pilot Track(Phase)]** in the **[OFDM]** tab.

    (Pilot Track (Phase) is a function which synchronizes the phase for each symbol by referring to the pilot signal of the signal to be measured.)

27. Touch **[ON]** of the **[CH Estimation(Preamble)]** option button in the **[OFDM]** tab.

    The CH Estimation(Preamble) function is a function to estimate and correct the frequency characteristics of the signal to be measured using the preamble portion.

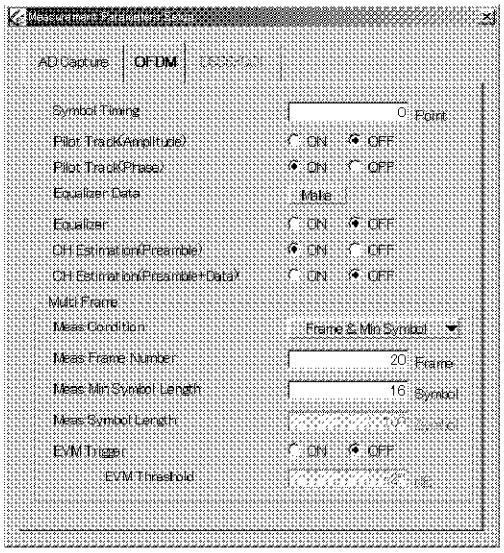


Figure 4-13 **[Measurement Parameters Setup]** Dialog Box - **OFDM** Setup Tab

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

29. Touch the **A/D Capture** key on the soft menu bar.
    A/D data of the signal under test is taken in, and upon completion the waveform of the signal under test is displayed in the Frame Selection display.

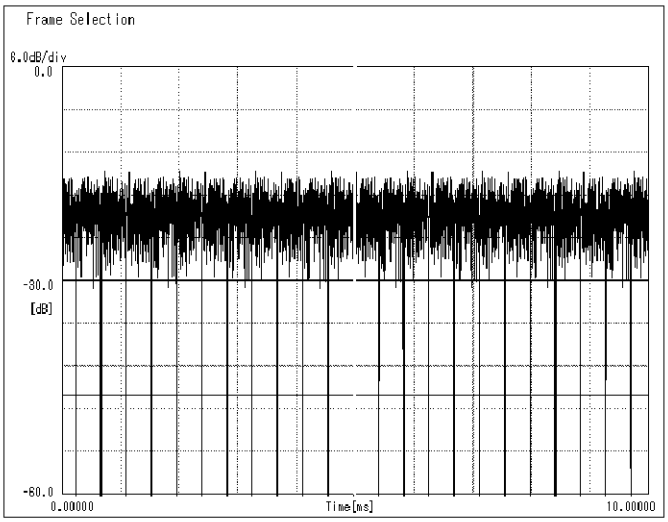


Figure 4-14 Frame Selection Display

30. Touch the Specify Cursor button  on the measurement tool bar.

31. In the waveform of the signal under test in the Frame Selection display, touch near a frame to measure it. The cursor is placed within the frame.

32. Touch the **Analysis Restart** key on the soft menu bar.
    Measurement is executed, and the measurement result is displayed.

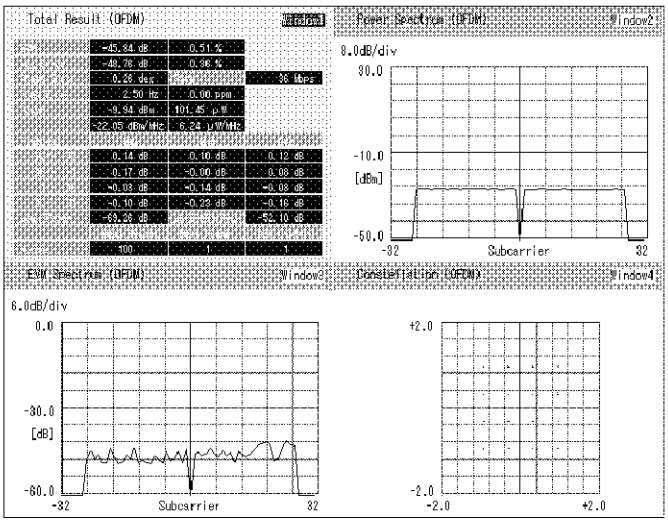


Figure 4-15 Measurement Results of Single Frame Mode

4.1.3 Measurement of Frequency Characteristics of a DUT Using Equalizer

You can cancel out the frequency characteristics of a signal source and measure the frequency characteristics of a DUT (amp, filter, etc.) by using the Equalizer function.

[Specifications of signal to be measured]

Conforming standards:	IEEE802.11g (ERP-OFDM) signal
Center frequency:	2457 MHz
Level:	-10 dBm
Data rate:	36 Mbps (Modulation system 16 QAM)
Number of OFDM symbols:	100 (excluding SIGNAL)

[Measuring conditions]

A/D Capture Length:	10 ms
Threshold Level:	Auto
Symbol Timing:	0
Pilot Track(Phase):	ON
Pilot Track(Amplitude):	OFF
Equalizer:	ON
Trigger Source:	Free Run

[Device connection]

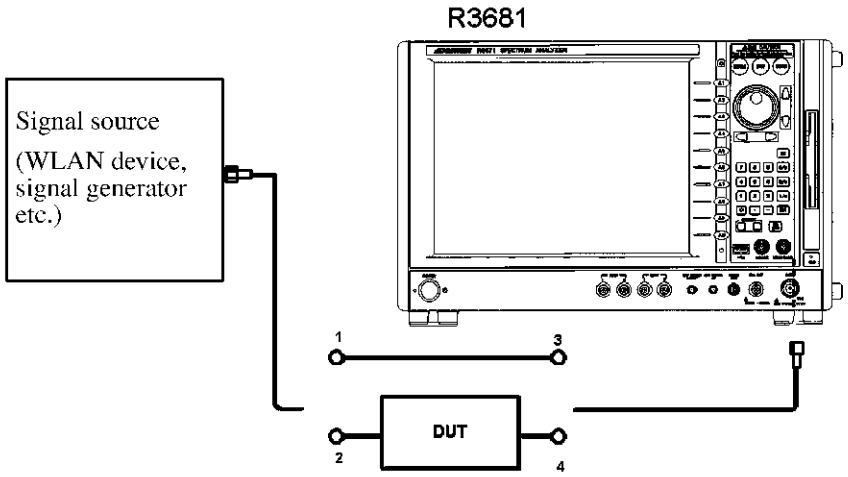


Figure 4-16 Connection Diagram for Frequency Characteristics Measurement of a DUT Using Equalizer

[Setting the Measuring Conditions]

1. Connect the instruments as in circuits 1-3 of Figure 4-16.
2. Touch **[Config]** on the tool bar and select **[Modulation Analyzer]**.
3. Touch **[Modulation]** on the menu bar and select **[IEEE802.11b/g]**.
4. Touch the **{FREQ}** button on the function bar.
   The current center frequency is displayed in entry box 1, and can be changed.
5. Touch the **Center** button.
6. Press **2**, **4**, **5**, **7** and **M/n** in this order on the ten-key pad.
   The center frequency will be set at 2457 MHz.
7. Touch the **{LEVEL}** button on the function bar.
8. Touch the **Auto Level Set** key on the soft menu bar.
   The Ref Level will be set automatically at the optimum value.
9. Touch the **{STD}** button on the function bar.
10. Touch the **IEEE802.11g OFDM** key on the soft menu bar.
    The measuring parameters will be set to the IEEE802.11g standard.
11. Touch the **{TRIGGER}** button on the function bar.
12. Touch the **Trigger Source** key on the soft menu bar.
13. Touch the **Free Run** key on the soft menu bar.
14. Touch the **{INPUT}** button on the function bar.
15. Touch the **Input Setup** button on the soft menu bar.
    The **[Input Setup]** dialog box will be displayed.
16. Set the **[Input]** of the **[Input Setup]** dialog box to **[RF]**.
17. Touch the close button in the **[Input Setup]** dialog box to close the dialog box.

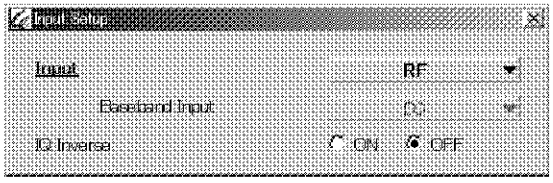


Figure 4-17 **[Input Setup]** Dialog Box

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

    Touch the **Single Frame** key on the soft menu bar and select the single frame mode.

19. Touch the **Meas Parameters** button on the soft menu bar.

    The **[Measurement Parameters Setup]** dialog box will be displayed.

20. Touch the **[AD Capture]** tab in the **[Measurement Parameters Setup]** dialog box. The screen is switched to the AD Capture Setup screen.

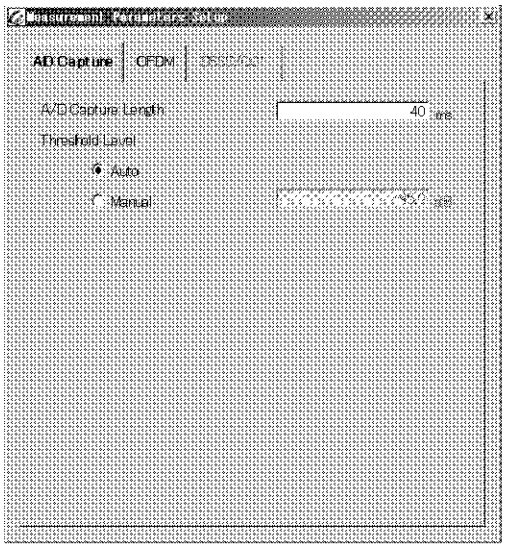


Figure 4-18 **[Measurement Parameters Setup]** Dialog Box - **AD Capture** Setup Tab

21. Set the length of the data to be taken into the memory for one data acquisition.

    Touch the **[A/D Capture Length]** text box in the **[AD Capture]** tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing **1**, **0** and **ENT** on the ten-key pad or by turning the data knob until the numerical value 10 is displayed.

22. Touch **[Auto]** under **[Threshold Level]** in the **[AD Capture]** tab.

    The setting of the threshold level to search for the frame signal (burst signal) is set to Auto.

    (Set the threshold level when the measuring instrument searches for the frame signal (burst signal) to Auto. If the signal level is unstable, select **[Manual]**.)

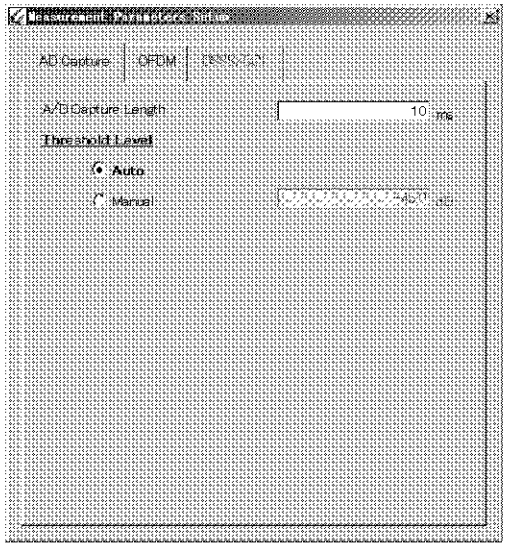


Figure 4-19 **[Measurement Parameters Setup]** Dialog Box - **AD Capture** Setup Tab

23. Touch the **[OFDM]** tab in the **[Measurement Parameters Setup]** dialog box. The screen is switched to the OFDM Setup screen.

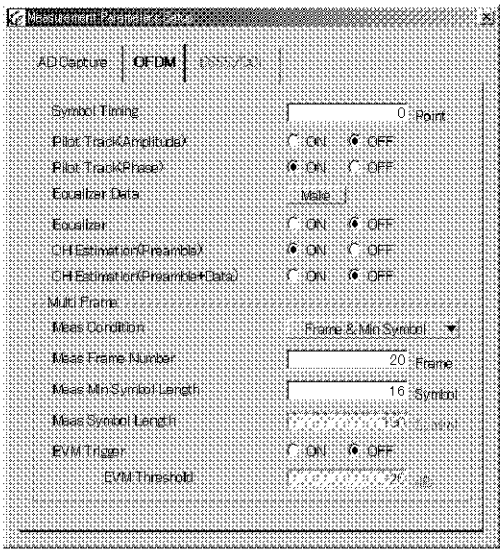


Figure 4-20 **[Measurement Parameters Setup]** Dialog Box - **OFDM** Setup Tab

24. Touch the **[Symbol Timing]** text box in the **[OFDM]** tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing **0**, **ENT** on the ten-key pad or by turning the data knob until the numerical value 0 is displayed. (Symbol Timing is set to the FFT process start position at the time of demodulation. The center of the guard interval is taken as 0.)

25. Touch the **[OFF]** option button of **[Pilot Track(Amplitude)]** in the **[OFDM]** tab.

    (Pilot Track (Amplitude) is a function which corrects the amplitude for each symbol by referring to the pilot signal of the signal to be measured.)

26. Touch the **[ON]** option button of **[Pilot Track(Phase)]** in the **[OFDM]** tab.

    (Pilot Track (Phase) is a function which synchronizes the phase for each symbol by referring to the pilot signal of the signal to be measured.)

27. Touch **[ON]** of the **[CH Estimation(Preamble)]** option button in the **[OFDM]** tab.

    The CH Estimation(Preamble) function is a function to estimate and correct the frequency characteristics of the signal to be measured using the preamble portion.

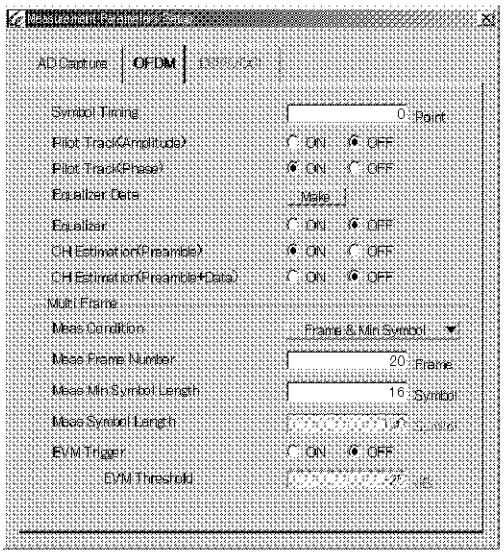


Figure 4-21 **[Measurement Parameters Setup]** Dialog Box - **OFDM** Setup Tab

28. Touch the close button ☒ in the **[Measurement Parameters Setup]** dialog box to close the dialog box.

29. Touch the **A/D Capture** key on the soft menu bar.
    A/D data of the signal under test is taken in, and upon completion the waveform of the signal under test is displayed in the Frame Selection display.

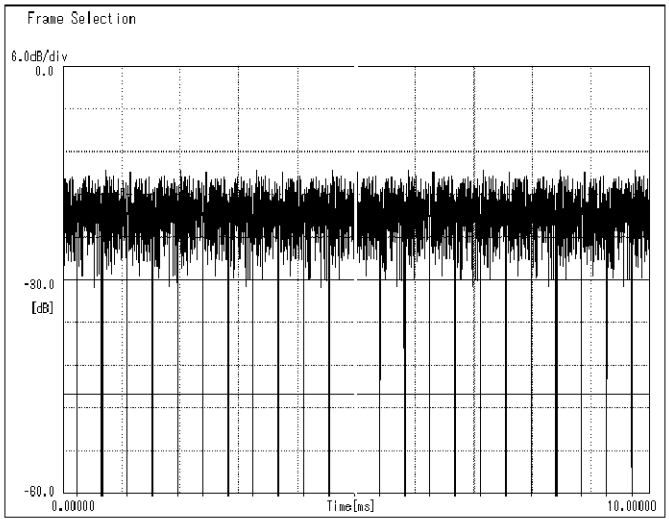


Figure 4-22 Frame Selection Display

30. Touch the Specify Cursor button  on the measurement tool bar.

31. In the waveform of the signal under test in the Frame Selection display, touch near a frame to measure it. The cursor is placed within the frame.

32. Touch the **Analysis Restart** key on the soft menu bar.
    Measurement is executed, and the measurement result is displayed.

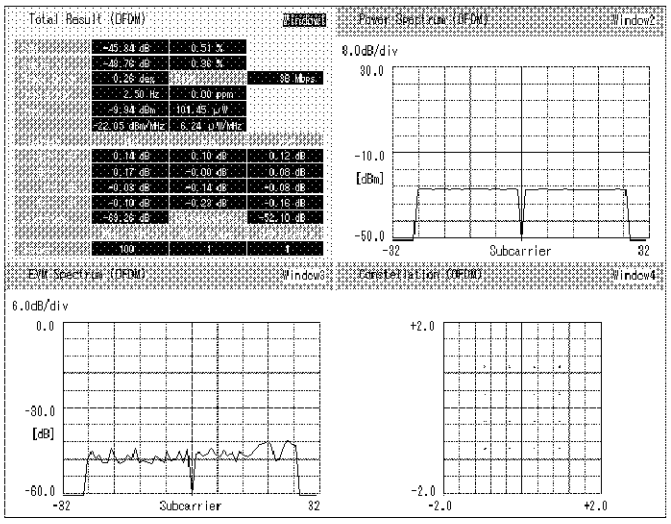


Figure 4-23 Signal Source Measurement Results

33. Check the measurement results to confirm that measurement has been completed normally.

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

35. Touch the **Meas Parameters** button on the soft menu bar.
    The **[Measurement Parameters Setup]** dialog box will be displayed.

36. Touch the **[OFDM]** tab in the **[Measurement Parameters Setup]** dialog box.
    The screen is switched to the OFDM Setup screen.

37. Touch the **Make** button of **[Equalizer Data]** in the **[OFDM]** tab.
    The Equalizer data is calculated. The Equalizer data is retained until the data is calculated by re-pressing the **Make** button. The data can be used as the frequency characteristics correction data until the INPUT, FREQ or STD setting is changed.

38. Touch the **[ON]** option button of **[Equalizer]** in the **[OFDM]** tab.
    When analyzing, the frequency characteristics are corrected by using the Equalizer data.
    The Equalizer function has an exclusive relationship to the CH Estimation function. When the Equalizer is set to ON, the CH Estimation function is automatically set to OFF.

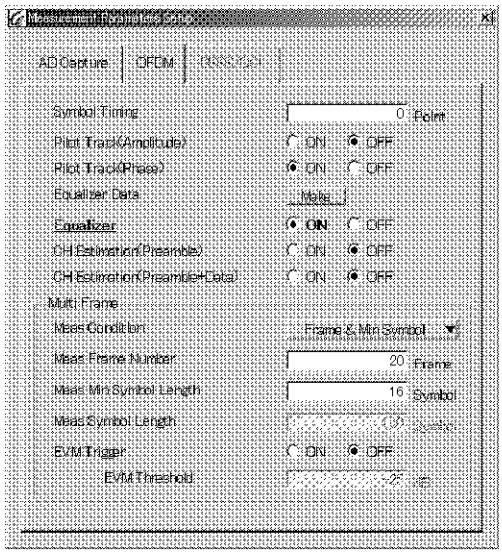


Figure 4-24 **[Measurement Parameters Setup]** Dialog Box

39. Touch the close button **X** in the **[Measurement Parameters Setup]** dialog box to close the dialog box.

40. Touch the **Analysis Restart** key on the soft menu bar.
    The frame at the cursor position is measured again, and the measurement results after Equalizer processing, such as Total Result, are displayed.

