MS2830A/MS2840A
Signal Analyzer
Vector Signal Generator
Operation Manual
Operation

Seventh Edition

- **For safety and warning information, please read this manual before attempting to use the equipment.**
- **Additional safety and warning information is provided within the MS2830A Signal Analyzer Operation Manual (Mainframe Operation) or MS2840A Signal Analyzer Operation Manual (Mainframe Operation). Please also refer to this document before using the equipment.**
- **Keep this manual with the equipment.**

ANRITSU CORPORATION

Document No.: M-W3337AE-7.0

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Ensure that you clearly understand the meanings of the symbols BEFORE using the equipment. Some or all of the following symbols may be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.

Symbols used in manual

⚠ DANGER This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.

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⚠ CAUTION This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

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

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

These indicate that the marked part should be recycled.

MS2830A/MS2840A
Signal Analyzer Vector Signal Generator
Operation Manual Operation

15 December 2009 (First Edition)
13 May 2016 (Seventh Edition)

Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories, including the National Institute of Advanced Industrial Science and Technology, and the National Institute of Information and Communications Technology, and was found to meet the published specifications.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within one year after shipment due to a manufacturing fault. However, software fixes will be made in accordance with the separate Software End-User License Agreement. Moreover, Anritsu Corporation will deem this warranty void when:

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- The fault is due to mishandling, misuse, or unauthorized modification or repair of the equipment by the customer.
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- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster, including fire, wind, flooding, earthquake, lightning strike, or volcanic ash, etc.
- The fault is due to damage caused by acts of destruction, including civil disturbance, riot, or war, etc.
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- The fault is due to use of non-specified peripheral or applied equipment or parts, or consumables, etc.
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- In dusty places
- Outdoors
- In liquids, such as water, oil, or organic solvents, and medical fluids, or places where these liquids may adhere
- In salty air or in places where chemically active gases (SO_2, H_2S, Cl_2, NH_3, NO_2, or HCl, etc.) are present
- In places where high-intensity static electric charges or electromagnetic fields are present
- In places where abnormal power voltages (high or low) or instantaneous power failures occur
- In places where condensation occurs
- In the presence of lubricating oil mists
- At low atmospheric pressure
- In the presence of frequent vibration or mechanical shock, such as in cars, ships, or airplanes

Anritsu Corporation Contact

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

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Anritsu affixes the CE Conformity marking on the following product(s) in accordance with the Council Directive 93/68/EEC to indicate that they conform to the EMC and LVD directive of the European Union (EU).

CE marking

1. Product Model

Option: MS2830A/MS2840A Vector Signal Generator

2. Applied Directive and Standards

When the MS2830A/MS2840A Vector Signal Generator is installed in the MS2830A or MS2840A, the applied directive and standards of this Option conform to those of the MS2830A or MS2840A main frame.

PS: About main frame
Please contact Anritsu for the latest information on the main frame types that MS2830A/MS2840A Vector Signal Generator can be used with.