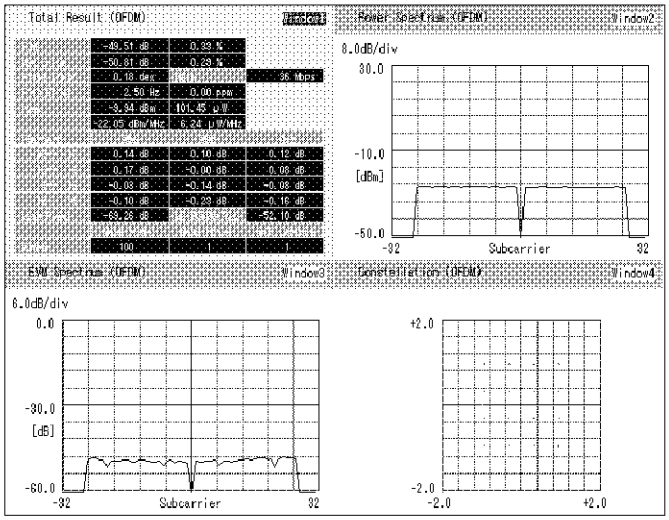


Figure 4-25 Signal Source Measurement Results (After Equalizer Process)

41. Verify that the EVM, etc., of the measurement results have been improved.
42. Connect the instruments as in circuits 2-4 of Figure 4-16.
43. Touch the **{LEVEL}** button on the function bar.
44. Touch the **Auto Level Set** key on the soft menu bar.
    The Ref Level will be set automatically at the optimum value.
45. Touch the **{MEAS CONTROL}** button on the function bar.
46. Touch the **A/D Capture** key on the soft menu bar.
    A/D data of the signal under test is taken in, and upon completion the waveform of the signal under test is displayed in the Frame Selection display.

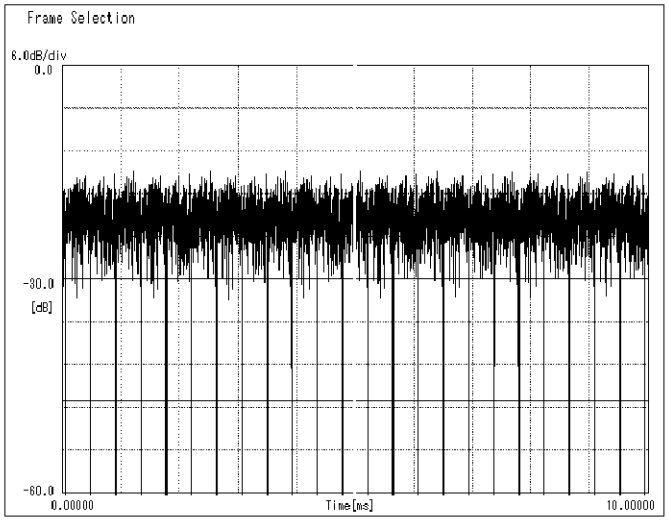


Figure 4-26 Frame Selection Display

47. Touch the Specify Cursor button  on the measurement tool bar.

48. In the waveform of the signal under test in the Frame Selection display, touch near a frame to measure it. The cursor is placed within the frame.

49. Touch the **Analysis Restart** key on the soft menu bar.
    Measurement is executed, and the measurement result is displayed.

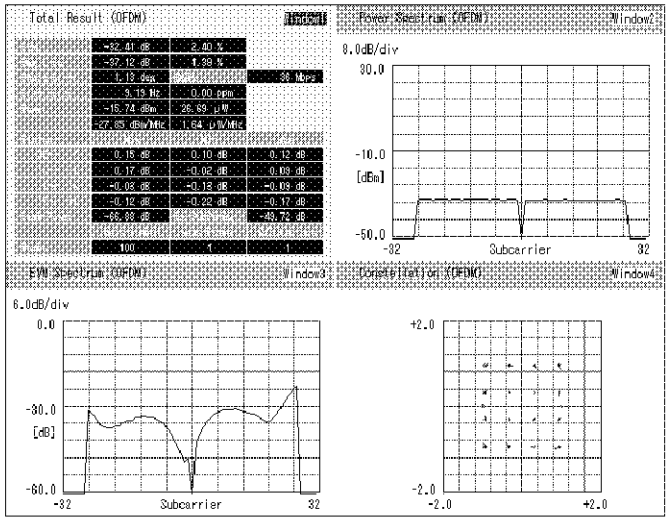


Figure 4-27 DUT Measurement Results

4.2 Measurement of an IEEE802.11b Signal

This section describes the way to use this option, with the following example of measurement of an IEEE802.11b signal.

- Measurement of an IEEE802.11b Signal Using Multi Frame Mode

---

NOTE: ***For Single Frame measurement, the flow of measurement is the same as for measurement of an IEEE802.11g signal. (However, make the settings for the*** **{STD}** ***on the function bar and*** **[Measurement Parameters Setup]** ***dialog as in 4.2.1)***

4.2.1 Measurement of an IEEE802.11b Signal Using Multi Frame Mode

You can repeat measurement of various frames and chips by using Multi Frame Mode. This mode is suitable for measurements based on the standards.

[Specifications of signal to be measured]

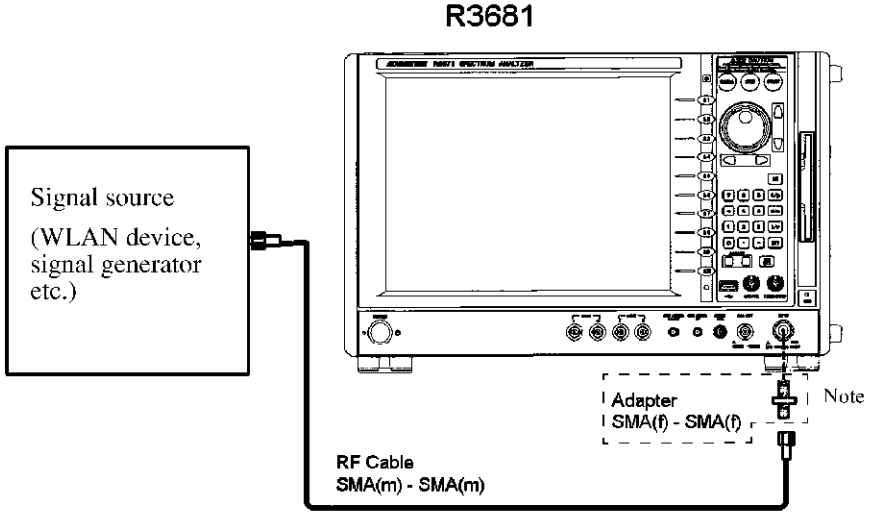
Conforming standards:	IEEE802.11b signal
Center frequency:	2457 MHz
Level:	0 dBm
Data rate:	2 Mbps (Modulation system DQPSK)
Number of chips:	1408 (not including PLCP)

[Measuring conditions]

Meas Filter:	Nyquist
Nyquist BW:	22 MHz
Roll Off:	0.5
Ramp Up/Down Smoothing:	11 Point
Constellation 45deg Rotation:	ON
Continuous Signal:	OFF
Meas Condition:	Frame & Min Chip
Meas Frame Number:	10
Meas Min Chip Length:	1000 Chip
EVM Trigger:	ON
EVM Threshold:	35%

Single Measurement

[Device connection]



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

Figure 4-28 Connection Diagram for Measurement Using Multi Frame Mode

|Setting the measuring conditions|

1. Touch **[Config]** on the menu bar and select **[Modulation Analyzer]**.
2. Touch **|Modulation|** on the menu bar and select **|IEEE802.11b/g|**.
3. Touch the **{FREQ}** button on the function bar.
4. Touch the **Center** key on the soft menu bar.
5. Press [2], [4], [5], [7] and [M/n] in this order on the ten-key pad.
   The center frequency will be set at 2457 MHz.
6. Touch the **{LEVEL}** button on the function bar.
7. Touch the **Auto Level Set** key on the soft menu bar.
   The Ref Level will be set automatically at the optimum value.
8. Touch the **{STD}** button on the function bar.
9. Touch the **IEEE802.11b/g DSSS/CCK DSSS-OFDM** key on the soft menu bar.
   The measuring parameters will be set to the IEEE802.11b/g standard.
10. Touch the **{TRIGGER}** button on the function bar.
11. Touch the **Trigger Source** key on the soft menu bar.

12. Touch the **Free Run** key on the soft menu bar.
13. Touch the **{INPUT}** button on the function bar.
14. Touch the **Input Setup** button on the soft menu bar.
    The **[Input Setup]** dialog box will be displayed.
15. Set the **[Input]** of the **[Input Setup]** dialog box to **[RF]**.
16. Touch the close button in the **[Input Setup]** dialog box to close the dialog box.

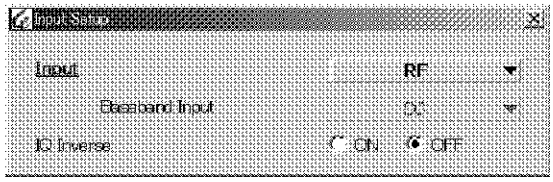


Figure 4-29 **[Input Setup]** Dialog Box

17. Touch the **{MEAS CONTROL}** button on the function bar.
18. Touch the **Multi Frame** key on the soft menu bar and select the multi frame mode.
19. Touch the **Meas Parameters** button on the soft menu bar.
    The **[Measurement Parameters Setup]** dialog box will be displayed.
20. Touch the **[AD Capture]** tab in the **[Measurement Parameters Setup]** dialog box. The screen is switched to the AD Capture Setup screen.

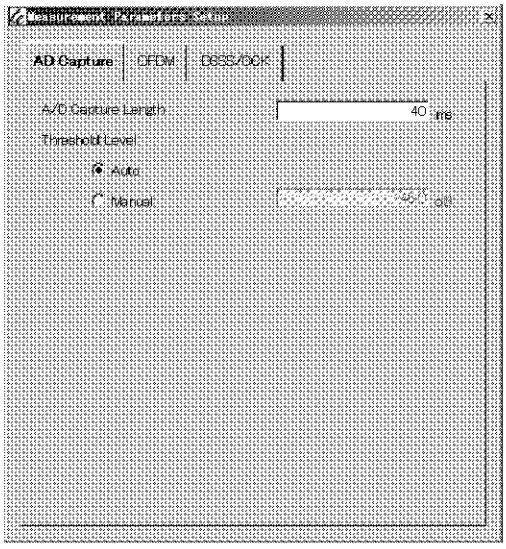


Figure 4-30 **[Measurement Parameters Setup]** Dialog Box - **AD Capture** Setup Tab

21. Sets the length of the data to be taken into the memory for one data acquisition.

    Touch the **[A/D Capture Length]** text box in the [**AD Capture**] tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing **5** and **ENT** on the ten-key pad or by turning the data knob until the numerical value 5 is displayed.

22. Touch [**Auto**] under **[Threshold Level]** in the **[AD Capture]** tab.

    The setting of the threshold level to search for the frame signal (burst signal) is set to Auto.

    (Set the threshold level when the measuring instrument searches for the frame signal (burst signal) to Auto. If the signal level is unstable, select **[Manual]**.)

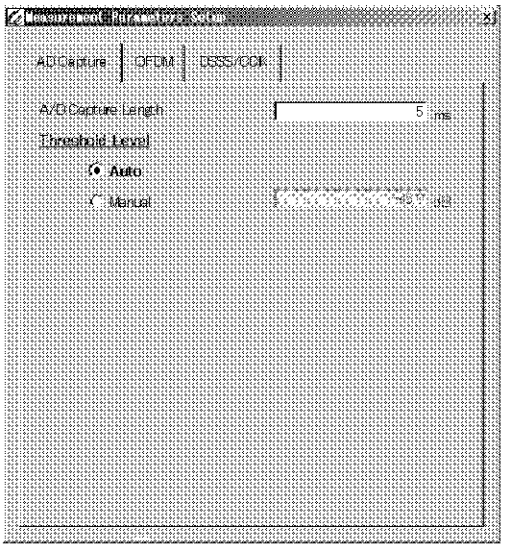


Figure 4-31 **[Measurement Parameters Setup]** Dialog Box - **AD Capture** Setup Tab

23. Touch the [**DSSS/CCK**] tab in the **[Measurement Parameters Setup]** dialog box. The screen is switched to the DSSS/CCK Setup screen.

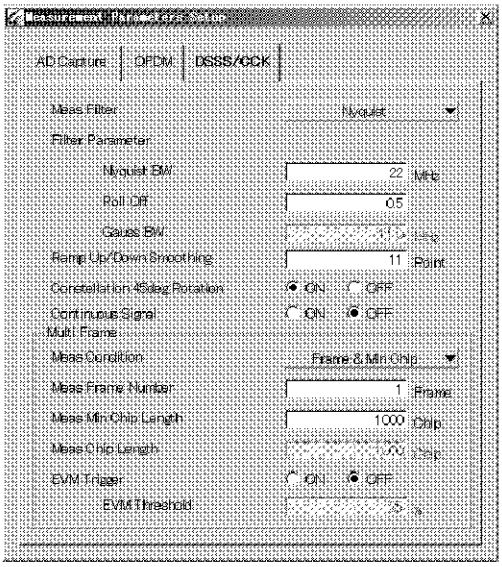


Figure 4-32 **[Measurement Parameters Setup]** Dialog Box - **DSSS/CCK** Setup Tab

24. Set [**Meas Filter**] in the [**DSSS/CCK**] tab to [**Nyquist**].

25. Touch the [**Nyquist BW**] text box in the [**DSSS/CCK**] tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing [**2**], [**2**] and [**M/n**] on the ten-key pad or by turning the data knob until the numerical value 22 is displayed.

26. Touch the [**Roll Off**] text box in the [**DSSS/CCK**] tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing [**0**], [**.**], [**5**] and [**ENT**] on the ten-key pad or by turning the data knob until the numerical value 0.5 is displayed.

27. Touch the [**Ramp Up/Down Smoothing**] text box in the [**DSSS/CCK**] tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing [**1**], [**1**] and [**ENT**] on the ten-key pad or by turning the data knob until the numerical value 11 is displayed.

28. Touch [**ON**] of the [**Constellation 45deg Rotation**] option button in the [**DSSS/CCK**] tab.

    (Constellation 45deg Rotation is a function to rotate the constellation chip position display by ±45°.

29. Touch [**OFF**] on the [**Continuous Signal**] option button in the [**DSSS/CCK**] tab.

30. Set [**Meas Condition**] in the [**DSSS/CCK**] tab to [**Frame & Min Chip**].

31. Set the number of frames to be measured to 10.

    Touch the **[Meas Frame Number]** text box in the **[DSSS/CCK]** tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing [1], [0] and [ENT] on the ten-key pad or by turning the data knob until the numerical value 10 is displayed.

    (The measuring instruments analyze frames until reaching the number of frames set here. The number of frames analyzed will be the number of frames set here.)

32. Make the setting so that frames containing 1000 chips or more are analyzed.

    Touch the **[Meas Min Chip Length]** text box in the **[DSSS/CCK]** tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing [1], [0], [0], [0] and [ENT] on the ten-key pad or by turning the data knob until the numerical value 1000 is displayed.

    (The measuring instruments will not analyze frames containing less than the number of chips set here.)

33. Touch **[ON]** of the **[EVM Trigger]** option button in the **[DSSS/CCK]** tab.

34. Touch the **[EVM Threshold]** text box in the **[DSSS/CCK]** tab.

    The set value is displayed in a black/white inverted state. Input the numerical value either by pressing [3], [5] and [ENT] on the ten-key pad or by turning the data knob until the numerical value 35 is displayed.

    (If a frame exceeding the EVM set here is analyzed, the measuring instruments will end measurements at that frame.)

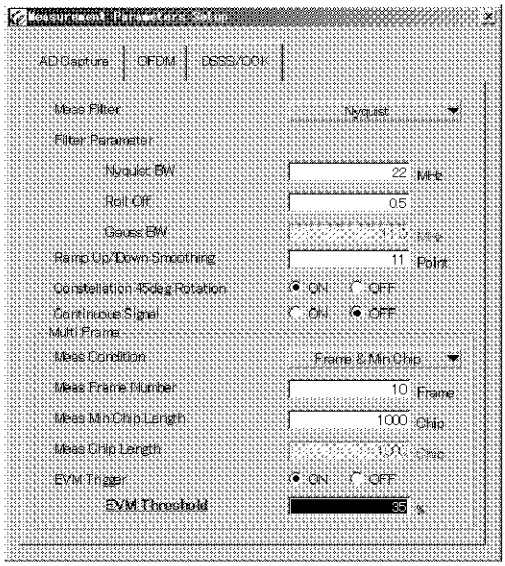


Figure 4-33 **[Measurement Parameters Setup]** Dialog Box - **DSSS/CCK** Setup Tab

35. Touch the close button [X] in the **[Measurement Parameters Setup]** dialog box to close the dialog box.

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

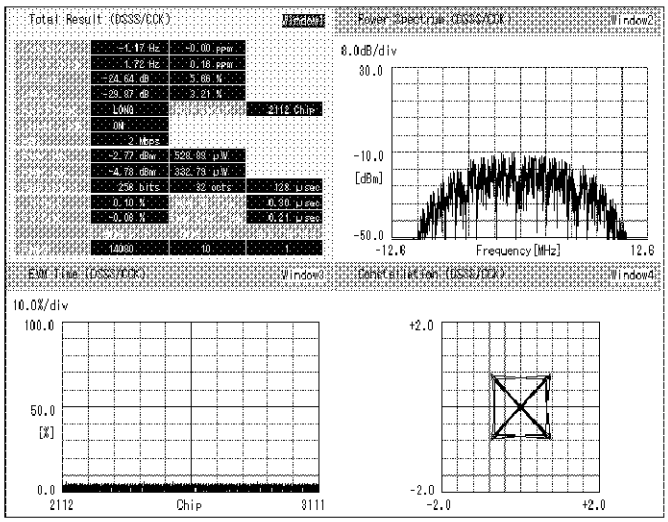


Figure 4-34 Multi Frame Mode Measurement Results

5. MENU MAP, FUNCTIONAL EXPLANATION

This chapter describes the configurations and functions of the soft keys displayed on the touch screen of the IEEE802.11b/g 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 a 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:

[File]	[System]	[Config]	[Modulation]	[Cal]	[Special]

The menu bar consists of the same items as those of Spectrum Analyzer except that the additional items; Save Meas. Data... and Save A/D Data... exist under the File menu when Modulation Analyzer is used.