C-tick Conformity Marking

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

C-tick marking

1. Product Model

Option: MS2830A/MS2840A Vector Signal Generator

2. Applied Directive and Standards

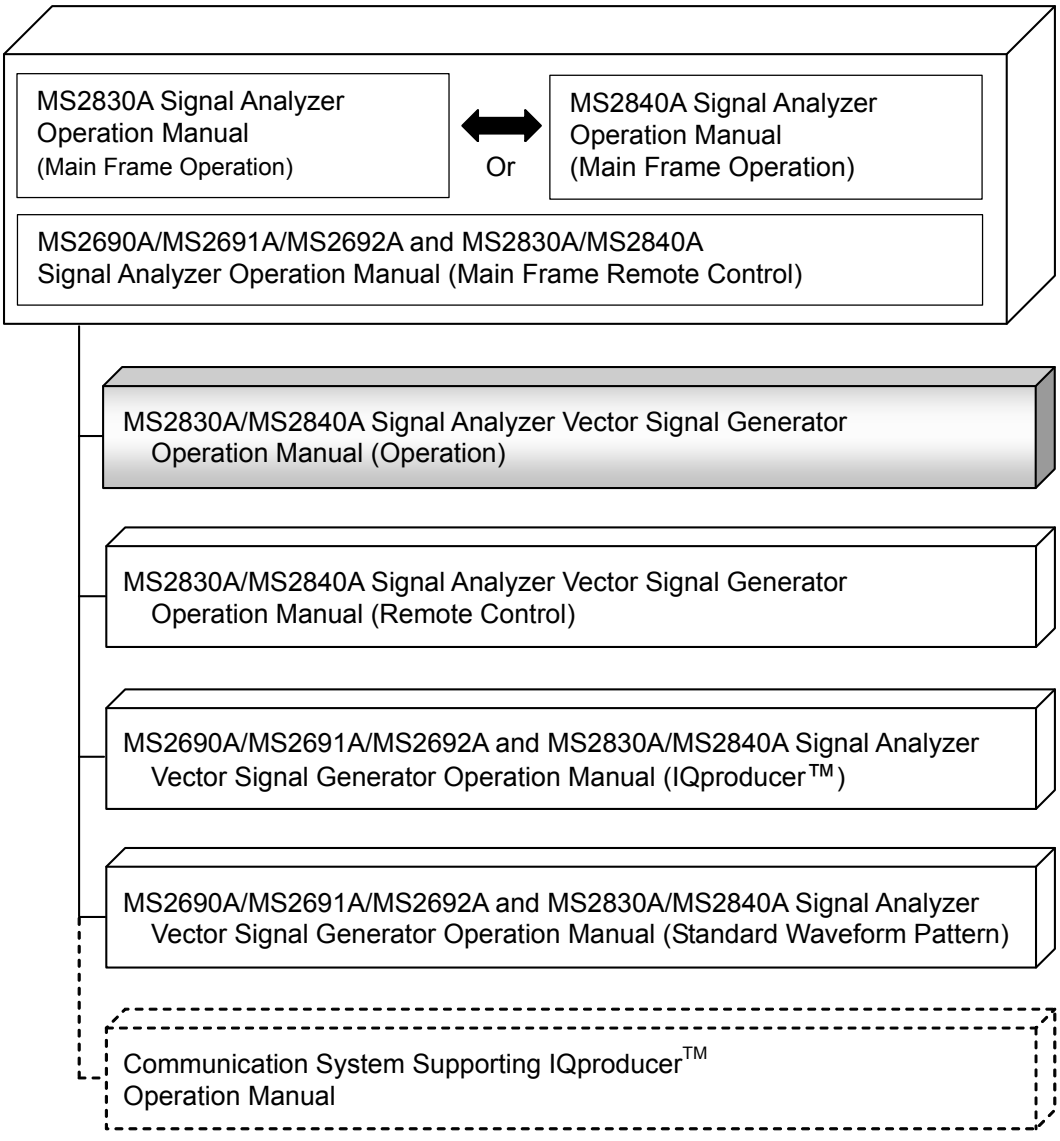
When the MS2830A/MS2840A Vector Signal Generator is installed in the MS2830A or MS2840A, the applied directive and standards of this Option conform to those of the MS2830A or MS2840A main frame.

PS: About main frame
Please contact Anritsu for the latest information on the main frame types that MS2830A/MS2840A Vector Signal Generator can be used with.

About This Manual

■ **Composition of Operation Manuals**

The operation manuals for the MS2830A/MS2840A Signal Analyzer are comprised as shown in the figure below.



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

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

- **Vector Signal Generator Operation Manual (Operation)**

<This document>

This manual describes functions, operating methods, and so on of the vector signal generator (option).

- **Vector Signal Generator Operation Manual (Remote Control)**

This manual describes remote control of the vector signal generator (option).

- **Vector Signal Generator Operation Manual (IQproducer™)**

This manual describes functions, operating methods, and so on of the IQproducer, which is application software used with the vector signal generator (option).

- **Vector Signal Generator Operation Manual (Standard Waveform Pattern)**

This manual describes details on the standard waveform pattern data used with the vector signal generator (option).

In this document,  indicates a panel key.

Table of Contents

Chapter 1 Outline

This chapter provides an outline of the MS2830A-020/021 Vector Signal Generator and MS2840A-020/021 Vector Signal Generator and describes the product composition.

1.1 Product Overview

The MS2830A-020/021 Vector Signal Generator or MS2840A-020/021 Vector Signal Generator is an option that can be added to the MS2830A Signal Analyzer or MS2840A Signal Analyzer to enable output of vector signals based on arbitrary waveforms. It can be used for a wide range of applications, from R&D to manufacturing of digital mobile communication systems, devices, and equipment.

This function has following features:

- Frequency range covered: 250 MHz to 3600 kHz (Option 020/120)
  250 MHz to 6000 Hz (Option 021/121)
- RF modulation bandwidth: 120 MHz
- High-capacity internal waveform memory:
  64 M samples (Standard)
  256 M samples (Option 027/127)
- AWGN addition function: Option 028/128
- BER measurement function: Option 026/126
- Low Power Extension for Vector Signal Generator:
  Lowest output level –136 dBm Option 022/122

The supplied CD-ROM contains application software. This application software allows baseband waveform data generation supporting communication systems and external data conversion.

1.2 Product Configuration

Table 1.2-1 lists the configuration of the application. At unpacking, check that all items are included. Contact your Anritsu Service and Sales Office or agent if any parts are missing or damaged.

Table 1.2-1 Configuration of application

Item	Model Name/Symbol	Product	Q'ty	Remarks
Accessories	---	Installation CD-ROM	1	Application software, Operation Manual CD-ROM

1.3 Specifications

The specifications of the application are defined under the following conditions unless otherwise specified.
Table 1.3-1 shows the specifications.

<Common to CW and modulation modes>

- Pulse modulation : Off

Note:

A frequency of over 3.6 GHz can only be used when the MS2830A-021/121 or MS2840A-021/121 is installed.

<Only in modulation mode>

- –3.00 dB≤RMSnom≤+3.00 dB

  Assuming that the RMS value of the waveform pattern is RMSw [*linear value*]:

  RMSnom = 10 × log (RMSw/4628) (for 16-bit data)

  RMSnom = 10 × log (RMSw/2314) (for 15-bit data)

  RMSnom = 10 × log (RMSw/1157) (for 14-bit data)
- After performing SG Level Calibration

Table 1.3-1 Specifications for MS2830A-020/021, MS2840A-020/021

Item	Specification Value
Frequency	
Range	Option 020/120: 250 kHz to 3.6 GHz Option 021/121: 250 kHz to 6 GHz
Resolution	0.01 Hz step
Output Level	
Setting range	When option 022/122 is NOT installed: –40 dBm to +20 dBm (f>25 MHz) –40 dBm to +2 dBm (f≤ 25 MHz) When option 022/122 is installed: –136 dBm to +15 dBm (f>25 MHz) –136 dBm to –3 dBm (f≤ 25 MHz)
Unit	dBm, dBμV (terminated, open)
Resolution	0.01 dB
Output level accuracy	When the option 022/122 is not installed, in CW mode, at 18 to 28°C: Output level p [dBm]: –40≤p≤+2 ±0.5 dB typ. (f≤25 MHz) –40≤p≤+9 ±0.5 dB typ. (25 MHz<f<375 MHz) –40≤p≤+9 ±0.5 dB (375 MHz≤f≤3.6 GHz) –40≤p≤+4 ±0.8 dB (f>3.6 GHz) When the option 022/122 is installed, in CW mode, at 18 to 28°C: Output level p [dBm]: –110≤p<–3 ±1.0 dB typ. (≤25 MHz) –110≤p<+4 ±1.0 dB typ. (25 MHz<f<100 MHz) –110≤p<+4 ±0.5 dB typ. (100 MHz≤f<375 MHz) –110≤p<+4 ±0.5 dB (375 MHz≤f≤3.6 GHz) –110≤p<–1 ±0.8 dB (f >3.6 GHz) –120≤p<–110 ±1 dB (100 MHz≤f≤3.6 GHz) –127≤p<–120 ±1 dB typ. (100 MHz≤f≤3.6 GHz) –127≤p<–110 ±2.5 dB typ. (f >3.6 GHz)
Output level linearity	When the option 022/122 is not installed, in CW mode, at 18 to 28°C: With –10 dBm as the output reference Output level p [dBm]: –40≤p≤–10 ±0.2 dB typ. (≤3.6 GHz) –40≤p≤–10 ±0.3 dB typ. (>3.6 GHz) When the option 022/122 is installed, in CW mode, at 18 to 28°C: With –15 dBm as the output reference –110≤p≤–15 ±0.2 dB typ. (≤3.6 GHz) –110≤p≤–15 ±0.3 dB typ. (>3.6 GHz)
Output connector	N-J connector, 50 Ω (front panel, SG Output (Opt))

Table 1.3-1 Specifications for MS2830A-020/021, MS2840A-020/021 (Cont'd)