[Save Meas. Data...] Saves the data displayed on the selected display.

[Save A/D Data...] Saves the A/D data.

If the AD data is saved by selecting File Type:DAT, the AD data, whose frequency characteristics were corrected, is saved in text format.

For more information, refer to A.3, "A/D Data Save Function."

If the AD data is saved by selecting File Type:MNT, the AD data, whose frequency characteristics were not corrected, is saved in binary format.

These data is used only for maintenance, and therefore cannot be disclosed.

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

Next, select the IEEE802.11b/g modulation analysis function from among the modulation analysis functions.

Select **[IEEE802.11b/g]** from **[Modulation]** on the menu bar to select the IEEE802.11b/g 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:

MEAS CONTROL	INPUT	TRIGGER	STD	DISPLAY	SCALE	MKR	LEVEL	FREQ

When you click 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.

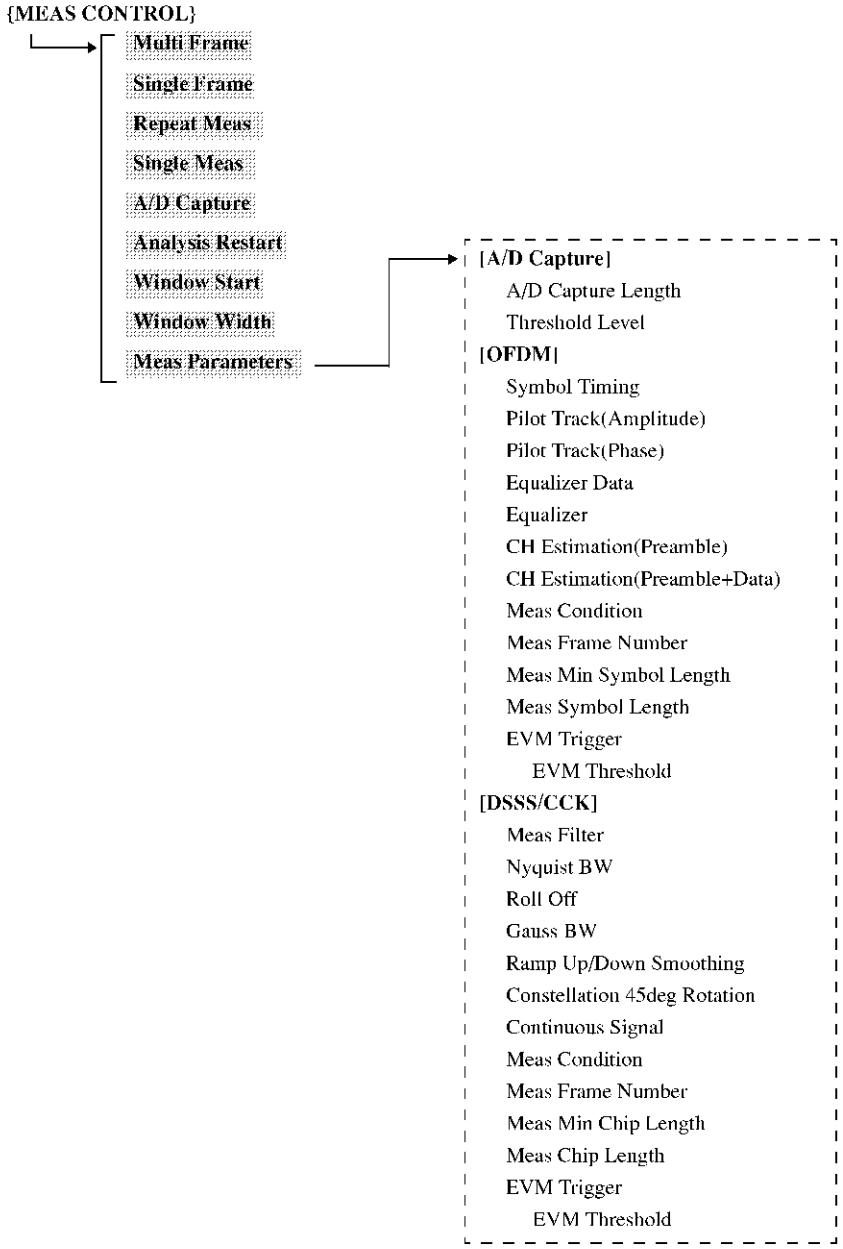
When you touch a button on the function bar, the associated soft keys are displayed on the soft menu bar.

5.5 Description of the Function of Each Key

This section describes the function of each key.

5.5.1 {MEAS CONTROL}

When you touch the **{MEAS CONTROL}** button, the soft keys related to the selection of a measurement mode, import and analysis of A/D data on measurement signals, and setup of measurement conditions are displayed on the soft menu bar.



Multi Frame

When you touch the **Multi Frame** button, the measurement mode is set to the Multi Frame mode.
The Multi Frame mode is used to acquire the A/D data on the signal to be measured, analyze multiple frames contained in the data until the conditions set in Meas Parameters are satisfied, and display the measurement results. If the conditions set in Meas Parameters are not satisfied by one acquisition of A/D data on the signal to be measured, repeat A/D data acquisitions the required number of times. With regard to the measurement result, a cumulative value of all frames analyzed after the start of the measurement is displayed as "Total Result." In the displays other than "Total Result," only the result of the immediately preceding analyzed frame is displayed.

MEMO: ***The Multi Frame mode is suitable for performing measurements of multiple symbols repeatedly under the same measurement conditions.***

Single Frame

When you touch the **Single Frame** button, the measurement mode is set to the Single Frame mode.
In the Single Frame mode, using A/D Capture, measurements can be repeatedly performed by using the once acquired A/D data on the measurement signal under various measurement conditions.

MEMO: ***The Single Frame mode is suitable for performing measurement by selecting a burst to be measured from the data captured.***

Repeat Meas

Valid only in the Multi Frame mode.
When you touch the **Repeat Meas** button, measurements in the Multi Frame mode are repeatedly performed. When the conditions set in Meas Parameters are satisfied, the number of symbols measured is returned to 0 and measurement is restarted.

Single Meas

Valid only in the Multi Frame mode.
When you touch the **Single Meas** button, measurement is performed in the Multi Frame mode once. When the conditions set in Meas Parameters are satisfied, the measurement is terminated.

A/D Capture

Valid only in the Single Frame mode.
When you touch the **A/D Capture** button, acquisition of A/D data on the signal to be measured is started. When acquisition of A/D data is complete, the time waveform of the acquired burst is displayed in the form of the Frame Selection display.

IMPORTANT:

Regarding the Frame Selection display
When acquisition by A/D Capture is complete, the envelope waveform of the signal measured is displayed. This is called the Frame Selection display.
Using this display, select the frame to be measured. To select a frame, position the cursor on the frame to be measured.

Analysis Restart

Valid only in the Single Frame mode.
When you touch the **Analysis Restart** button, the measurement is started. When you touch the **Analysis Restart** button after measurement, the measurement is restarted.

IMPORTANT:

When you touch the Analysis Restart button before completing the A/D data acquisition, an error occurs.

Window Start

Valid in the Single Frame mode.
In the frame selected using the Frame Selection display, sets the start position of the range to be analyzed. The set start position moves with the measurement range window in the Meas Window display. The value can be set only in the case of OFDM. The unit used for setting is "symbol(sym)." In the case of DSSS/CCK, the value is automatically set and the set value is displayed. The unit is "chip."

Window Width

Valid in the Single Frame mode.
In the frame selected using the Frame Selection display, sets the number of symbols (chips) in the range to be analyzed. The set number of symbols (chips) moves with the measurement range window in the Meas Window display. When the data part is OFDM, the unit used for setting is "symbol(sym)." When it is DSSS/CCK, the unit is "chip."

IMPORTANT:

In the initial analysis of the selected frame, the set previous values of Window Start and Window Width are ignored, and their values are automatically set according to the frame structure and length. In the second and subsequent analyses, the set values become valid.

Meas Parameters

When you touch the **Meas Parameters** button, the dialog box used to set measurement conditions is displayed.

[A/D Capture] Sets the measurement conditions of A/D data Capture.

[A/D Capture Length] Sets the A/D data time length of the signal to be measured.

[Threshold Level] Switches the setting method of the threshold level used to judge whether the frame exists or not between automatic and manual.

Auto: Sets the threshold level automatically.

Manual: Sets the threshold level manually.
When "Manual" is selected, the text box for manual input of the threshold level is displayed.

[OFDM] Sets the measurement conditions for measuring the OFDM signal.

[Symbol Timing] In the OFDM symbol, sets the start position of the range used for FFT (demodulation).

[Pilot Track(Amplitude)]
Switches ON and OFF the amplitude correction function which uses the pilot subcarrier.

ON: Uses the amplitude correction function.

OFF: Does not use the amplitude correction function.

[Pilot Track(Phase)] Switches ON and OFF the phase synchronization function which uses the pilot subcarrier.

ON: Uses the phase synchronization function.

OFF: Does not use the phase synchronization function.

[Equalizer Data] The Equalizer data is calculated by touching the **Make** button. The frequency characteristics correction data is calculated based on the measurement results of the Mag Flatness Spectrum and the Phase Error Spectrum. The Equalizer data is retained until re-calculating.

IMPORTANT:

To calculate the Equalizer data, the frame analysis must be completed.

If the measurement conditions (INPUT, FREQ, STD) are different from the conditions on which the measurement results used in the data calculation are taken, the Equalizer data is invalid and cannot be used.

[Equalizer] Switches the Equalizer function ON and OFF.

ON: Uses the Equalizer function.
The frequency characteristics are corrected by using the Equalizer data.

OFF: Does not use the Equalizer function.

IMPORTANT:

The Equalizer function cannot be used when the Equalizer data does not exist or is invalid.

[CH Estimation (Preamble)]
Switches ON and OFF the channel correction function which uses the preamble (LTS of IEEE802.11g).

ON: Uses the channel correction function.
The frequency characteristics are corrected.

OFF: Does not use the channel correction function.

[CH Estimation (Preamble+Data)]
Switches ON and OFF the channel correction function which uses the preamble (LTS of IEEE802.11g) and the data analysis results.

ON: Uses the channel correction function.
The frequency characteristics are corrected.

OFF: Does not use the channel correction function.

IMPORTANT:
The Equalizer function has an exclusive relationship with the CH Estimation (Preamble) function and CH Estimation (Preamble+Data) function. Two or more functions cannot be set to ON at the same time. If one of the three functions is set to ON, the other two functions are automatically set to OFF.

[Meas Condition] Valid in the Multi Frame mode. Sets the Total Result measurement conditions.

Frame: Measures the set number of Frames.

Symbol: Measures the set number of Symbols.

Frame & Min Symbol:
Measures the set number of Frames. However, any Frame whose number of symbols in the data part is less than Min Symbol is not measured.

[Meas Frame Number] Valid in the Multi Frame mode. Sets the number of frames required for Total Result measurement.

[Meas Min Symbol Length]
Valid in the Multi Frame mode. Sets the minimum number of symbols per frame required for Total Result measurement.

[Meas Symbol Length] Valid in the Multi Frame mode. Sets the number of symbols required for Total Result measurement.

[EVM Trigger] Valid in the Multi Frame mode. Sets the EVM trigger ON and OFF.

ON: Turns on the EVM trigger function.

OFF: Turns off the EVM trigger function.
When the function is turned on, a text box for input of the threshold is displayed.

[EVM Threshold]
Sets the threshold when the EVM Trigger is turned on.

MEMO: ***To measure a DSSS-OFDM signal, both the parameters in the [OFDM] tab and [DSSS/CCK] tab must be set.***

[DSSS/CCK] Sets the measurement conditions for measuring a DSSS/CCK signal.

[Meas Filter] Sets the receiving filter.

Nyquist: Sets the Nyquist filter.

Gauss: Sets the Gauss filter.

Sinc: Sets the sin(x)/x filter.

[Nyquist BW] Sets the -3dB bandwidth of the Nyquist filter.

[Roll Off] Sets the rolloff coefficient of the Nyquist filter.

[Gauss BW] Sets the -3dB bandwidth of the Gauss filter.

[Ramp Up/Down Smoothing]
Sets the smoothing coefficient for Ramp Up/Down.

[Constellation 45deg Rotation]
Sets whether to display the constellation with 45-degree rotation.

MEMO: ***When [Constellation 45deg Rotation] is set to OFF, the eye diagram cannot be displayed.***
To display the eye diagram, set [Constellation 45deg Rotation] to ON.

[Continuous Signal] Sets whether the measurement signal is a continuous wave.

ON: Measures the continuous wave.

OFF: Measures the burst signal.

MEMO: ***If Continuous Signal is set to ON, 1 Frame is measured per each AD Capture. Although AD Capture Length is 40 msec, 30,000 chips are measured.***

[Meas Condition] Valid in the Multi Frame mode. Sets the Total Result measurement conditions.

Frame: Measures the set number of Frames.

Chip: Measures the set number of chips.

Frame & Min Chip:
Measures the set number of Frames. However, any Frame whose number of chips in the data part is less than Min Chip is not measured.

[Meas Frame Number] Valid in the Multi Frame mode. Sets the number of frames required for Total Result measurement.

[Meas Min Chip Length]
Valid in the Multi Frame mode. Sets the minimum number of chips per frame required for Total Result measurement.

[Meas Chip Length] Valid in the Multi Frame mode. Sets the number of chips required for Total Result measurement.

[EVM Trigger] Valid in the Multi Frame mode. Sets the EVM trigger ON and OFF.

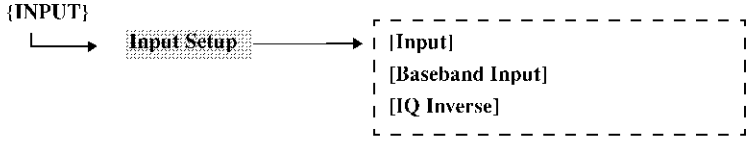
ON: Turns on the EVM trigger function.

OFF: Turns off the EVM trigger function.
When the function is turned on, a text box for input of the threshold is displayed.

[EVM Threshold]
Sets the threshold when the EVM Trigger is turned on.

5.5.2 {INPUT}

When you touch the **{INPUT}** key, the soft keys related to the setting up of the input format for the measuring instrument are displayed on the soft menu bar.



Input Setup

When you touch the **Input Setup** button, the dialog box for setting up the input format for the measuring instrument is displayed. Set up in accordance with the measurement signal.

[Input]

Sets the input channel for the signal.

RF: Sets the RF signal input.

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

[Baseband Input]

Sets the coupling for the IQ signal input.

AC: Selects the AC coupling.

DC: Selects the DC coupling.

[IQ Inverse]

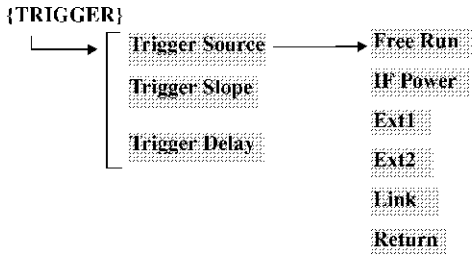
Selects whether or not to invert the phase of the signal to be measured.

ON: Inverts.

OFF: Does not invert.

5.5.3 {TRIGGER}

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



Trigger Source

When you touch the **Trigger Source** button, the soft keys related to the trigger setup are displayed on the soft menu bar.

Free Run

Obtains and analyzes data according to the internal timing of the measuring instrument.

IF Power

Obtains and analyzes data synchronized with the IF signal.

Ext1

Obtains and analyzes data synchronized 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 synchronizing 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 synchronizing with the trigger of an optional function.

---

*MEMO: **For information on the directions for use of 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 polarity of the trigger slope.
Available only for IF Power, Ext1, and Ext2.

+: Starts sweep at the rise of a trigger.

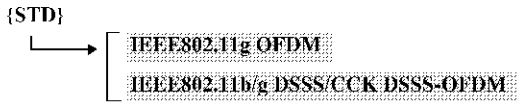
-: Starts sweep at the fall of a trigger.

Trigger Delay

Sets the delay time from the trigger point. Is available only for IF Power, Ext1, and Ext2. When analyzing, the start position of AD data acquisition is shifted to the delay time.

5.5.4 {STD}

When you touch the **{STD}** button, the soft keys related to the analysis parameter setup are displayed on the soft menu bar.



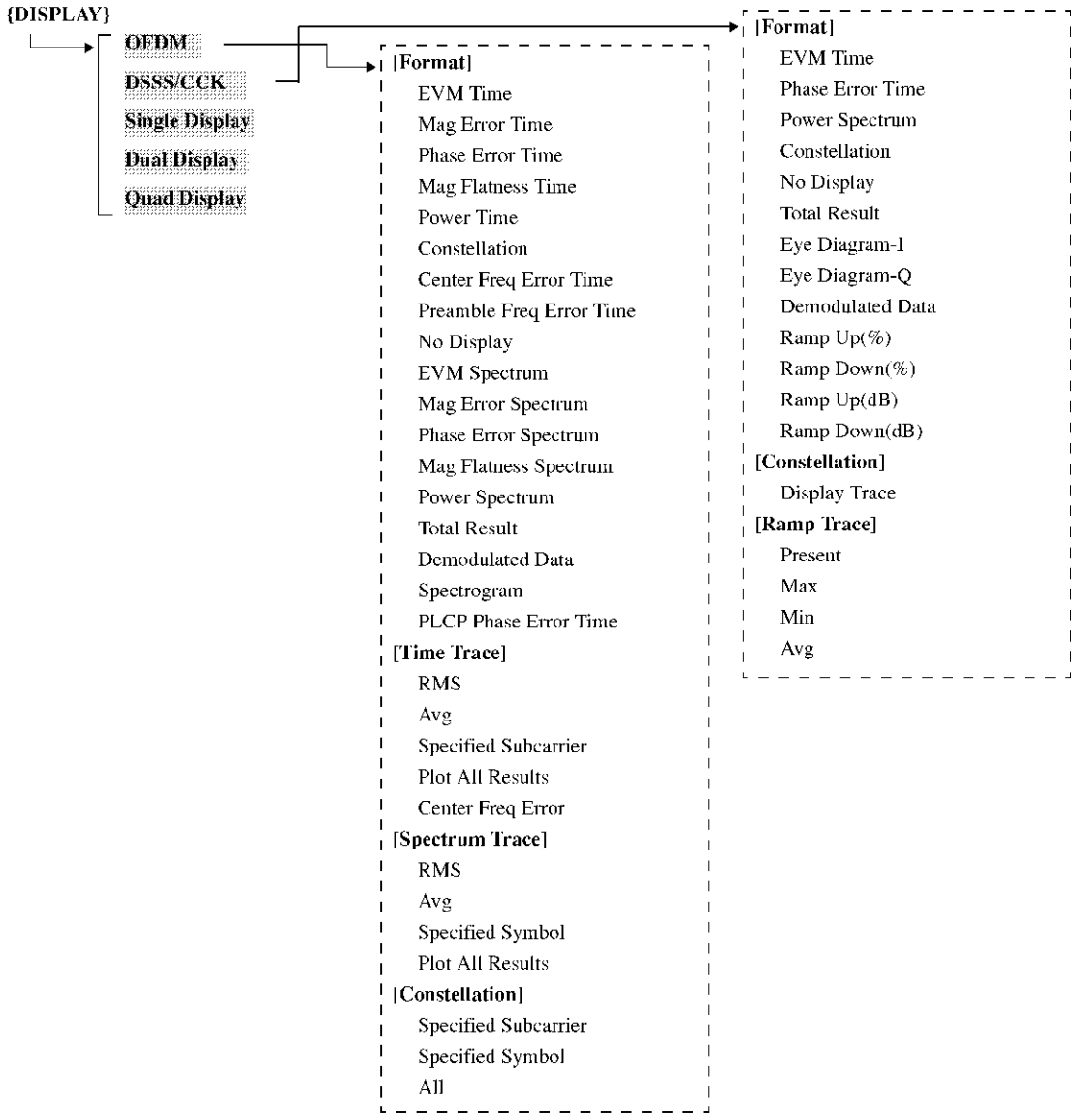
IEEE802.11g OFDM Measures the ERP-OFDM signal of IEEE802.11g.