Item	Specification Value
VSWR	When the option 022/122 option is not installed and at 18 to 28°C: Output level: –10 dBm or less 1.5 (≤3.6 GHz) 2.0 (>3.6 GHz) Option 022/122 installed, 18 to 28°C, Output level: –15 dBm or less 1.3 (≤3.6 GHz) 1.9 (>3.6 GHz)
Maximum reverse input Reverse input power	0 V DC Max When the option 022/122 option is not installed +12 dBm (<20 MHz) +24 dBm (≥20 MHz) When the option 022/122 option is installed +18 dBm (<20 MHz) +30 dBm (≥20 MHz)
Signal Purity	
Harmonic spurious	When output level ≤+0 dBm (Option 022/122 option not installed) or output level ≤–5 dBm (Option 022/122 option installed), in CW mode <–30 dBc (1 MHz≤frequency≤3.6 GHz) <–30 dBc (3.6 GHz<frequency)
Non-harmonic spurious	When output level ≤+0 dBm (Option 022/122 option not installed) or output level ≤ –5 dBm (Option 022/122 option installed), in CW mode, and when the offset from the output frequency = 15 kHz or more <–46 dBc (100 MHz ≤ frequency ≤ 3 GHz) <–40 dBc (3 GHz < frequency ≤ 6 GHz)

Table 1.3-1 Specifications for MS2830A-020/021, MS2840A-020/021 (Cont'd)

Item	Specification Value
Vector modulation	
Vector Accuracy	W-CDMA(DL1code), output level ≤ 0 dBm (Option 022/122 option not installed) or output level ≤ –5 dBm (Option 022/122 option installed), output frequency = 800 to 2700 MHz, and at 18 to 28°C ≤1.4% (rms) LTE-DL(20 MHz) output level ≤ 0 dBm (Option 022/122 option not installed) or output level ≤ –5 dBm (Option 022/122 option installed), output frequency = 600 to 2700 MHz, and at 18 to 28°C ≤1.4% (rms)
Carrier leak	When RMS Value = 0 dB, 18 to 28°C, 375 MHz≤frequency≤2.4 GHz ≤–40 dBc
Image rejection	At 18 to 28°C and when a sinusoidal wave of 10 MHz or less is used ≤–40 dBc
ACLR	At 18 to 28°C, when output level ≤ 0 dBm (Option 022/122 option not installed) or output level ≤ –5 dBm (Option 022/122 option installed), and when a W-CDMA (Test Model 1 64DPCH) signal is used 375 MHz ≤ output frequency ≤ 2.4 GHz 5 MHz offset : ≤–64 dBc/3.84 MHz 10 MHz offset : ≤–67 dBc/3.84 MHz 2.4 GHz<output frequency≤3.6 GHz 5 MHz offset : ≤–59 dBc/3.84 MHz 10 MHz offset : ≤–63 dBc/3.84 MHz 3.6 GHz<output frequency≤6 GHz 5 MHz offset : ≤–56 dBc/3.84 MHz 10 MHz offset : ≤–60 dBc/3.84 MHz
Level error from CW during vector modulation	With an AWGN signal with a bandwidth of 5 MHz and at 18 to 28°C At 100 MHz ≤ frequency When output level ≤ 0 dBm (Option 022/122 option not installed) or output level ≤ –5 dBm (Option 022/122 option installed) ±0.2 dB
Spectrum reversal function	Spectrum reverse is possible.
Pulse modulation	
On/Off ratio	At frequency<3 GHz >60 dB At 3 GHz ≤frequency≤6 GHz >40 dB
Rising/falling time	≤90 ns (10 to 90%)
Pulse repetition frequency	DC to 1 MHz (Duty 50%)
External pulse modulation signal input	Rear panel Aux connector, TTL, H: Signal output On, L: Signal output Off

Table 1.3-1 Specifications for MS2830A-020/021, MS2840A-020/021 (Cont'd)

Item	Specification Value
Waveform generator	
Waveform resolution	I/Q is 14, 15, or 16 bits
Marker Output	When waveform resolution is 14 bits: 3 signals in the waveform pattern or 3 signals generated in real time When waveform resolution is 15 bits: 1 signal in the waveform pattern or 3 signals generated in real time When waveform resolution is 16 bits: 3 signals generated in real time Can be toggled between positive and negative logic pulse output.

Table 1.3-1 Specifications for MS2830A-020/021, MS2840A-020/021 (Cont'd)

Item	Specification Value
Waveform generator	
Internal baseband reference clock	
Range	20 kHz to 160 MHz
Resolution	0.001 Hz
External baseband reference clock	
Range	20 kHz to 40 MHz
Divisional and multiplication function	A clock that is generated internally by multiplying the input signal by 1, 2, 4, 8, 16, 1/2, 1/4, 1/8, and 1/16 can be used as the DAC sampling clock.
Input connector	Rear AUX Connector
Input level	≥0.7 Vp-p/50 Ω (AC coupling)
Waveform memory	
Memory capacity	When Option 027/127 is NOT installed: 64 M samples When Option 027/127 is installed: 256 M samples
Number of loadable files	Up to 1,000 waveform patterns can be loaded per package and up to 100 packages can be loaded in the waveform memory. However, the total number of patterns must not exceed 4096, and there must be at least 128 samples per pattern.
SG Trigger Input	Starts outputting waveform pattern in sync with trigger signal.
Trigger type	Start trigger: Used to start waveform output Frame trigger: When executing burst output, this trigger is used to output signals at the burst timing. Burst length data is output when the frame trigger occurs and the system then waits for the next trigger.
Input connector	Rear panel, BNC-J connector Used to switch between start trigger and frame trigger
Input level	Can be selected from TTL, rising edge, or falling edge
AWGN generation function	
Absolute value of CN ratio	When Option 028/128 is installed ≤40 dB

Chapter 2 Operation (Signal Generator Function)

This chapter describes the basic operation methods for the signal generation function of the MS2830A-020/021 or MS2840A-020/021 (hereinafter, referred to as "Signal Generator function").

2.1 Displaying Signal Generator Screen

After the MS2830A has been powered on, the Signal Generator screen can be displayed from the **Application Switch** button or Application key.

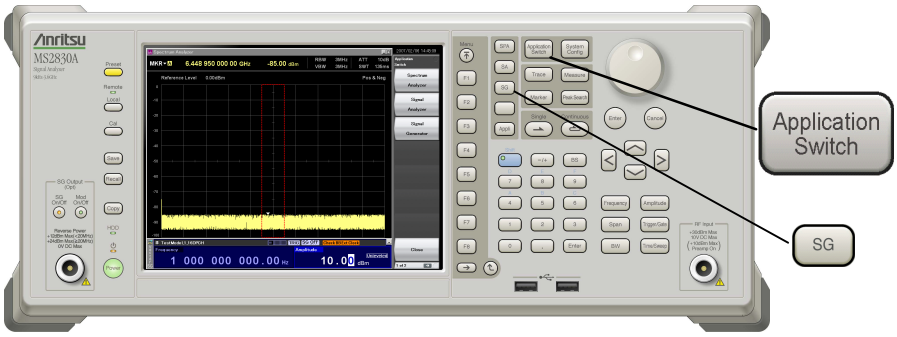


Figure 2.1-1 Application Switch key

<Procedure 1>

1. Press Application Switch to display the Application Switch menu.
2. Select **Signal Generator** from the Application Switch menu to display the Signal Generator main screen.

<Procedure 2>

1. Press SG of the Application key to display the Signal Generator main screen.

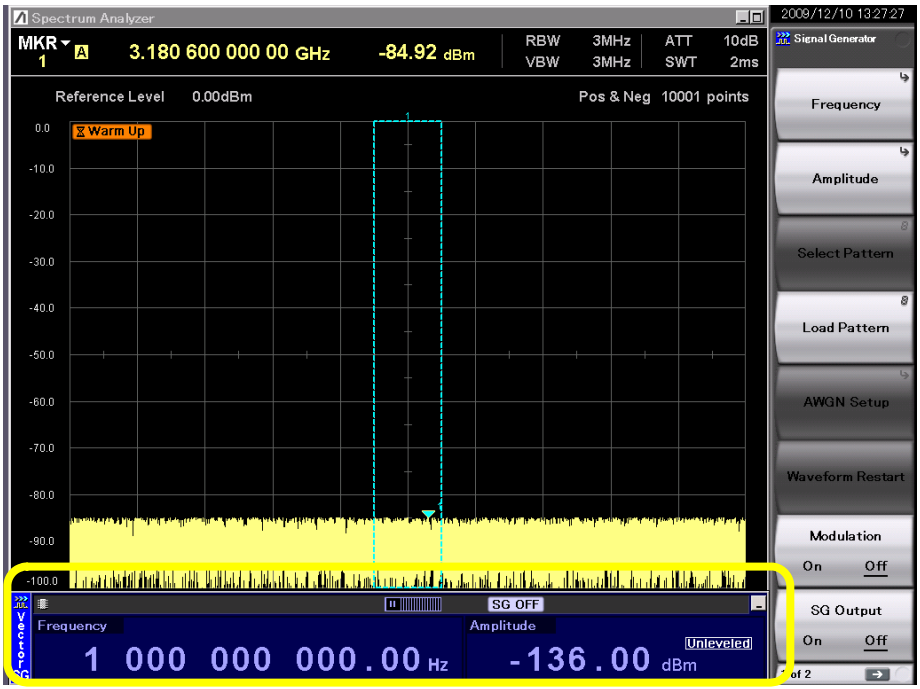


Figure 2.1-2 Signal Generator main screen

2.1.1 Display description

This section describes the Signal Generator main screen.