IEEE802.11b/g DSSS/CCK DSSS-OFDM
Measures the IEEE802.11b signal and ERP-DSSS signal, ERP-CCK signal, and DSSS-OFDM signal of IEEE802.11g.

5.5.5 {DISPLAY}

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

5.5.5 {DISPLAY}



OFDM

Displays the dialog box used to set the type of the display result in the active window on the OFDM result display screen.
Selects **[Format]** of the display result, and sets the selected Format in more detail by setting **[Time Trace]**, **[Spectrum Trace]**, and **[Constellation]**.

[Format]

Selects the type of the display result.

[EVM Time] Displays the EVM of each symbol on a graph.
On the graph, the vertical axis shows EVM (dB) and the horizontal axis shows time (symbol). The EVM RMS value traces, the EVM value trace of any one of the subcarriers, or the EVM value plot of each symbol or subcarrier can be displayed.

[Mag Error Time] Displays the Magnitude Error of each symbol on a graph.
On the graph, the vertical axis shows Magnitude Error (dB) and the horizontal axis shows time (symbol).
The Magnitude Error RMS value trace, the Magnitude Error value trace of any one of the subcarriers, or the Magnitude Error value plot of each symbol or subcarrier can be displayed.

[Phase Error Time] Displays the Phase Error of each symbol on a graph.
On the graph, the vertical axis shows Phase Error (deg) and the horizontal axis shows time (symbol). The Phase Error average value trace, the Phase Error value trace of any one of the subcarriers, or the Phase Error value plot of each symbol or subcarrier can be displayed.

[Mag Flatness Time] Displays the Magnitude Flatness of each symbol on a graph.
On the graph, the vertical axis shows Magnitude Flatness (dB) and the horizontal axis shows time (symbol). The Magnitude Flatness average value trace, the Magnitude Flatness value trace of any one of the subcarriers, or the Magnitude Flatness value plot of each symbol or subcarrier can be displayed.

[Power Time] Displays the power of each symbol on a graph.
On the graph, the vertical axis shows power (dBm) and the horizontal axis shows time (symbol). The average power value trace, the power value trace of any one of the subcarriers, or the power value plot of each symbol or subcarrier can be displayed.

[Constellation] Displays the constellation. On the graph, the vertical axis shows the magnitude of the I signal and the horizontal axis shows the magnitude of the Q signal. Constellations of all symbols or subcarriers, the constellation of any one of the subcarriers, or the constellation of any one of the symbols can be displayed.

[Center Freq Error Time]
Displays the center frequency error of each symbol on a graph.
On the graph, the vertical axis shows the frequency error (Hz) and the horizontal axis shows time (symbol). The center frequency error trace and the average value can be displayed.

[Preamble Freq Error Time]
Displays the center frequency error of the preamble (STS: Short Training Symbols) on a graph.
The result is displayed only when IEEE802.11g OFDM is measured.
On the graph, the vertical axis shows the frequency error (Hz) and the horizontal axis shows time (sec).

[No Display] Nothing is displayed.

[EVM Spectrum] Displays the EVM of each subcarrier on a graph.
On the graph, the vertical axis shows EVM (dB) and the horizontal axis shows frequency (subcarrier). The EVM RMS value traces, the EVM value trace of any one of the symbols, or the EVM value plot of each symbol or subcarrier can be displayed.

[Mag Error Spectrum]

Displays Magnitude Error of each subcarrier on a graph.
On the graph, the vertical axis shows Magnitude Error (dB) and the horizontal axis shows frequency (subcarrier). The Magnitude Error RMS value trace, the Magnitude Error value trace of any one of the symbols, or the Magnitude Error value plot of each symbol or subcarrier can be displayed.

[Phase Error Spectrum]

Displays Phase Error of each subcarrier on a graph. On the graph, the vertical axis shows Phase Error (deg) and the horizontal axis shows frequency (subcarrier). The Phase Error average value trace, the Phase Error value trace of any one of the symbols, or the Phase Error value plot of each symbol or subcarrier can be displayed.

[Mag Flatness Spectrum]

Displays the Magnitude Flatness of each subcarrier on a graph.
On the graph, the vertical axis shows Magnitude Flatness (dB) and the horizontal axis shows frequency (subcarrier).
The Magnitude Flatness average value trace, the Magnitude Flatness value trace of any one of the symbols, or the Magnitude Flatness value plot of each symbol or subcarrier can be displayed.

[Power Spectrum]

Displays the power of each subcarrier on a graph.
On the graph, the vertical axis shows power (dBm) and the horizontal axis shows frequency (subcarrier). The average power value trace, the power value trace of any one of the symbols, or the power value plot of each symbol or subcarrier can be displayed.

[Total Result]

Displays the total of the measurement values of all subcarriers for the symbols in the measurement range as the result.

- RMS EVM (dB): Modulation Accuracy
- Mag Error (dB): Magnitude Error
- Phase Error (deg): Phase Error
- Center Frequency Error (Hz, ppm): Center Frequency Error
- Power (dBm, dBm/MHz, W, W/MHz): Power
- Rate: Transmission rate
- Leak-Power (dB): Center Frequency Leakage Power

  Relative to overall power: Relative to the overall power

  Relative to subcarrier average power: Relative to the average power of all subcarriers
- Spectral Flatness (dB): Spectral Flatness
- Number of Meas. Symbol: Number of symbols measured
- Number of Meas. Frame: Number of frames measured
- Number of A/D Capture: Number of A/D data captures

[Demodulated Data] The demodulated data on the signal measured is displayed.
It is displayed for each symbol and subcarrier in a hexadecimal number respectively. The subcarrier type and the modulation system are distinguished by color. The demodulated data on the first 10 symbols (when the dual or quad display is selected) or the first 24 symbols (when the single display is selected) in the measurement range is displayed on the screen. To see the demodulated data on the subsequent symbols, change the measurement range. All the demodulated data in the measurement range can be saved in a file.

BPSK: purple
QPSK: green
16QAM: light blue
64QAM: cream
Pilot subcarrier:yellow
When there are no subcarriers, red asterisks (**) are displayed.

[Spectrogram] Displays the spectrogram.
Displays the time change of the spectrum of the measurement signal. The vertical axis shows time (symbol) and the horizontal axis shows frequency (subcarrier). The color shows the power strength.

[PLCP Phase Error Time]
Displays the Phase Error in the PLCP part of each chip on a graph. The result is displayed only when DSSS-OFDM is measured.
On the graph, the vertical axis shows Phase Error (deg) and the horizontal axis shows time (chip).

[Time Trace] Sets the result graph that has a horizontal axis showing time (symbol). The checked items are displayed on the graph. Multiple items can be selected.

[RMS] Displays the RMS value of the measurement result on a trace.

NOTE: ***RMS can be selected only for EVM Time and Mag Error Time.***

[Avg] Displays the average value of the measurement result on a trace.

NOTE: ***Avg can be selected only for Phase Error Time, Mag Flatness Time, Power Time, and Center Freq Error Time.***

[Specified Subcarrier] Sets the subcarrier number to be displayed on a graph.

NOTE: ***This cannot be selected for Center Freq Error Time.***

[Plot All Results] Displays measurement values of all subcarriers for each symbol on a plot.

NOTE: ***This cannot be selected for Center Freq Error Time.***

[Center Freq Error] Displays the center frequency error of each symbol on a trace.

[Spectrum Trace] Sets the result graph that has a horizontal axis showing frequency (subcarrier). The checked items are displayed on the graph. Multiple items can be selected.

[RMS] Displays the RMS value of the measurement result on a trace.

NOTE: RMS can be selected only for EVM Time and Mag Error Time.

[Avg] Displays the average value of the measurement result on a trace.

NOTE: Avg can be selected only for Phase Error Time, Mag Flatness Time, and Power Time.

[Specified Symbol]
Sets the symbol number to be displayed on a graph.

[Plot All Results]
Displays measurement values of all symbols for each subcarrier on a plot.

[Constellation] Performs setup related to the constellation display.
The checked items are displayed. Only one item can be selected at a time.

[Specified Subcarrier]
Displays the constellation of any one of the subcarriers.

[Specified Symbol]
Displays the constellation of any one of the symbols.

[All] Displays the constellations of all symbols and subcarriers.

DSSS/CCK Displays the dialog box used to set the type of the display result in the active window on the DSSS/CCK result display screen.
Selects "Format" of the display result, and sets the selected "Format" in more detail by setting "Constellation," and "Ramp Trace."

[Format] Selects the type of the display result.

[EVM Time] Displays the EVM of each chip on a graph.
On the graph, the vertical axis shows EVM (%) and the horizontal axis shows time (chip).

[Phase Error Time] Displays the Phase Error of each chip on a graph.
On the graph, the vertical axis shows Phase Error (deg) and the horizontal axis shows time (chip).

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

[Constellation] Displays the constellation. On the graph, the vertical axis shows the magnitude of the I signal and the horizontal axis shows the magnitude of the Q signal. Only chips or tracks between chips can be displayed.

MEMO: The Constellation screen can display up to 10000 chips.

[No Display] Nothing is displayed.

[Total Result] Displays the total of the measurement values of all frames for the chips in the measurement range as the result.

- Freq Error (Hz, ppm): Center Frequency Error
- Chip Freq Error (Hz, ppm): Chip Frequency Error
- EVM Maximum (dB, %): Maximum Value of Modulation Accuracy
- EVM Average (dB, %): Average Value of Modulation Accuracy
- PLCP Format: PLCP Format
- PLCP Length: PLCP length
- Locked Clock: Locked clock for carriers and symbols
- Rate (Mbps): Transmission rate
- Power Maximum (dBm, W): Maximum power value
- Power Average (dBm, W): Average power value
- PSDU Length (bits, octet, µsec): PSDU length
- I Offset (%): I-component DC offset
- Q Offset (%): Q-component DC offset
- Ramp Up Time (sec): Ramp up time
- Ramp Down Time (sec): Ramp down time
- Number - Meas. Chip: Number of chips to be measured
- Number - Meas. Frame: Number of frames to be measured
- Number - A/D Capture: Number of A/D data captures

NOTE: ***The EVM of the Total Result is calculated by using only the PSDU portion.***

[Eye Diagram-I] Displays the I-component eye diagram.

MEMO: ***The Eye Diagram-I screen can display up to 10000 chips.***

[Eye Diagram-Q] Displays the Q-component eye diagram.

MEMO: ***The Eye Diagram-Q screen can display up to 10000 chips.***

[Demodulated Data] The demodulated data on the signal measured is displayed.

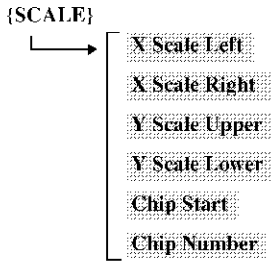
Displayed every 8 bits from PLCP Header. PLCP Header is distinguished by the color of characters. 1800 bits (single display), 864 bits (dual display), or 384 bits (quad display) of demodulated data is displayed on the screen. All the demodulated data in the measurement range (including PLCP Header) can be saved in a file.

[Ramp Up(%)] Displays the ramp up time.
On the graph, the vertical axis shows power (%) and the horizontal axis shows time (sec).

[Ramp Down(%)]	Displays the ramp down time. On the graph, the vertical axis shows power (%) and the horizontal axis shows time (sec).
[Ramp Up(dB)]	Displays the ramp up time. On the graph, the vertical axis shows power (dBm for RF input and dB for IQ input) and the horizontal axis shows time (sec).
[Ramp Down(dB)]	Displays the ramp down time. On the graph, the vertical axis shows power (dBm for RF input and dB for IQ input) and the horizontal axis shows time (sec).
[Constellation]	Performs setup related to the constellation display.
[Display Trace]	Display of only chips or tracks between chips can be selected.
[Ramp Trace]	Performs setup related to the Ramp display. The checked items are displayed. Multiple items can be selected at a time.
[Present]	Displays Ramp of the last frame measured.
[Max]	Displays the maximum Ramp value at each time.
[Min]	Displays the minimum Ramp value at each time.
[Avg]	Displays the average Ramp value at each time.
Single Display	Selects the single display.
Dual Display	Selects the dual display.
Quad Display	Selects the quad display.

5.5.6 {SCALE}

When you touch the **{SCALE}** button, the soft keys related to the setup of the X-axis and Y-axis scales in the active display window are displayed on the soft menu bar.

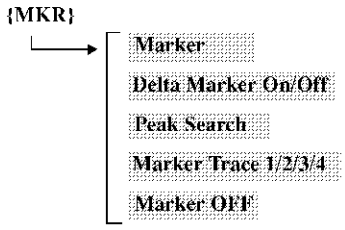


X Scale Left	Sets the minimum value on the X axis.
X Scale Right	Sets the maximum value on the X axis.
Y Scale Upper	Sets the maximum value on the Y axis.
Y Scale Lower	Sets the minimum value on the Y axis.
Chip Start	Sets the chip position to start drawing of a constellation or eye diagram.
Chip Number	Sets the number of chips in the drawing range of a constellation or eye diagram.

*NOTE: **Chip Start and Chip Number can only be set when the active display window in the DSSS/CCK measurement result screen is set to Constellation or Eye Diagram.***

5.5.7 {MKR}

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



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: Deletes the display of the delta marker.

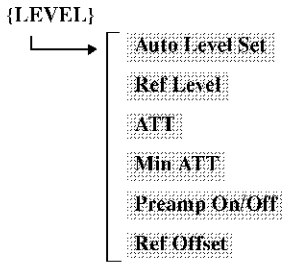
Peak Search — Moves the marker to the maximum peak of the trace in the targeted search range.

Marker Trace 1/2/3/4 — When more than one trace exists, moves the normal marker between traces. The marker moves between traces every time it is pressed.

Marker OFF — Deletes the display of the normal marker.

5.5.8 {LEVEL}

When you touch the **{LEVEL}** button, 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 in accordance with the signal to be measured. When the key is pressed, Auto Level Set is executed.

CAUTION: ***While Auto Level Set is being executed, the level of the signal measured 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 ON and 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 ON and OFF.

Ref Offset

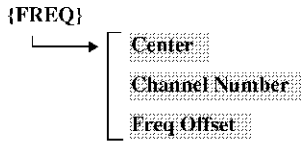
Switches the reference level offset function ON and OFF.

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

Off: Cancels the offset function.

5.5.9 {FREQ}

When you touch the **{FREQ}** button, the soft keys related to the measurement frequency setup are displayed on the soft menu bar.



Center

Sets the center frequency of the measurement signal.

CAUTION: ***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

When 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.

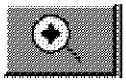
On: Sets the offset value and changes only the displayed center frequency by the offset value.
(Displayed center frequency = Set value + Offset value)

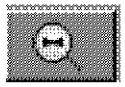
Off: Cancels the offset function.

5.5.10 Measurement Tool Bar

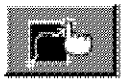
The functions of waveform range selection, active window selection, and so on are displayed as icons.

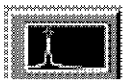
The following functions can be used by touching the icons:


: 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 on the range.

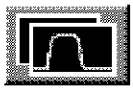

: Zoom out icon: Used to zoom out from the waveform displayed in the window.

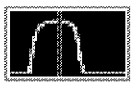

: Range specification icon (X-axis mode):
Used to specify a range in the window in which the waveform is displayed. After touching the icon, touch both sides of the range to be specified.


: 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 after searching for the peak of the waveform in the range specified by the range specification icon.


: Active window switching: Used to make one of the split windows active.


: Window switching: Switches the waveform window and the result window.


: Cursor specification icon: Used to specify the signal to be measured using a cursor.
After touching the icon, select the signal to be measured on the Frame Selection screen.

6. SCPI COMMAND REFERENCE

This chapter describes the SCPI command reference for this instrument.

6.1 Command Reference Format

This section describes the format of explanations of each command described in this chapter.

Explanations of each command include the following items:

Function description

SCPI command

Parameter

Query reply

- [Function description]

  The usage of commands and operation of this instrument when they are executed.

- [SCPI command]

  The SCPI command shows the syntax of a command sent from the external controller to this instrument. The syntax consists of a command part and a parameter part. The command part and parameter part are delimited by a space.

  When there are multiple parameters, they are delimited by commas (,). The three points (...) displayed between commas represent the parameter(s) omitted in the 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.

  When the parameter is a character string type such as <character string>,<character string 1>, the parameter must be enclosed in double quotation marks (" "). When the parameter is <block>, it shows the block format data.

  The part written in lowercase alphabetical characters in the syntax shows that it 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
|:	Written in curly brackets {..} and used as a delimiter for multiple items
<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, the 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 is selected [{1|2|3|4}]

For example, when a 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.

  When the parameter is a numeric type or a character (string) type, it is enclosed in angle brackets (< >).

  When the parameter is an optional type, 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 >: String of OFF|ON

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

  <block>: Block data type
  The content of data 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 ({ }). When multiple items delimited by a vertical bar (|) exist in curly brackets ({ }), only one of those items is read out. When multiple parameters are read out, they are delimited by commas (,). The three points (...) displayed between commas represent the data omitted in the 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.

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

  When the parameter to be read is a value in a unit, the description like "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 IEEE common 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
Notice of completion of all running operations	*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 for the completion of all running operations	*WAI	-	-	

*1 If the *DDT? command is executed when the macro is undefined, 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 at the last power-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	IE80211BG	IE80211BG	
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	: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				
Input Signal RF/Baseband	:INPut<ch=1|2>:SIGNal	RF|BASeband	RF|BAS	*1
Baseband Input AC/DC	:INPut<ch=1|2>:BASeband	AC|DC	AC|DC	*2
IQ Inverse ON/OFF	:INPut<ch=1|2>:IQ:INVerse	OFF|ON	OFF|ON	

*1: The Level setting item is invalid when selecting the Baseband.
*2: Only valid when selecting the Baseband.