Press Menu when the Signal Generator main screen is displayed to display the main function menu.

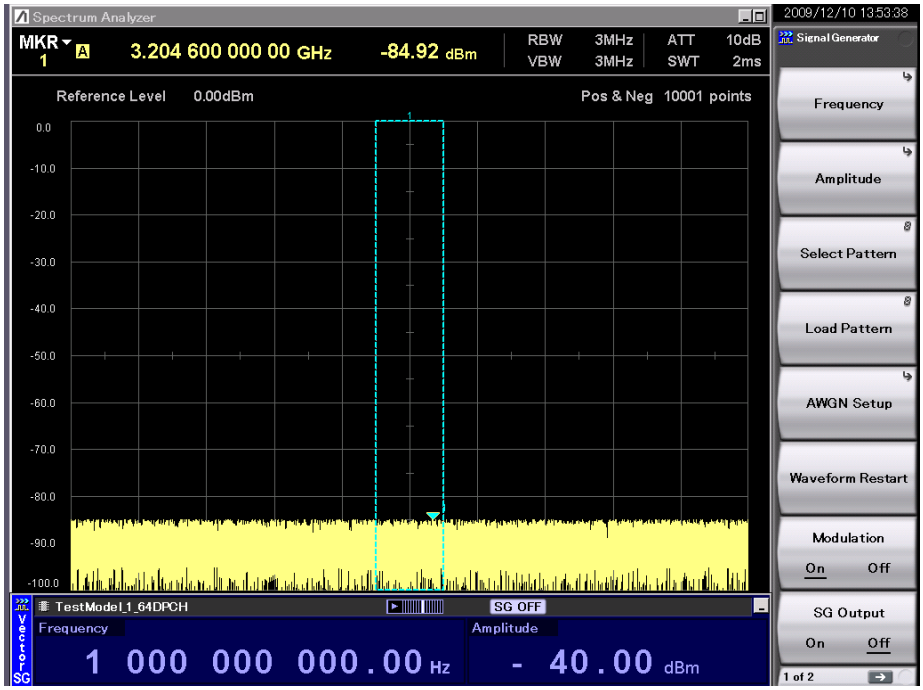


Figure 2.1.1-1 Signal Generator main screen

Table 2.1.1-1 Status display

Actual view	Display	Description
SG OFF	SG OFF	Indicates that the SG output is Off.
CW	CW	Indicates that the CW signal is being output (Modulation Off).
	No display	Indicates that the modulation signal is being output.
TestModel1_64DPCH	—	Indicates the selected modulation signal pattern.
	—	Indicates that the selected modulation signal pattern is being played back.
	—	Indicates that the modulation signal pattern playback is stopped.

Table 2.1.1-2 Main Function Menu

Function Key	Menu Display	Function
	Page 1	
F1	Frequency	Sets the frequency. ☞ 2.2 "Setting Frequency"
F2	Amplitude	Sets the output level. ☞ 2.3 "Setting Output Level"
F3	Select Pattern	Selects the waveform pattern to be output. ☞ 2.4.2 "Selecting waveform pattern(s)"
F4	Load Pattern	Loads the waveform pattern to the memory. ☞ 2.4.1 "Loading waveform pattern(s) to memory"
F5	AWGN Setup	Sets AWGN. ☞ 2.5 "AWGN Addition Function"
F6	Waveform Restart	Re-outputs the waveform pattern, beginning at the head. ☞ 2.4.7 "Re-outputting Pattern Beginning at Head"
F7	Modulation (On/Off)	Selects between turning modulation On and Off. ☞ 2.4.6 "Turning modulation signal on/off"
F8	SG Output (On/Off)	Selects between turning RF output On and Off. ☞ 2.3.10 "Turning RF output on/off"
	Page 2	
F1	Ext I/O Setup	Sets the external I/O. ☞ 2.6 "Setting External I/O"
F2	SA Trigger Out Pattern Sync	Selects the trigger type to be output for other applications such as the Signal Analyzer function. ☞ 2.7 "Selecting SA Trigger"
F3	Baseband Information	Displays information of the selected waveform pattern. ☞ 2.4.8 "Displaying information of selected waveform pattern"
F6	Copy Pattern File to HDD/SSD	Copies the waveform pattern to the HDD/SSD. ☞ 2.4.4 "Copying waveform file(s) to HDD/SSD"
F7	Delete Pattern File on HDD/SSD	Deletes waveform patterns on the HDD/SSD. ☞ 2.4.5 "Deleting waveform file(s) from HDD/SSD"
F8	Accessory	Sets other functions. ☞ 2.8 "Other Functions"

2.2 Setting Frequency

Pressing F1 from page 1 of the main function menu, or pressing Frequency (Frequency) displays the Frequency function menu. A cursor will be displayed on one of the digits displaying the frequency. This section describes operation methods for when the Frequency function menu is displayed, unless otherwise specified.