6.3.3 Subsystem-SENSe

Function description	SCPI command	Parameter	Query reply	Remarks
FREQuency				
Center Freq setting	[:SENSe<ch=1|2>]:FREQuency:CENTer	<real>	<real>	
Center Number setting	[:SENSe<ch=1|2>]:FREQuency:CHANnel:NUMBer	<int>	<int>	
Freq Offset setting	[:SENSe<ch=1|2>]:FREQuency:OFFSet	<real>	<real>	*3
Freq Offset ON/OFF	[:SENSe<ch=1|2>]:FREQuency:OFFSet:STATe	OFF|ON	OFF|ON	
Auto Level Set				
Auto Level Set execution	[:SENSe<ch=1|2>]:POWer:LEVel:AUTO	-	-	
Measurement Control				
Multi Frame/Single Frame selection	[:SENSe<ch=1|2>]:CONDition:FRAMe	MULTi|SINGle	MULT|SING	
Measurement Parameters (AD Capture)				
AD Capture Length setting	[:SENSe<ch=1|2>]:CONDition:CAPTure:LENGth	<real>	<real>	
Threshold Level setting (Manual)	[:SENSe<ch=1|2>]:CONDition:THReshold	<real>	<real>	*4
Threshold Level (auto/manual)	[:SENSe<ch=1|2>]:CONDition:THReshold:AUTO	OFF|ON	OFF|ON	
Measurement Parameters (OFDM)				
Symbol Timing setting	[:SENSe<ch=1|2>]:CONDition[:OFDM]:STIMing	<int>	<int>	
Pilot Track (Amplitude) ON/OFF	[:SENSe<ch=1|2>]:CONDition[:OFDM]:PTRAck:AMPLitude	OFF|ON	OFF|ON	
Pilot Track (Phase) ON/OFF	[:SENSe<ch=1|2>]:CONDition[:OFDM]:PTRAck:PHASe	OFF|ON	OFF|ON	
Equalizer Data Calculation	[:SENSe<ch=1|2>]:CONDition[:OFDM]:EQUAlizer:DMAKe	-	-	
Equalizer ON/OFF	[:SENSe<ch=1|2>]:CONDition[:OFDM]:EQUAlizer:FUNCtion	OFF|ON	OFF|ON	*5
CH Estimation (Preamble) ON/OFF	[:SENSe<ch=1|2>]:CONDition[:OFDM]:CESTimation:PREAmble	OFF|ON	OFF|ON	*5
CH Estimation (Preamble+Data) ON/OFF	[:SENSe<ch=1|2>]:CONDition[:OFDM]:CESTimation:PDATa	OFF|ON	OFF|ON	*5

*3: Setting becomes possible when Frequency Offset is ON.
*4: Setting becomes possible only when Threshold Level is Manual.
*5: Channel Estimation and Equalizer are exclusive controls.

6.3.3 Subsystem-SENSe

Function description	SCPI command	Parameter	Query reply	Remarks
Meas Condition setting	[:SENSe<ch=1|2>]:CONDition:OFDM:MCONdition	FRAMe|FMSYmbol|SYMBol	FRAM|FMSY|SYMB	
Meas Frame Number setting	[:SENSe<ch=1|2>]:CONDition:OFDM:MFRame:NUMBer	<int>	<int>	
Meas Minimum Symbol Length setting	[:SENSe<ch=1|2>]:CONDition[:OFDM]:MMSYmbol:LENGth	<int>	<int>	
Meas Symbol Length setting	[:SENSe<ch=1|2>]:CONDition[:OFDM]:SYMbol:LENGth	<int>	<int>	
EVM Trigger ON/OFF	[:SENSe<ch=1|2>]:CONDition:OFDM:ETRigger	OFF|ON	OFF|ON	
EVM Trigger Threshold setting	[:SENSe<ch=1|2>]:CONDition:OFDM:ETRigger:LEVel	<real>	<real>	
Measurement Parameters (DSSS/CCK)				
Filter selection	[:SENSe<ch=1|2>]:CONDition[:DSSS]:FILTer	NYQuist|GAUSs|SINC	NYQ|GAUS|SINC	
Nyquist Filter BW setting	[:SENSe<ch=1|2>]:CONDition[:DSSS]:FILTer:NYQuist:BW	<real>	<real>	
Nyquist Filter Roll OFF setting	[:SENSe<ch=1|2>]:CONDition[:DSSS]:FILTer:NYQuist:ROLLoff	<real>	<real>	
Gauss Filter BW setting	[:SENSe<ch=1|2>]:CONDition[:DSSS]:FILTer:GAUSs:BW	<real>	<real>	
Ramp Up/Down Smoothing Point setting	[:SENSe<ch=1|2>]:CONDition[:DSSS]:RAMP:SMOothing	<int>	<int>	
Constellation 45-degree Rotation ON/OFF	[:SENSe<ch=1|2>]:CONDition[:DSSS]:CONStellation:ROTation	OFF|ON	OFF|ON	
Continuous Signal setting	[:SENSe<ch=1|2>]:CONDition:DSSS:CSIGnal	OFF|ON	OFF|ON	
Meas Condition setting	[:SENSe<ch=1|2>]:CONDition:DSSS:MCONdition	FRAMe|FMCHip|CHIP	FRAM|FMCH|CHIP	
Meas Frame Number setting	[:SENSe<ch=1|2>]:CONDition:DSSS:MFRame:NUMBer	<int>	<int>	
Meas Minimum Chip Length setting	[:SENSe<ch=1|2>]:CONDition[:DSSS]:MMCHip:LENGth	<int>	<int>	
Meas Chip Length setting	[:SENSe<ch=1|2>]:CONDition[:DSSS]:MCHip:LENGth	<int>	<int>	
EVM Trigger ON/OFF	[:SENSe<ch=1|2>]:CONDition:DSSS:ETRigger	OFF|ON	OFF|ON	
EVM Trigger Threshold setting	[:SENSe<ch=1|2>]:CONDition:DSSS:ETRigger:LEVel	<real>	<real>	
STD				
Specification Mode selection	[:SENSe<ch=1|2>]:SIGNal:STANdard	OFDM|DSSS	OFDM|DSSS	

6.3.4 Subsystem-TRIGger

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

6.3.5 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	-	-	

6.3.6 Subsystem-DISPlay

Function description	SCPI command	Parameter	Query reply	Remarks
WINDow Ref Level setting	:DISPlay<ch=1|2>[:WINDow<scrn=1>]: TRACe:Y[:SCALe]:RLEVel	<real>	<real>	*6
Level Offset setting	:DISPlay<ch=1|2>[:WINDow<scrn=1>]: TRACe:Y[:SCALe]:RLEVel:OFFSet	<real>	<real>	*7
Level Offset ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1>]:TRACe: Y[:SCALe]:RLEVel:OFFSet:STATe	OFF|ON	OFF|ON	
Multi Screen setting	:DISPlay<ch=1|2>[:WINDow<scrn=1>]	SINGle|DUAL|QUAD	SING|DUAL|QUAD	
Active Screen setting	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:ACTive	-	1|2|3|4	
Analysis Display Screen switching	:DISPlay<ch=1|2>:PAGE	AD|OFDM|DSSS	AD|OFDM|DSSS	

*6: The setting range depends on whether Preamp is ON or OFF.
Preamp ON: -170 dBm - +30 dBm
Preamp OFF: -170 dBm - +60 dBm

*7: Can only be set when Level Offset is ON.

6.3.6 Subsystem-DISPlay

Function description	SCPI command	Parameter	Query reply	Remarks
Screen Format setting (OFDM)	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:FORMat	OFF|SPECtrogram|TRESult|EVMSpectrum|EVMTime|MESPectrum|METIme|PESPectrum|PETIme|MFSPectrum|MFTIme|CONStellation|CFETime|PSPEctrum|PTIMe|DDATa|PFETime|PLPTime	OFF|SPEC|TRES|EVMS|EVMT|MESP|METI|PESP|PETI|MFSP|MFTI|CONS|CFET|PSPE|PTIM|DDAT|PFET|PLPT	
Screen Format setting (DSSS/CCK)	:DISPlay<ch=1|2>:DSSS[:WINDow<scrn=1|2|3|4>]:TRACe:FORMat	OFF|TRESult|EVMTime|PETIme|PSPEctrum|CONStellation|EYEi|EYEQ|DDATa|RUPercent|RDPercent|RUDB|RDDB	OFF|TRES|EVMT|PETI|PSPE|CONS|EYE|EYEQ|DDAT|RUP|RDP|RUDB|RDDB	
Time Trace RMS ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:TIMe:RMS	OFF|ON	OFF|ON	
Time Trace AVG ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:TIMe:AVERage	OFF|ON	OFF|ON	
Time Trace Specified Subcarrier ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:TIMe:SSUBcarrier	OFF|ON	OFF|ON	
Time Trace Specified Subcarrier Number setting	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:TIMe:SSUBcarrier:NUMBer	<int>	<int>	
Time Trace All Measurement Value Plot ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:TIMe:PLOT:ALL	OFF|ON	OFF|ON	
Time Trace Center Freq Error ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:TIMe:CFERror	OFF|ON	OFF|ON	
Spectrum Trace RMS ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:SPECtrum:RMS	OFF|ON	OFF|ON	
Spectrum Trace AVG ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:SPECtrum:AVERage	OFF|ON	OFF|ON	
Spectrum Trace Specified Symbol ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:SPECtrum:SSYMbol	OFF|ON	OFF|ON	
Spectrum Trace Specified Symbol Number setting	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:SPECtrum:SSYMbol:NUMBer	<int>	<int>	
Spectrum Trace All Measurement Value Plot ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:SPECtrum:PLOT:ALL	OFF|ON	OFF|ON	
Constellation Trace setting	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:CONStellation	ALL|SUBCarrier|SYMBol	ALL|SUBCarrier|SYMBol	
Constellation Specified Subcarrier Number setting	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:CONStellation:SSUBcarrier:NUMBer	<int>	<int>	

Function description	SCPI command	Parameter	Query reply	Remarks
Constellation Specified Symbol Number setting	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:CONStellation:SSYMbol:NUMBer	<int>	<int>	
Constellation Drawing Start Chip Position setting	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:CONStellation:CHIP:STARt	<int>	<int>	
Constellation Drawing Chip Range setting	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:CONStellation:CHIP:NUMBer	<int>	<int>	
Constellation Drawing Pattern setting	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:CONStellation:TYPE	CHIP|LCHip	CHIP|LCH	
Eye Diagram-I Drawing Start Chip Position setting	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:EYEi:CHIP:STARt	<int>	<int>	
Eye Diagram-I Drawing Chip Range setting	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:EYEi:CHIP:NUMBer	<int>	<int>	
Eye Diagram-Q Drawing Start Chip Position setting	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:EYEQ:CHIP:STARt	<int>	<int>	
Eye Diagram-Q Drawing Chip Range setting	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:EYEQ:CHIP:NUMBer	<int>	<int>	
Ramp Up/Down Present ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:RAMP:PRESent	OFF|ON	OFF|ON	
Ramp Up/Down Max ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:RAMP:MAX	OFF|ON	OFF|ON	
Ramp Up/Down Min ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:RAMP:MIN	OFF|ON	OFF|ON	
Ramp Up/Down Avg ON/OFF	:DISPlay<ch=1|2>[:WINDow<scrn=1|2|3|4>]:TRACe:RAMP:AVERage	OFF|ON	OFF|ON	
X Scale Left setting (OFDM)	:DISPlay<ch=1|2>:OFDM[:WINDow<scrn=1|2|3|4>]:TRACe:X[:SCALe]:LEFT	<real>	<real>	
X Scale Right setting (OFDM)	:DISPlay<ch=1|2>:OFDM[:WINDow<scrn=1|2|3|4>]:TRACe:X[:SCALe]:RIGHt	<real>	<real>	
Y Scale Upper setting (OFDM)	:DISPlay<ch=1|2>:OFDM[:WINDow<scrn=1|2|3|4>]:TRACe:Y[:SCALe]:UPPer	<real>	<real>	
Y Scale Lower setting (OFDM)	:DISPlay<ch=1|2>:OFDM[:WINDow<scrn=1|2|3|4>]:TRACe:Y[:SCALe]:LOWer	<real>	<real>	
X Scale Left setting (DSSS/CCK)	:DISPlay<ch=1|2>:DSSS[:WINDow<scrn=1|2|3|4>]:TRACe:X[:SCALe]:LEFT	<real>	<real>	
X Scale Right setting (DSSS/CCK)	:DISPlay<ch=1|2>:DSSS[:WINDow<scrn=1|2|3|4>]:TRACe:X[:SCALe]:RIGHt	<real>	<real>	
Y Scale Upper setting (DSSS/CCK)	:DISPlay<ch=1|2>:DSSS[:WINDow<scrn=1|2|3|4>]:TRACe:Y[:SCALe]:UPPer	<real>	<real>	
Y Scale Lower setting (DSSS/CCK)	:DISPlay<ch=1|2>:DSSS[:WINDow<scrn=1|2|3|4>]:TRACe:Y[:SCALe]:LOWer	<real>	<real>	

6.3.7 Subsystem-MMEMory

Function description	SCPI command	Parameter	Query reply	Remarks
Save/Recall				
Saving the A/D data	:MMEMory:STORe:AD:STATe	<int>	-	*8
Saving the measurement result	:MMEMory:STORe:MEASure:STATe	<int>	-	*8
Saving the settings of this instrument	:MMEMory:STORe:STATe	<int>	-	*8
Loading the settings of this instrument	:MMEMory:LOAD:STATe	<int>	-	*8
Measurement condition Save selection	:MMEMory:SELect:ITEM:IE80211BG:SETup	OFF|ON	OFF|ON	

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

6.3.8 Subsystem-MEASure (OFDM)

Function description	SCPI command	Parameter	Query reply	Remarks
Total Result(OFDM)				
EVM reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:EVM?	-	<real>,<real>	
Mag Error reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:MAG?	-	<real>,<real>	
Phase Error reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:PHASe?	-	<real>	
Frequency Error reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:FREQ?	-	<real>,<real>	
Transmit Power reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:POWer?	-	<real>,<real>, <real>,<real>	
Rate reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:RATE?	-	R6M|R9M|R12M|R18M|R24M|R36M|R48M|R54M|PERR|RERR	
Spectral Flatness reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:FLATness[:NUMBer<tbl=1|2|3|4>]?	-	<int>,<int>,<real>, <real>,<real> ... <int>,<int>,<real>, <real>,<real> (4 sets)	
Frequency Leakage reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:LEAKage?	-	<real>,<real>	
Frequency Leakage reading (Overall)	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:LEAKage:OPOWer?	-	<real>	
Frequency Leakage reading (Average Power)	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:LEAKage:APOWer?	-	<real>	
Measurement Number reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:NUMBer?	-	<int>,<int>,<int>	

Function description	SCPI command	Parameter	Query reply	Remarks
Measurement Symbol Number reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:NUMBer:SYMBol?	-	<int>	
Measurement Burst Number reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:NUMBer:BURSt?	-	<int>	
Measurement A/D Capture Number reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:NUMBer:CAPTure?	-	<int>	

6.3.9 Subsystem-READ (OFDM)

Function description	SCPI command	Parameter	Query reply	Remarks
Total Result(OFDM)				
EVM reading	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:EVM?	-	<real>,<real>	
Mag Error reading	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:MAG?	-	<real>,<real>	
Phase Error reading	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:PHASe?	-	<real>	
Frequency Error reading	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:FREQ?	-	<real>,<real>	
Transmit Power reading	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:POWer?	-	<real>,<real>,<real>,<real>	
Rate reading	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:RATE?	-	R6M|R9M|R12M|R18M|R24M|R36M|R48M|R54M|PERR|RERR	
Spectral Flatness reading	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:FLATness[:NUMBer<tbl=1|2|3|4>]?	-	<int>,<int>,<real>,<real>,<real>...<int>,<int>,<real>,<real>,<real> (4 sets)	
Frequency Leakage reading	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:LEAKage?	-	<real>,<real>	
Frequency Leakage reading (Overall)	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:LEAKage:OPOWer?	-	<real>	
Frequency Leakage reading (Average Power)	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:LEAKage:APOWer?	-	<real>	
Measurement Number reading	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:NUMBer?	-	<int>,<int>,<int>	
Measurement Symbol Number reading	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:NUMBer:SYMBol?	-	<int>	
Measurement Burst Number reading	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:NUMBer:BURSt?	-	<int>	
Measurement A/D Capture Number reading	:READ<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:NUMBer:CAPTure?	-	<int>	

6.3.10 Subsystem-FETCh (OFDM)

Function description	SCPI command	Parameter	Query reply	Remarks
Total Result(OFDM)				
Analysis Result inquiry	:FETCh<ch=1|2>:MODulation	-	OFDM|DSSS	
EVM reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:EVM?	-	<real>,<real>	
Mag Error reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:MAG?	-	<real>,<real>	
Phase Error reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:PHASe?	-	<real>	
Frequency Error reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:FREQ?	-	<real>,<real>	
Transmit Power reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:POWer?	-	<real>,<real>,<real>,<real>	
Rate reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:RATE?	-	R6M|R9M|R12M|R18M|R24M|R36M|R48M|R54M|PERR|RERR	
Spectral Flatness reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:FLATness[:NUMBer<tbl=1|2|3|4>]?	-	<int>,<int>,<real>,<real>,<real>...<int>,<int>,<real>,<real>,<real> (4 sets)	
Frequency Leakage reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:LEAKage?	-	<real>,<real>	
Frequency Leakage reading (Overall)	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:LEAKage:OPOWer?	-	<real>	
Frequency Leakage reading (Average Power)	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:LEAKage:APOWer?	-	<real>	
Measurement Number reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:NUMBer?	-	<int>,<int>,<int>	
Measurement Symbol Number reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:NUMBer:SYMBol?	-	<int>	
Measurement Burst Number reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:NUMBer:BURSt?	-	<int>	
Measurement A/D Capture Number reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>][:OFDM]:TRESult:NUMBer:CAPTure?	-	<int>	

6.3.11 Subsystem-MEASure (DSSS/CCK)

Function description	SCPI command	Parameter	Query reply	Remarks
Total Result(DSSS/CCK)				
Frequency Error reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:FREQ?	-	<real>,<real>	
Chip Clock Frequency Error reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:CCLock?	-	<real>,<real>	
EVM Max reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:EVM:MAXimum?	-	<real>,<real>	
EVM Average reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:EVM:AVERage?	-	<real>,<real>	
I Origin Offset reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:IOFFset?	-	<real>	
Q Origin Offset reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:QOFFset?	-	<real>	
Power Max reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:POWer:MAXimum?	-	<real>,<real>	
Power Average reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:POWer:AVERage?	-	<real>,<real>	
PLCP Format reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:PLCP:FORMat?	-	LONG | SHORT | FERR	
PLCP Length reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:PLCP:LENGth?	-	1056 | 2112 | FERR	
Data Rate reading (Overall)	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:RATE?	-	R1M |R2M |R5.5M |R11M	
Locked Clock reading (Average Power)	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:LCLock?	-	ON|OFF	
PSDU Length reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:PSDU?	-	<int>,<int>,<real>	
Ramp Up Time reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:RUP?	-	<real>	
Ramp Down Time reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:RDOWn?	-	<real>	
Meas Chip Number reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:NUMBer:CHIP?	-	<int>	
Meas Frame Number reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:NUMBer:BURSt?	-	<int>	
A/D Capture Number reading	:MEASure<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:NUMBer:CAPTure?	-	<int>	

6.3.12 Subsystem-READ (DSSS/CCK)

Function description	SCPI command	Parameter	Query reply	Remarks
Total Result(DSSS/CCK)				
Frequency Error reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:FREQ?	-	<real>,<real>	
Chip Clock Frequency Error reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:CCLock?	-	<real>,<real>	
EVM Max reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:EVM:MAXimum?	-	<real>,<real>	
EVM Average reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:EVM:AVERage?	-	<real>,<real>	
I Origin Offset reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:IOFFset?	-	<real>	
Q Origin Offset reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:QOFFset?	-	<real>	
Power Max reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:POWer:MAXimum?	-	<real>,<real>	
Power Average reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:POWer:AVERage?	-	<real>,<real>	
PLCP Format reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:PLCP:FORMat?	-	LONG | SHORT | FERR	
PLCP Length reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:PLCP:LENGth?	-	1056 | 2112 | FERR	
Data Rate reading (Overall)	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:RATE?	-	R1M |R2M |R5.5M |R11M	
Locked Clock reading (Average Power)	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:LCLock?	-	ON|OFF	
PSDU Length reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:PSDU?	-	<int>,<int>,<real>	
Ramp Up Time reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:RUP?	-	<real>	
Ramp Down Time reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:RDOWn?	-	<real>	
Meas Chip Number reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:NUMBer:CHIP?	-	<int>	
Meas Frame Number reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:NUMBer:BURSt?	-	<int>	
AD Capture Number reading	:READ<ch=1|2>[:WINDow<scm=1|2|3|4>]:DSSS:TRESult:NUMBer:CAPTure?	-	<int>	

6.3.13 Subsystem-FETCh (DSSS/CCK)

Function description	SCPI command	Parameter	Query reply	Remarks
Total Result(DSSS/CCK)				
Analysis Result inquiry	:FETCh<ch=1|2>:MODulation	-	OFDM|DSSS	
Frequency Error reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:FREQ?	-	<real>,<real>	
Chip Clock Frequency Error reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:CCLock?	-	<real>,<real>	
EVM Max reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:EVM:MAXimum?	-	<real>,<real>	
EVM Average reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:EVM:AVERage?	-	<real>,<real>	
I Origin Offset reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:IOFFset?	-	<real>	
Q Origin Offset reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:QOFFset?	-	<real>	
Power Max reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:POWer:MAXimum?	-	<real>,<real>	
Power Average reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:POWer:AVERage?	-	<real>,<real>	
PLCP Format reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:PLCP:FORMat?	-	LONG | SHORT | FERR	
PLCP Length reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:PLCP:LENGth?	-	1056 | 2112 | FERR	
Data Rate reading (Overall)	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:RATE?	-	R1M |R2M |R5.5M |R11M	
Locked Clock reading (Average Power)	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:LCLock?	-	ON|OFF	
PSDU Length reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:PSDU?	-	<int>,<int>,<real>	
Ramp Up Time reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:RUP?	-	<real>	
Ramp Down Time reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:RDOWn?	-	<real>	
Meas Chip Number reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:NUMBer:CHIP?	-	<int>	
Meas Frame Number reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:NUMBer:BURSt?	-	<int>	
A/D Capture Number reading	:FETCh<ch=1|2>[:WINDow<scrn=1|2|3|4>]:DSSS:TRESult:NUMBer:CAPTure?	-	<int>	

6.3.14 Subsystem-DIAGnostic

Function description	SCPI command	Parameter	Query reply	Remarks
DIAGnostic				
Power on DIAG result reading	:DIAGnostic:PON?	-	PASS|FAIL	

6.3.15 Subsystem-STATus

Function description	SCPI command	Parameter	Query reply	Remarks
STATus				
Standard Operation Enable Register setting	:STATus:OPERation:ENABle	<int>	<int>	
Standard Operation Event Register reading	:STATus:OPERation:EVENt?	-	<int>	
Questionable Enable Register setting	:STATus:QUEStionable:ENABle	<int>	<int>	
Questionable Event Register reading	:STATus:QUEStionable:EVENt?	-	<int>	
Modulation Enable Register setting	:STATus:QUEStionable:MODulation:ENABle	<int>	<int>	
Modulation Event Register reading	:STATus:QUEStionable:MODulation:EVENt?	-	<int>	
Measuring Enable Register setting	:STATus:OPERation:MEASure:ENABle	<int>	<int>	
Measuring Event Register reading	:STATus:OPERation:MEASure:EVENt?	-	<int>	

6.3.16 Subsystem-HCOPy

Function description	SCPI command	Parameter	Query reply	Remarks
HCOPy				
Outputting a copy to the file or printer	:HCOPy[:IMMediate]	-	-	
Specification of the output destination (file or printer)	:HCOPy:DESTination	MMEMory|PRINt	MMEM|PRIN	
Specification of the output file number	:HCOPy:MMEMory:FILE:NUMBer	<int>	<int>	
Specification of the output file type	:HCOPy:MMEMory:FILE:TYPE	BITMap|PNGraphic	BITM|PNG	

6.4 Status Register

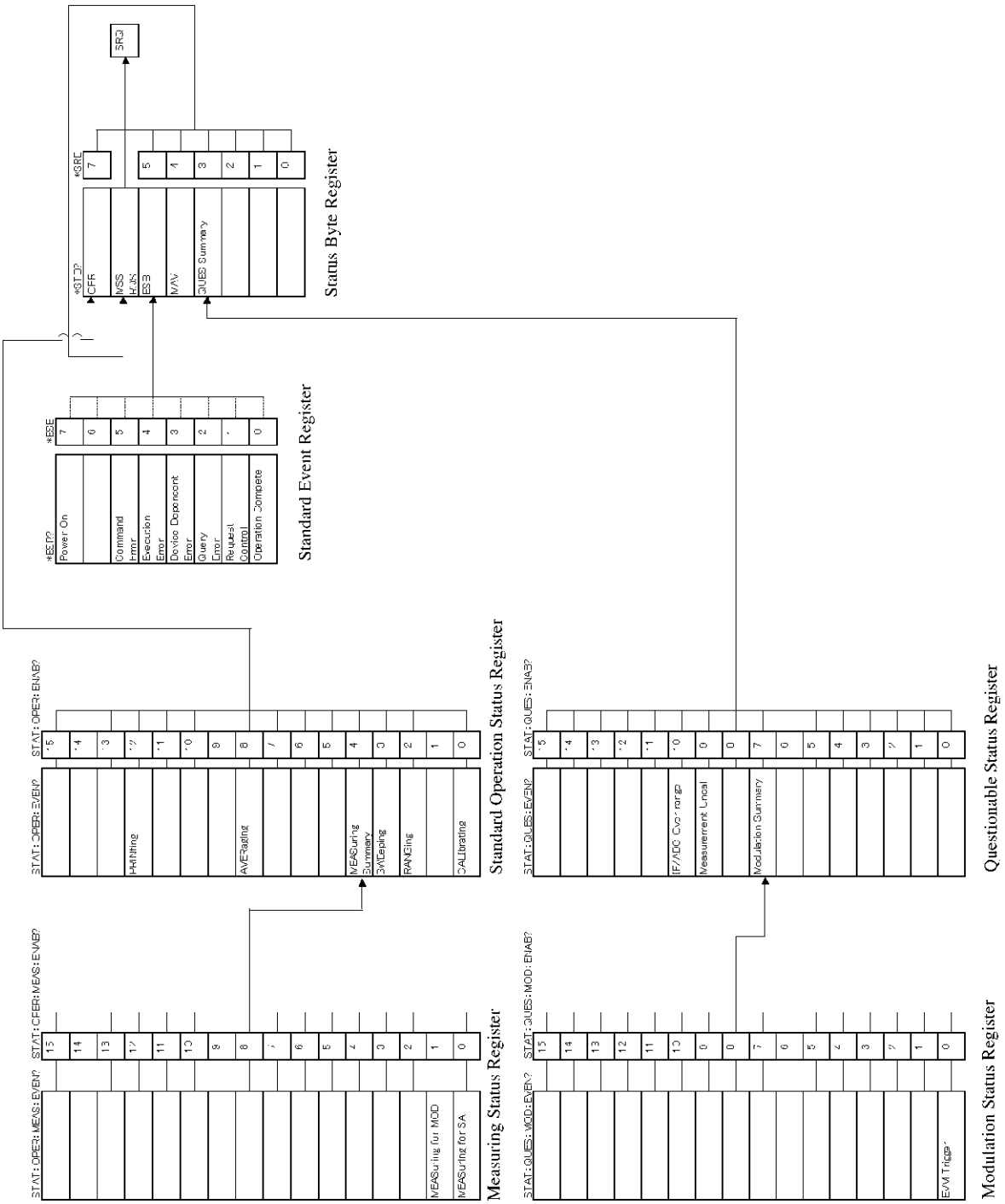


Figure 6-1 Status Registers

7. PERFORMANCE VERIFICATION

This chapter describes the method of verifying whether or not this instrument meets the specified performance.

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

CAUTION: ***Before executing performance verification, execute warm-up and all calibrations.***

7.1 Test Signal Specifications

The test signals used for performance verification are shown below:

Table 7-1 List of Test Signal Specifications

No.	Test signal name	Signal specifications	Test item
1	IEEE802.11g signal (ERP-OFDM)	Center frequency: 2457 MHz Power: -10 dBm Rate: 6 Mbps Number of symbols: 100 (excluding SIGNAL)	Power measurement Center frequency error measurement
2	IEEE802.11b signal	Center frequency: 2457 MHz Power: -10 dBm Rate: 2 Mbps Number of chips: 1000 (excluding PLCP)	Center frequency error measurement Chip frequency error measurement

7.2 Test Procedures

Connect the signal source as shown below:

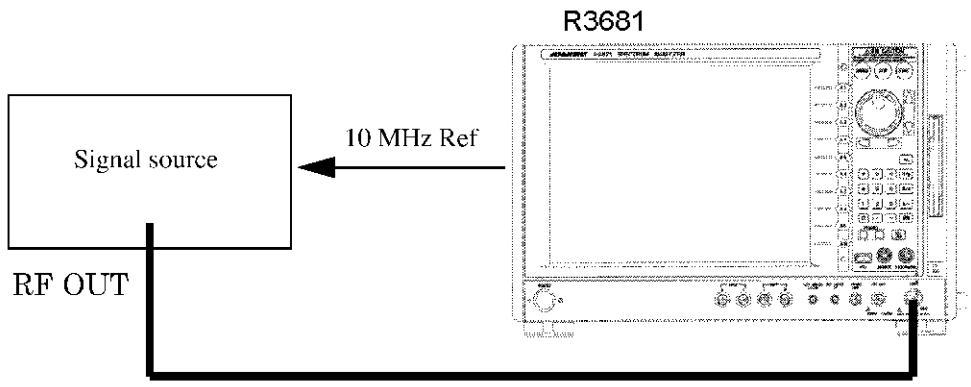


Figure 7-1 Connection Diagram for the Signal Source

7.2.1 For the IEEE802.11g (ERP-OFDM) Signal

7.2.1.1 Power Measurement

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

   FREQ: 2457 MHz
   LEVEL: Execute Auto Level Set.
   DISPLAY: Set to display Total Result.
   STD: IEEE802.11g OFDM
   TRIGGER: Trigger Source Free Run
   INPUT: Input RF
   MEAS CONTROL: Multi Frame Mode
   Set the Measurement Parameters dialog box as follows:

   [AD Capture]
   A/D Capture Length: 40 ms
   Threshold Level: Auto
   [OFDM]
   Symbol Timing: 0
   Pilot Track(Phase): ON
   Pilot Track(Amplitude): OFF
   CH Estimation(Preamble): ON
   Meas Condition: Symbol
   Meas Symbol Length: 100
   EVM Trigger: OFF

2. Press **SINGLE** of this instrument and conduct measurement.
3. Enter the Power [dBm] of the Total Result in the test data record sheet.

7.2.1.2 Center Frequency Error Measurement

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

   FREQ: 2457 MHz
   LEVEL: Execute Auto Level Set.
   DISPLAY: Set to display Total Result.
   STD: IEEE802.11g OFDM
   TRIGGER: Trigger Source Free Run
   INPUT: Input RF
   MEAS CONTROL: Multi Frame Mode
   Set the Measurement Parameters dialog box as follows:

   [AD Capture]
   A/D Capture Length: 40 ms
   Threshold Level: Auto
   [OFDM]
   Symbol Timing: 0
   Pilot Track(Phase): ON
   Pilot Track(Amplitude): OFF
   CH Estimation(Preamble): ON
   Meas Condition: Symbol
   Meas Symbol Length: 100
   EVM Trigger: OFF

2. Press **SINGLE** of this instrument and conduct measurement.
3. Enter the Freq. Error [Hz] of the Total Result in the test data record sheet.

7.2.2 For the IEEE802.11b Signal

7.2.2.1 Center Frequency Error Measurement

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

   FREQ: 2457 MHz
   LEVEL: Execute Auto Level Set.
   DISPLAY: Set to display Total Result.
   STD: IEEE802.11b/g DSSS/CCK DSSS-OFDM
   TRIGGER: Trigger Source Free Run
   INPUT: Input RF
   MEAS CONTROL: Multi Frame Mode
   Set the Measurement Parameters dialog box as follows:

   [AD Capture]

A/D Capture Length:	40 ms
Threshold Level:	Auto

   [DSSS/CCK]

Meas Filter:	Nyquist
Nyquist BW:	22 MHz
Roll Off:	1.0
Ramp Up/Down Smoothing:	11 Point
Constellation 45deg Rotation:	ON
Continuous Signal:	OFF
Meas Condtion:	Chip
Meas Min Chip Length:	1000 Chip
EVM Trigger:	OFF

2. Press **SINGLE** of this instrument and conduct measurement.
3. Enter the Freq. Error |Hz| of the Total Result in the test data record sheet.

7.2.2.2 Chip Frequency Error Measurement

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

   FREQ: 2457 MHz
   LEVEL: Execute Auto Level Set.
   DISPLAY: Set to display Total Result.
   STD: IEEE802.11b/g DSSS/CCK DSSS-OFDM
   TRIGGER: Trigger Source Free Run
   INPUT: Input RF
   MEAS CONTROL: Multi Frame Mode
   Set the Measurement Parameters dialog box as follows:

   [AD Capture]

A/D Capture Length:	40 ms
Threshold Level:	Auto

   [DSSS/CCK]

Meas Filter:	Nyquist
Nyquist BW:	22 MHz
Roll Off:	1.0
Ramp Up/Down Smoothing:	11 Point
Constellation 45deg Rotation:	ON
Continuous Signal:	OFF
Meas Condtion:	Chip
Meas Min Chip Length:	1000 Chip
EVM Trigger:	OFF

2. Press **SINGLE** of this instrument and conduct measurement.
3. Enter the Chip F Error [ppm] of the Total Result 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	Measured value	Maximum value	Pass/Fail
IEEE802.11g signal (ERP-OFDM)	Power measurement	-10.6 dBm		-9.4 dBm	
	Center frequency error measurement	-100 Hz		+100 Hz	
IEEE802.11b signal	Center frequency error measurement	-20 Hz		+20 Hz	
	Chip frequency error measurement	-2 ppm		+2 ppm	

8. SPECIFICATIONS

8.1 OFDM Modulation Analysis Compliance System

- IEEE 802.11g (ERP-OFDM, DSSS-OFDM)

8.2 OFDM Modulation Analysis Performance

Item	Specifications
Temperature range	Ambient temperature: +20°C - +30°C
EVM	(100 symbol RMS value when the IEEE802.11g ERP-OFDM, IEEE802.11g DSSS-OFDM signal; S/N>40 dB is measured by using Equalizer On.)
Residual EVM	Less or equal -40 dB
Center frequency error	(S/N>40 dB, 1000 symbol average)
Measurement range	
IEEE802.11g (ERP-OFDM)	± 312.5 kHz
IEEE802.11g (DSSS-OFDM)	± 124 kHz
Measurement accuracy	±(100 Hz + (Center frequency × Frequency reference error))
Amplitude measurement	(After automatic calibration, S/N>40 dB, preamp OFF, input attenuator 10 dB, 100 symbol average)
Frequency response	
50 MHz - 2.5 GHz	<± 0.4 dB
20 Hz - 3.5 GHz	<± 1.0 dB
Power measurement accuracy	<± (0.2 dB + Frequency response)
Residual center frequency leakage power	-40 dB (to subcarrier average power)

8.3 DSSS/CCK Modulation Analysis Compliance System

- IEEE 802.11b(DBPSK, DQPSK, CCK5.5Mbps, CCK11Mbps)
- IEEE 802.11g (ERP-DSSS, ERP-CCK)

8.4 DSSS/CCK Modulation Analysis Performance

Item	Specifications
Temperature range	Ambient temperature: +20°C - +30°C
EVM	(1000 chip RMS value when the IEEE802.11b DQPSK signal; S/N > 40 dB is measured.)
Residual EVM	2 % or less
Center frequency error	(S/N > 40 dB, 1000 chip average)
Measurement range	±124 kHz
Measurement accuracy	±(20 Hz + (Center frequency × reference frequency error))
Chip frequency error	(S/N > 40 dB, 1000 chip average)
Measurement range	±45 ppm
Measurement accuracy	±2 ppm
Analysis range	
The number of chips	Up to 30000 chips (including PLCP)

APPENDIX

This section describes the following supplemental information:

A.1 Technical Data (OFDM)
A.2 Technical Data (DSSS/CCK)
A.3 A/D Data Save Function
A.4 Measurement Data Save Function
A.5 Error Message List

A.1 Technical Data (OFDM)

A.1.1 Method to Calculate Measurement Values

EVM (Error Vector Magnitude)

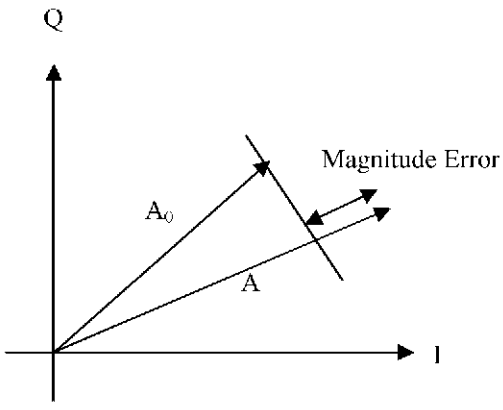
EVM RMS of the Total Result is calculated using the EVM defined format described in "IEEE Std 802.11a-1999 17.3.9.7 Transmit modulation accuracy test."

$$Error_{RMS} = \frac{\sum_{i=1}^{N_f} \sqrt{\frac{\sum_{j=1}^{L_p}\left[\sum_{k=1}^{52}\left\{\left(I(i,j,k)-I_0(i,j,k)\right)^2+\left(Q(i,j,k)-Q_0(i,j,k)\right)^2\right\}\right]}{52L_p \times P_0}}}{N_f}$$

The average power P_0 necessary for calculation is the average power of the ideal symbol ($P_0 = 1$), as per the standard.