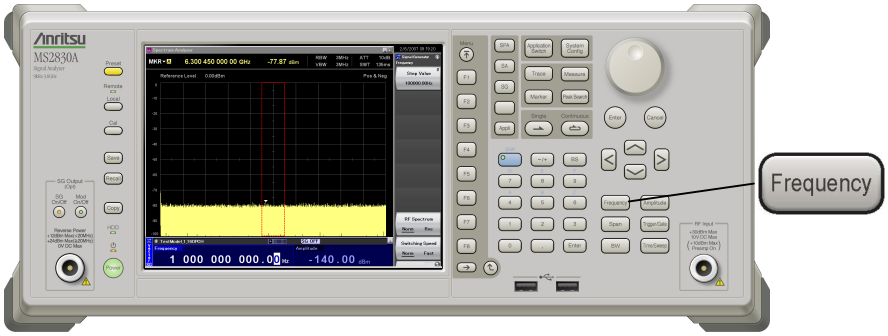


Figure 2.2-1 Frequency key

Setting range, maximum resolution setting, and minimum resolution setting of the frequency

Frequency setting range:

Option 020/120: 250 kHz to 3600 MHz

Option 021/121: 250 kHz to 6000 MHz

Maximum resolution setting of frequency: 1000000000.00 Hz

Minimum resolution setting of frequency: 0.01 Hz

If the frequency setting exceeds the above range an error message will be displayed.

The frequency can be set using the following.

- Numeric keypad
- Rotary knob
- Step keys

2.2.1 Display description

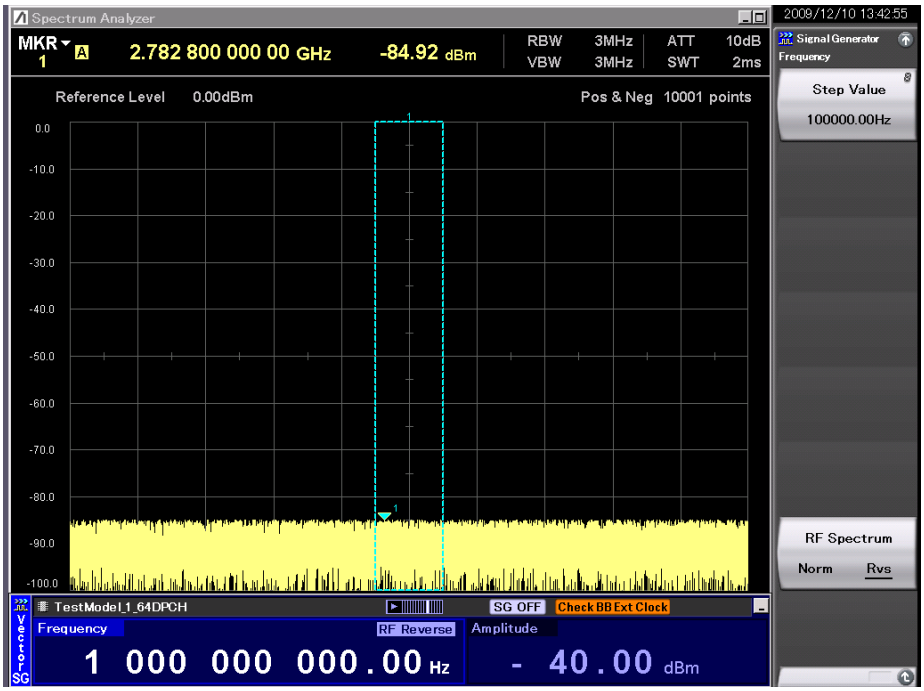


Figure 2.2.1-1 Frequency setup screen

This section describes the frequency setup screen display.

Table 2.2.1-1 Status display

Actual View	Display	Description
RF Reverse	RF Reverse	Indicates that it is set to reverse the spectrum of RF output.

Table 2.2.1-2 Alarm display

Actual View	Display	Description
Check BB Ext Clock	Check BB Ext Clock	Indicates that the frequency is not locked when the external reference signal source is valid.

Table 2.2.1-3 Frequency function menu

Function Key	Menu Display	Function
F1	Step Value	Sets the incremental or decremental value of the frequency that is used when a step key (or) is pressed. 2.2.4 “Using step keys to set frequency”
F7	RF Spectrum (Norm/Rvs)	Reverses an RF output spectrum. 2.2.5 “Reversing RF signal spectrum”

2.2.2 Using numeric keypad to set frequency

The numeric keypad can be used to set numeric values and their units for the frequency.