The RMS value of EVM Time is calculated for each symbol using the EVM defined format. The RMS value of EVM Spectrum is calculated for each subcarrier using the EVM defined format. The plotted EVM values are calculated for each symbol and each subcarrier using the EVM defined format.

Magnitude Error



With the ideal symbol of Subcarrier No. k, symbol No. j, and frame No. i taken as (I_0 (i, j, k), Q_0 (i, j, k)) and the measured symbol taken as (I (i, j, k), Q (i, j, k)), magnitude A_0 of the ideal symbol and magnitude A of the measured symbol are defined as follows:

$$A_0(i,j,k) = \sqrt{(I_0(i,j,k))^2 + (Q_0(i,j,k))^2}$$

$$A(i,j,k) = \sqrt{(I(i,j,k))^2 + (Q(i,j,k))^2}$$

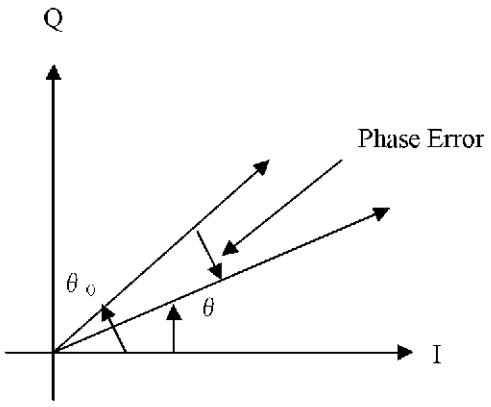
Magnitude Error RMS of Total Result is calculated by the following equation:

$$MagError_{RMS} = \frac{\sum_{i=1}^{N_f} \sqrt{\frac{\sum_{j=1}^{L_p}\left[\sum_{k=1}^{N_s}\left\{\frac{(A(i,j,k)-A_0(i,j,k))^2}{(A_0(i,j,k))^2}\right\}\right]}{N_s \times L_p}}}{N_f}$$

N_s is the number of subcarriers, L_p is the packet length (number of symbols), and N_f is the number of frames.

The RMS value of Magnitude Error Time is calculated for each symbol using the Magnitude Error defined format. The RMS value of Magnitude Error Spectrum is calculated for each subcarrier using the Magnitude Error defined format. The plotted Magnitude Error values are calculated for each symbol and each subcarrier using the Magnitude Error defined format.

Phase Error



The phase θ_0 of the ideal symbol and phase θ of the measured symbol are defined as follows:

$$\theta_0(i,j,k) = \arctan\left[\frac{Q_0(i,j,k)}{I_0(i,j,k)}\right]$$

$$\theta(i,j,k) = \arctan\left[\frac{Q(i,j,k)}{I(i,j,k)}\right]$$

Phase Error RMS of Total Result is calculated by the following equation:

$$PhaseError_{RMS} = \frac{\sum_{i\ 1}^{N_f} \sqrt{\frac{\sum_{j=1}^{L_p}\left[\sum_{k=1}^{N_s}\left\{(\theta(i,j,k)-\theta_0(i,j,k))^2\right\}\right]}{N_s \times L_p}}}{N_f}$$

The AVG value of Phase Error Time is calculated for each symbol as the Phase Error average value. The AVG value of Phase Error Spectrum is calculated for each subcarrier as the Phase Error average value. The plotted Phase Error values are calculated for each symbol and each subcarrier.

Magnitude Flatness

Magnitude Flatness is calculated as the ratio of the magnitude of the measured symbol to that of the ideal symbol. The distinction from Magnitude Error is shown by the following equations:

$$MagError(i,j,k) = \frac{A(i,j,k) - A_0(i,j,k)}{A_0(i,j,k)}$$

$$MagFlat(i,j,k) = \frac{A(i,j,k)}{A_0(i,j,k)}$$

The AVG value of Magnitude Flatness Time is calculated for each symbol as the Magnitude Flatness average value. The AVG value of Magnitude Flatness Spectrum is calculated for each subcarrier as the Magnitude Flatness average value. The plotted Magnitude Flatness values are calculated for each symbol and each subcarrier.

Power

Power is calculated from the subcarrier power obtained by demodulation (FFT) of each symbol. The AVG value of Power Time is calculated for each symbol as the average value of power for all subcarriers. The AVG value of Power Spectrum is calculated for each subcarrier as the average value of power for all symbols.

Power of Total Result is the average value of all power derived from the aggregate total of Power Spectrum AVG values. Numerical values displayed in units [W/MHz] are the average value of all power divided by the frequency bandwidth [MHz] of the OFDM signal. Here bandwidth does not mean OBW, but rather is a value obtained from the frequency difference between the two subcarriers that are farthest above and below the center frequency. For the IEEE802.11g (ERP-OFDM) signal, this is 16.25 (=0.3125 x 52 subcarriers).

Leak Power

Leak Power of the Total Result is calculated based on the definition described in "IEEE Std 802.11a-1999 17.3.9.6.1 Transmitter center frequency leakage."

The channel estimation preamble (LTS: Long Training Symbols) is used for calculation.

Spectral Flatness

Spectral Flatness of the Total Result is calculated based on the definition described in "IEEE Std 802.11a-1999 17.3.9.6.2 Transmitter spectral flatness."

The channel estimation preamble (LTS: Long Training Symbols) is used for calculation. Levels are relative values based on the average power(0 dB) of subcarrier numbers -16 to -1 and +1 to +16.

A.1.2 Judgment of Subcarrier Modulation Format

The modulation format is determined by acquiring the RATE data from the SIGNAL decoding data. However, when there is a parity error or RATE data does not exist, a judgment is made using an automatic judgment algorithm (Auto Detect).

Auto Detect first finds, for each modulation format, the ideal symbol with the minimum EVM from the ideal symbol map. Then, from among these, the modulation format is determined from the one with the minimum EVM.

CAUTION: ***When Auto Detect is used, if the EVM is degraded, the modulation format could be misjudged. In this case correct measurement values will not be displayed.***

A.1.3 Judgment of Ideal Symbol

The ideal symbol is determined by the same method as Auto Detect for modulation format judgment.

CAUTION: ***If the EVM is degraded, the ideal symbol could be misjudged. In this case correct measurement values will not be displayed.***

A.1.4 Frequency Characteristics Correction Function

CH Estimation(Preamble)

This function estimates frequency characteristics (gain and phase) using the preamble portion (LTS: Long Training Symbols) of a signal. The preamble signal is predetermined by the standard, so the correction values for phase and magnitude are determined at the preamble portion for each subcarrier so as to minimize magnitude errors and phase errors. In the data portion, after correction is applied using these correction values, E.V.M. is calculated.

CH Estimation(Preamble+Data)

The correction data, which minimizes the amplitude and phase errors, is calculated for each subcarrier based on the measurement results of the data portion in the CH Estimation (Preamble) function. The measurement results are re-analyzed and calculated by using the calculated correction data. The CH Estimation (Preamble+Data) function can perform the analysis by using a higher accuracy channel estimation than the CH Estimation (Preamble) function.

Pilot Track(Phase)

Using the pilot subcarrier, this function performs analyses, including symbol synchronization and initial phase estimation, for each symbol. This is effective when the carrier frequency or the FFT sampling frequency changes, or in similar situations. (When Pilot Track(Phase) is OFF, symbol synchronization and initial phase synchronization for each symbol are not performed after symbol synchronization and initial phase estimation at the preamble.)

Pilot Track(Amplitude)

This function performs the analysis after correcting the amplitude for each symbol by using the pilot subcarrier. This function is effective when the burst signal level fluctuates. If the Pilot Track (Amplitude) is set to OFF, the amplitude for each symbol is not corrected after the amplitude was corrected by using the preamble.

Equalizer

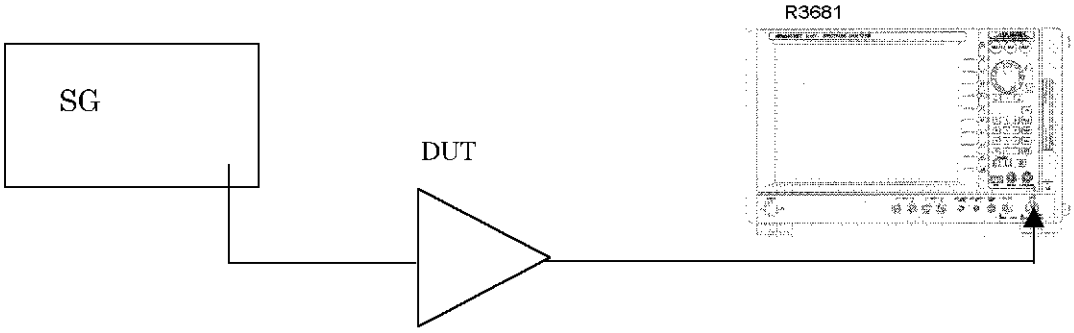
This function corrects amplitude and phase in order to minimize EVM of the data portion.

When the **Make** button of Equalizer Data is touched, the correction values are calculated and are applied. Use this function as follows:

1. Connect the SG signal directly to the measuring instrument and measure EVM. (Equalizer: OFF)

CAUTION: ***Equalizer is not designed to correct distortion of SG, unbalance of IQ signal, or errors of a quadrature modulator, so if there is E.V.M. degradation arising from any of these causes, E.V.M. cannot be reduced using Equalizer.***

2. Touch the **Make** button. The Equalizer data is calculated.
3. Next, turn ON Equalizer.
4. Touch the **Analysis Restart** key on the soft menu bar. EVM corrected by the Equalizer data is displayed.
5. Connect the DUT (Device Under Test) and measure EVM. The amount of EVM worsened by the DUT can be measured.



The difference between the Equalizer and the Channel Estimation is that the Channel Estimation estimates the frequency characteristics by using the preamble for each frame analysis, while the Equalizer estimates the frequency characteristics only when the **Make** button of Equalizer Data is touched.

A.1.5 SCPI Commands Compatibility

SCPI commands are listed in the command table in chapter 6.

If the SCPI commands of the primary version, which are not listed in the current command table, are used, some instruments perform as follows in order to retain the compatibility.

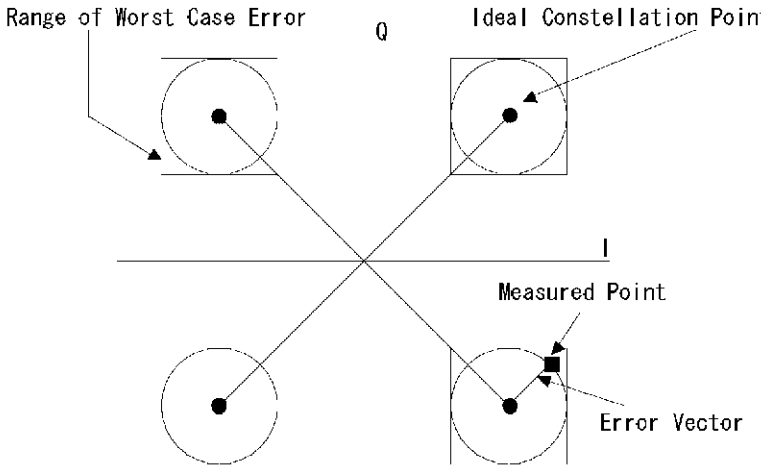
Function Description	SCPI Commands	Performance
Pilot Track ON/OFF	|:SENSe<ch>|:CONDition|:OFDM|:PTRAck	Performs in the same way as Pilot Track (Phase) ON/OFF.When set to ON by using this command, Pilot Track(Amplitude) is automatically set to OFF.
Equalizer ON/OFF	|:SENSe<ch>|:CONDition|:OFDM|:EQUAlizer	Using this command to set the equalizer to ON is the same as touching the **Make** button of Equalizer Data to calculate the Equalizer data and setting the Equalizer to ON.When set to OFF, Equalizer is set to OFF.

A.2 Technical Data (DSSS/CCK)

A.2.1 Method to Calculate Measurement Values

EVM (Error Vector Magnitude)

EVM Time is calculated using the Verr defined format described in "IEEE Std 802.11b-1999 18.4.7.8 Transmit modulation accuracy." However, DC offsets (Imean and Qmean) and average magnitudes (Imag and Qmag) necessary for calculation are found within the measurement range.



$$I_{mean} = \sum_{n=0}^{N-1} I(n) / N$$

$$Q_{mean} = \sum_{n=0}^{N-1} Q(n) / N$$

$$I_{dc}(n) = I(n) - I_{mean}$$

$$Q_{dc}(n) = Q(n) - Q_{mean}$$

$$I_{mag} = \sum_{n=0}^{N-1} \left| I_{dc}(n) \right| / N$$

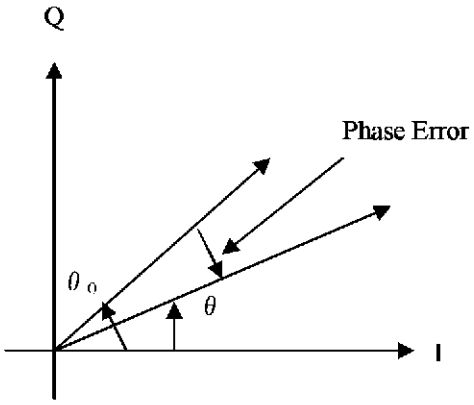
$$Q_{mag} = \sum_{n=0}^{N-1} \left| Q_{dc}(n) \right| / N$$

$$V_{err}(n) = \left[\frac{1}{2} \times \left(\left\{ \left| I_{dc}(n) \right| - I_{mag} \right\}^2 + \left\{ \left| Q_{dc}(n) \right| - Q_{mag} \right\}^2 \right) \right]^{\frac{1}{2}} - V_{correction}$$

Vcorrection is taken as 0 for calculation.

The value of EVM Maximum of Total Result is equal to the maximum value of Verr(n). The value of EVM Average of Total Result is equal to the RMS value of Verr(n). The value of EVM Time is equal to Verr(n) of each chip.

Phase Error



The phase θ_0 of the ideal symbol and phase θ of the measured symbol are defined as follows:

$$\theta_0(n) = \pm\frac{\pi}{4}, \pm\frac{3}{4}\pi \quad [\text{rad}]$$

$$\theta(n) = \arctan\left[\frac{Q(n)}{I(n)}\right]$$

The value of Phase Error Time is calculated for each chip as the Phase Error value.

Power

Power is calculated from the input signal power. The value of Power Maximum of Total Result is equal to the maximum value of input signal power. The value of Power Average of Total Result is equal to the average value of input signal power.

DC Offset

DC Offset is calculated using the formulae for DC Offset (Imean and Qmean) indicated previously in the section concerning EVM.

Ramp Up

Ramp Up is calculated by smoothing the rise of the input signal. The range for which calculation is performed is that from the 90% rise point of the maximum Power value ±5 µsec. In Multi Frame measurement, the Maximum, Minimum, and Average values of the Ramp waveform are calculated. Ramp Up Time of Total Result is calculated based on the time between the 90% rise point of the Power maximum value and the 10% rise point. In Multi Frame measurement, the maximum value of all measured frames is calculated.

Ramp Down

Ramp Down is calculated by smoothing the fall of the input signal. The range for which calculation is performed is that from the 10% fall point of the maximum Power value ±5 µsec. In Multi Frame measurement, the Maximum, Minimum, and Average values of the Ramp waveform are calculated. Ramp Down Time of Total Result is calculated based on the time between the 10% fall point of the Power maximum value and the 90% fall point. In Multi Frame measurement, the maximum value of all measured frames is calculated.

A.2.2 Judgment of PSDU Modulation Format

The modulation format is determined by acquiring the RATE data from the SIGNAL demodulation data. However, when there is a parity error, a judgment cannot be made.

A.2.3 Receiving Filter

Nyquist

This is a Nyquist filter.

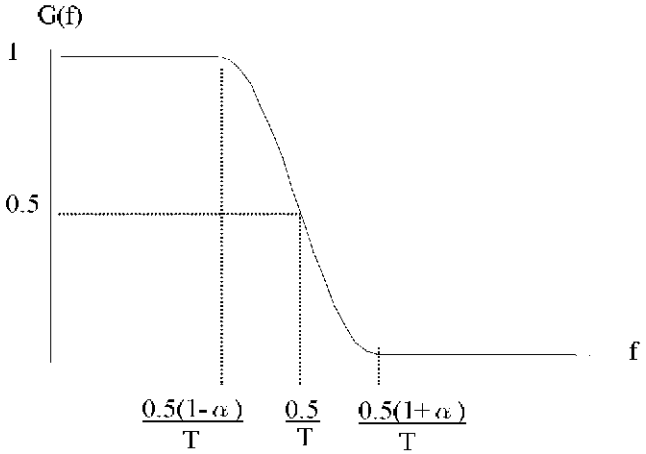
Nyquist BW: Sets the bandwidth. The set value is a 3 dB bandwidth.

Roll Off: Sets the rolloff factor. The smaller the rolloff is, the steeper the filter gets.

$$H(f)=\begin{cases}1 & |f|<\dfrac{(1-\alpha)}{2\cdot T}\\ Cos^2\left[\dfrac{T}{4\alpha}\left\{|f|-(1-\alpha)\dfrac{1}{2\cdot T}\right\}\right] & \dfrac{(1-\alpha)}{2\cdot T}<|f|<\dfrac{(1+\alpha)}{2\cdot T}\\ 0 & \dfrac{(1+\alpha)}{2\cdot T}<|f|\end{cases}$$

(1/T): Nyquist BW

α : Roll Off



Gauss

This is a Gaussian filter.

Gauss BW: Sets the bandwidth. The set value is a 3 dB bandwidth.

$$g_n = A \cdot g(n) \text{、} \quad n = -\frac{len-1}{2} \sim \frac{len-1}{2}$$

where

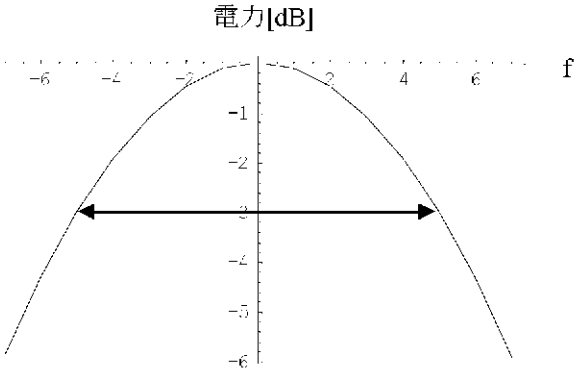
$$g(n) = Ae^{-\frac{0.5}{\log 2}\left(\pi \frac{3dB}{fs} n\right)^2}$$

A: $\dfrac{1}{\sum_n g(n)}$

n: Sample points

3 dB: Gauss BW

f_s: Sampling frequency



Sinc

This is a filter defined in IEEE802.11g 19.7.2.1.3.

$$h_{IdealBW}(t) = f_W \frac{\sin(\pi f_W t)}{\pi f_W t} = f_W \sin c(f_W t)$$

where

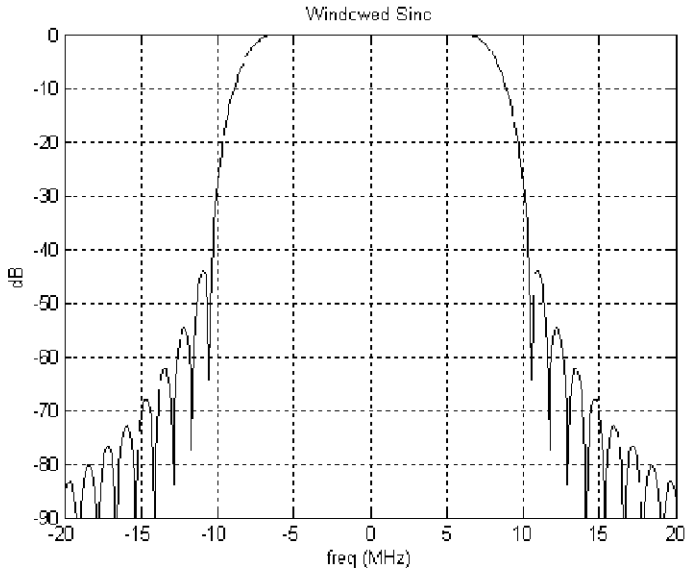
$f_W = 52(20/64)MHz$

$$h_{Window}(t) = 0.5\left[1 + \cos\left(2\pi \frac{t}{t_{SPAN}}\right)\right]$$

where

$t_{SPAN} = 0.8\mu \sec s$

$$p(t) = h_{Window} h_{IdealBW}(t)$$



A.3 A/D Data Save Function

This function is used to save A/D conversion data of a signal under test obtained by A/D Capture in a text format file. Ideal A/D data can be obtained after correction of this instrument's internal frequency characteristics.

The sampling frequency is 40 MHz. All data captured by A/D Capture is saved, so set only the necessary length of time in A/D Capture Length before executing A/D Capture.

The magnitudes of I signals and Q signals are written into one file in chronological order. The following shows the format:

I[0], Q[0]

I[1], Q[1]

I[2], Q[2]

:

:

I[n-1], Q[n-1]

A.4 Measurement Data Save Function

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

Only data displayed in the active window is saved. To save all displayed data of the 4 measurement result windows, switch each to active and save the results in turn.

In the beginning of the file, the measurement parameters set by the user interface are written. The measurement result data is written following this portion.

A.4.1 Measurement Result Save Format (OFDM)

- Spectrum system display (EVM Spectrum, etc.)

  Measurement result data of EVM Spectrum, Magnitude Error Spectrum, Phase Error Spectrum, Magnitude Flatness Spectrum, and Power Spectrum are saved in the following format:

  ***** Results *****

  Measurement result name

  Specified Symbol Number (This line is deleted when no choice has been made.)

  Title line

  Subcarrier number, RMS/AVG value, Specified Symbol measurement value, ALL values (for the number of symbols)

  Data is saved in order of subcarrier number.

  Whether or not to display RMS/AVG, Specified Symbol, and ALL can be selected, so only those items selected to display are saved in the file.

  For the ALL values, data within the symbol range set in Window Start and Window Width are saved along the horizontal axis in order of symbol number.

  Example of Power Spectrum

  ***** Results *****

  <<< Power [Spectrum] >>>

  Specified Symbol,3

  Subcar,AVG[dBm],Spec Sym[dBm],Symbol[3],Symbol[4],Symbol[5] ...

  -32,-59.73,-54.42,-54.42,-64.55,-67.02 ...

  -31,-58.82,-61.91,-61.91,-70.91,-72.32 ...

  -30,-59.58,-53.31,-53.31,-80.55,-58.05 ...

  :

  :

- Time system display (excluding Freq Error)

  Measurement result data of EVM Time, Magnitude Error Time, Phase Error Time, Magnitude Flatness Time, and Power Time are saved in the following format:

  ***** Results *****

  Measurement result name

  Specified Subcarrier Number (This line is deleted when no choice has been made.)

  Title line

  Symbol number, RMS/AVG value, Specified Subcar measurement value, ALL values (for the number of carriers)

  Data is saved in order of symbol number.

  Data within the symbol range set in Window Start and Window Width are saved.

  Whether or not to display RMS/AVG, Specified Subcarrier, and ALL can be selected, so only those items selected to display are saved in the file.

  Example of Power Time

  ***** Results *****

  <<< Power [Time] >>>

  Specified Subcarrier,27

  Symbol,AVG[dBm],Spec Sub[dBm],Subcar[-32],Subcar[-31],Subcar[-30] ...

  3,-26.13,-52.18,-54.41,-61.97,-53.33 ...

  4,-26.32,-59.69,-64.55,-70.94,-80.57 ...

  5,-25.48,-56.15,-67.02,-72.39,-58.04 ...

  :

  :

- Center Freq Error Time

  Measurement result data of Center Freq Error Time is saved in the following format:

  ***** Results *****
  <<< Center Freq Error Time >>>
  Title line
  Symbol number, waveform data

  Data is saved in order of symbol number.
  Data within the symbol range set in Window Start and Window Width are saved.

  Example of Center Freq Error Time
  ***** Results *****
  <<< Center Frequency Time >>>
  Symbol,AVG[Hz],Center Freq Error[Hz]
  3,-7589,-10556
  4,-7589,-2870
  5,-7589,-9352
  :
  :

- Preamble Freq Error Time
  Measurement result data of Preamble Freq Error Time is saved in the following format:

  ***** Results *****
  <<< Preamble Freq Error Time >>>
  Time of waveform data start position
  Time of waveform data end position
  Time resolution of waveform data
  Title line
  Sample number, waveform data

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

  Example of Preamble Freq Error Time
  ***** Results *****
  <<< Preamble Frequency Error Time >>>
  Start Time[s],0.000000400
  Stop Time[s],0.000006000
  Time Resolution[s],0.000000025
  No.,Freq Error[Hz]
  0,-79285
  1,-79404
  2,-79535
  :
  :

- Constellation

  Measurement result data of Constellation is saved in the following format:

  ***** Results *****
  <<< Constellation >>>
  Specified Symbol = n or Specified Subcarrier = m or ALL
  Title line
  Symbol number, subcarrier number, I signal, Q signal

  Data is saved in order of symbol number, and within the same symbol number, in order of subcarrier number.
  Data within the symbol range set in Window Start and Window Width are saved.

  Example of Constellation
  ***** Results *****
  <<< Constellation >>>
  ALL
  Symbol,Subcar,I,Q
  3,-32,********,********
  3,-31,********,********
  3,-30,********,********
  3,-29,********,********
  3,-28,********,********
  3,-27,********,********
  3,-26,-0.95818,-0.84726
  3,-25,-0.94491,+0.92378
  3,-24,-0.25531,-0.94444
  :
  :

- Demodulated Data

  Measurement result data of Demodulated Data is saved in the following format:

  ***** Results *****
  <<< Demodulated Data >>>
  Title line
  Symbol number, subcarrier number, demodulated data, modulation format

  Data is saved in order of symbol number, and within the same symbol number, in order of subcarrier number.
  Data within the symbol range set in Window Start and Window Width are saved.
  Where there is no subcarrier, demodulated data cannot be acquired, so *** is displayed.

  Example of Demodulated Data
  ***** Results *****
  <<< Demodulated Data >>>
  Symbol,Subcar,Data,Mod
  3,-32,***,***
  3,-31,***,***
  3,-30,***,***
  3,-29,***,***
  3,-28,***,***
  3,-27,***,***
  3,-26,0x00,16QAM
  3,-25,0x02,16QAM
  3,-24,0x04,16QAM
  3,-23,0x09,16QAM
  3,-22,0x04,16QAM
  3,-21,0x01,PILOT
  3,-20,0x09,16QAM
  :
  :

- Spectrogram

  Measurement result data of Spectrogram is saved in the following format:

  ***** Results *****
  <<< Spectrogram >>>
  Subcarrier number, ALL values (for the number of symbols)

  Data is saved in the order of subcarrier number along the vertical axis, and in order of symbol number along the horizontal axis.
  Data within the symbol range set in Window Start and Window Width are saved.

  Example of Spectrogram
  ***** Results *****
  <<< Spectrogram >>>
  Subcar,Symbol[3],Symbol[4],Symbol[5] ...
  -32,-54.42,-61.91,-53.36 ...
  -31,-26.08,-26.12,-26.05 ...
  -30,-23.26,-32.61,-23.16 ...
  :
  :

- PLCP Phase Error Time

  Measurement result data of PLCP Phase Error Time is saved in the following format:

  ***** Results *****
  <<< PLCP Phase Error Time >>>
  Title line
  Chip number, waveform data

  Data is saved in the order of chip number.
  The number of chips is 2112 when the LONG format is used, and 1056 when the SHORT format is used.

  Example of PLCP Phase Error Time
  ***** Results *****
  <<< PLCP Phase Error Time >>>
  Chip,PLCP Phase Error Time[deg]
  0,0.274
  1,0.477
  2,0.394
  :
  :

- Meas Window

  Measurement result data of Meas Window is saved in the following format:

  ***** Results *****
  Time of waveform data start position
  Time of waveform data end position
  Time resolution of waveform data
  <<< Meas Window >>>
  Sample number, waveform data, symbol number, symbol type

  Sample numbers are obtained by counting from the beginning of waveform data in chronological order.
  In the sample number line at the symbol start position, symbol number and symbol type are written.
  In other than the symbol start position, the symbol number and symbol type are displayed as *****.

  Example of Meas Window
  ***** Results *****
  Start Time[ms],2.13800
  Stop Time[ms],2.51500
  Time Resolution[ms],0.00001
  <<< Meas Window >>>
  No.,Power[dBm],Symbol No.,Symbol Type
  0,-58.10,********,********
  1,-55.29,********,********
  2,-53.63,********,********
  :
  :
  688,-55.55,********,********
  689,-62.75,********,********
  690,-62.14,0,STS
  691,-55.10,********,********
  692,-54.12,********,********
  :
  :

A.4.2 Measurement Result Save Format (DSSS/CCK)

- EVM Time
  Measurement result data of EVM Time is saved in the following format:

  ***** Results *****
  <<< EVM Time >>>
  Title line
  Chip number, waveform data

  Data is saved in order of chip number.
  Data within the chip range set in Window Start and Window Width are saved.

  Example of EVM Time
  ***** Results *****
  <<< EVM Time >>>
  Chip,EVM[%]
  2112,1.72
  2113,0.28
  2114,1.95
  :
  :

- Phase Error Time

  Measurement result data of Phase Error Time is saved in the following format:

  ***** Results *****
  <<< Phase Error Time >>>
  Title line
  Chip number, waveform data

  Data is saved in order of chip number.
  Following the PLCP portion, data within the chip range set in Window Start and Window Width are saved. The number of chips in the PLCP portion is 2112 in the case of LONG format, and 1056 in the case of SHORT format.

  Example of Phase Error Time
  ***** Results *****
  <<< Phase Error Time >>>
  Chip,Phase Error Time[deg]
  0,0.274
  1,0.477
  2,0.394
  :
  :

- Power Spectrum
  Measurement result data of Power Spectrum is saved in the following format:

  ***** Results *****
  <<< Power Spectrum >>>
  Frequency of spectrum data start position
  Frequency of spectrum data end position
  Data count of spectrum data
  Title line
  Index, waveform data

  Data is saved in order of index. Index numbers are obtained by counting from the beginning of waveform data in order of frequency. The frequency at the spectrum data start position is fixed at -12.6 MHz, the frequency at the spectrum data end position is fixed at +12.6 MHz, and the data count of spectrum data is fixed at 1173.

  Example of Power Spectrum
  ***** Results *****
  <<< Power Spectrum >>>
  Start Freq[MHz],-12.6
  Stop Freq[MHz],12.6
  Length,1173
  No.,Power[dBm]
  0,-43.30
  1,-43.21
  2,-44.17
  3,-45.05
  :
  :

- Constellation

  Measurement result data of Constellation is saved in the following format:

  ***** Results *****
  <<< Constellation >>>
  Title line
  Chip number, locus number, I signal, Q signal

  Data is saved in order of chip number, and within the same chip number, in order of locus number.
  Data within the chip range set in Chip Start and Chip Number of Scale are saved. Locus numbers are values from 0 to 7 assigned for each chip position in order. However, for the last chip position, the locus position 0 only is saved.

  Example of Constellation
  ***** Results *****
  <<< Constellation >>>
  Chip,Locus,I,Q
  0,0,+0.69370,+0.70046
  0,1,+0.62389,+0.63609
  0,2,+0.47416,+0.49031
  0,3,+0.25439,+0.27307
  0,4,-0.00957,+0.01004
  0,5,-0.27794,-0.26011
  0,6,-0.50569,-0.49385
  0,7,-0.65442,-0.65306
  1,0,-0.70152,-0.71320
  1,1,-0.64283,-0.66643
  :
  3518,6,-0.71124,+0.71544
  3518,7,-0.70861,+0.71268
  3519,0,-0.69299,+0.69659

- Eye Diagram-I/Q

  Measurement result data of Eye Diagram-I/Q are saved in the following format:

  ***** Results *****
  Measurement result name
  Title line
  Chip number, locus number, I signal

  Data is saved in order of chip number, and within the same chip number, in order of locus number.
  Data within the chip range set in Chip Start and Chip Number of Scale are saved. Locus numbers are values from 0 to 7 assigned for each chip position in order. However, for the last chip position, the locus number 0 only is saved.

  Example of Eye Diagram-I
  ***** Results *****
  <<< Eye Diagram-I >>>
  Chip,Locus,I
  0,0,+0.69370
  0,1,+0.62389
  0,2,+0.47416
  0,3,+0.25439
  0,4,-0.00957
  0,5,-0.27794
  0,6,-0.50569
  0,7,-0.65442
  1,0,-0.70152
  1,1,-0.64283
  :
  3518,6,-0.71124
  3518,7,-0.70861
  3519,0,-0.69299

- Demodulated Data

  Measurement result data of Demodulated Data is saved in the following format:

  ***** Results *****
  <<< Demodulated Data >>>
  Title line
  Bit number, demodulated data

  Data is saved in order of bit number.
  Following the bit data in the PLCP Header portion, bit data within the chip range set in Window Start and Window Width are saved. The bit length of the PLCP Header portion is 48 bits.

  Example of Demodulated Data
  ***** Results *****
  <<< Demodulated Data >>>
  Bit No.,Data
  144,0
  145,0
  146,1
  :
  :

- Ramp Up/Down (%,dB)

  Measurement result data of Ramp Up/Down (%, dB) is saved in the following format:

  ***** Results *****

  Measurement result name

  Title line

  Time, Present value, Maximum value, Minimum value, Average value

  Data is saved in chronological order.

  Data within the range of Start of 0.00000000 s and Width of 0.000010 s is saved. The time step is 0.00000001 s.

  Whether or not to display Present, Maximum, Minimum, and Average can be selected, so only those items selected to display are saved in the file.

  Example of Ramp Up/Down (%, dB)

  ***** Results *****

  <<< Ramp Up [dBm] >>>

  Time[s],Present,Average,Maximum,Minimum

  0.00000000,-60.77,-60.77,-60.77,-60.77

  0.00000001,-60.90,-60.90,-60.90,-60.90

  0.00000002,-61.12,-61.12,-61.12,-61.12

  :

  :

- Meas Window
  Measurement result data of Meas Window is saved in the following format:

  ***** Results *****
  Time of waveform data start position
  Time of waveform data end position
  Time resolution of waveform data
  <<< Meas Window >>>
  Sample number, waveform data

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

  Example of Meas Window
  ***** Results *****
  Start Time[ms],0.00300
  Stop Time[ms],0.33700
  Time Resolution[ms],0.00001
  <<< Meas Window >>>
  No.,Power[dBm]
  0,-65.46
  1,-66.15
  2,-66.99
  :

A.5 Error Message List

This section describes the error messages displayed on this instrument.

In explanation, the following items are explained:

Table A-1 Error Message List (1 of 2)

Error number	Displayed message	Cause of generation and cancellation method
-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 unnecessary files.
-1253	File read/write error.	An error was generated during file I/O. Check if disk space remains or write-protection is applied.
-1300	Device is not ready.	A disk is not 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.
-3200	Math error.	A parameter error or operation error was generated during internal processing.
-3210	Input Level is out of range. Check the Ref. Level.	The input signal level is out of 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 was not completed. Check to see if the input signal level is not constant or the attenuator is set to manual.
-3220	Cannot find out signal. Input level may be too low.	In Multi Frame Mode, a frame is not detected from within A/D data, or in Single Frame Mode a frame is not detected at the frame selection cursor position.
-3221	Analysis has stopped. A/D data is not captured.	In Single Frame Mode, Analysis Restart was executed before A/D capture was complete. Execute Analysis Restart after A/D capture is complete.
-3222	Cannot find Preamble. Standard may be mismatched.	A preamble was not detected at the beginning of a frame.
-3226	Not available while A/D capturing.	The requested operation cannot be accepted during A/D capture.
-3227	Not available while analyzing.	The requested operation cannot be accepted during measurement (or analysis).
-3228	Not available in I/Q input mode.	The requested operation cannot be accepted during baseband I/Q input.
-3230	Analysis has stopped. Equalizer data is not calculated.	The analysis is executed by setting the Equalizer to ON when the Equalizer data does not exist. Execute the analysis after calculating the Equalizer data.

Table A-1 Error Message List (2 of 2)

Error number	Displayed message	Cause of generation and cancellation method
-3231	Analysis has stopped. Press "Make" button again.	The analysis is executed by using the invalid Equalizer data. Execute the analysis after re-calculating the Equalizer data.
-3232	Cannot calculate equalizer data.	Equalizer data cannot be calculated. Check whether the OFDM analysis was completed correctly.
-3233	Cannot find Ramp Down. Frame length may be too long.	The falling edge of the frame cannot be detected. Check whether the whole frame is in the range of the A/D Capture Length.
-3300	Memory allocation error.	Failure to reserve work memory for use by internal processing.

ALPHABETICAL INDEX

[Symbol]

[A]

[C]

[N]

[O]

[P]

[Q]

[R]

[S]

[T]

[U]

[W]

[X]

[Y]

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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.

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