Example: Setting the frequency to 360.3 MHz

<Procedure>

1. Press one of the numeric keypad numeric keys (3 is pressed in this example). The frequency setup window (Freq. Value) opens with the numeric character "3" displayed.

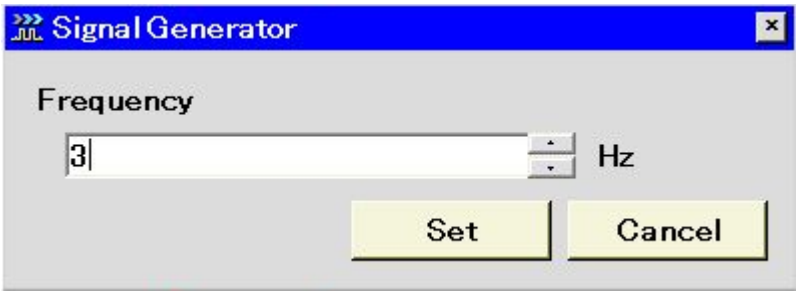


Figure 2.2.2-1 Frequency setup window

2. After pressing 3 6 0 . 3, press F2 (MHz) to set the frequency to 360.3 MHz.
3. When the unit function key (F2 in this example) is pressed, the numeric value and its unit are set, and at the same time, the frequency setup window closes. The frequency setup screen displays "360 300 000.00 Hz."

Figure 2.2.2-2 Frequency setup window

All digits past 0.01 Hz are rounded down.

2.2.3 Using rotary knob to set frequency

Use of the rotary knob makes it possible to increment or decrement the numeric value of the resolution digit (cursor position) that has been selected using < >. To use the rotary knob to set a frequency, follow the procedure below:

Initial setting of resolution digit (cursor position): 0.01 Hz digit

Example: Changing the frequency from the current value (360.3 MHz) to 360.7 MHz in steps of 100 kHz

<Procedure>

1. Move the cursor to the 100 kHz digit using < > (pressing < seven times moves it to that digit).

Figure 2.2.3-1 Frequency display

2. Turning the rotary knob clockwise increments the frequency in steps of 100 kHz. Turning it counterclockwise decrements the frequency in 100 kHz steps. Turn the knob clockwise in this manner to set the frequency to 360.7 MHz.

2.2.4 Using step keys to set frequency

[▲] [▼] can be used to increment or decrement the frequency in steps of the preset frequency.

Initial setting of frequency step: 100 kHz

Example: Setting the frequency to 360.3 MHz and incrementing or decrementing it in steps of 12.5 kHz

<Procedure>

1. After pressing [3] [6] [0] [.] [3], press [F2] (MHz) to set the frequency to 360.3 MHz.
2. Press [F1] (Step Value) to display the frequency step setup window.

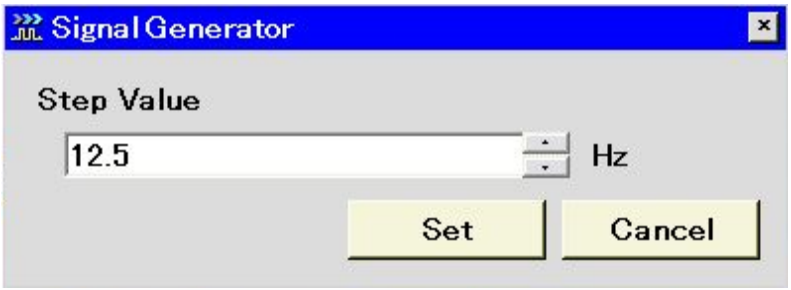


Figure 2.2.4-1 Frequency step setup window

3. After pressing [1] [2] [.] [5], press [F3] (kHz) to set the frequency step to 12.5 kHz. The window closes after the setup.
4. In the frequency setup window, pressing [▲] once increments the frequency by 12.5 kHz, changing it to 360.3125 MHz. Pressing [▼] once in this state decrements the frequency by 12.5 kHz, returning it to 360.3 MHz. The frequency can be incremented or decremented in the specified steps (12.5 kHz in this example) by using [▲] [▼] in this manner.

2.2.5 Reversing RF signal spectrum

This function reverses an RF signal spectrum when modulation is On.

Initial setting of RF Spectrum: Normal

Example: Reversing and restoring an RF signal spectrum

<Procedure>

1. Press F7 (RF Spectrum) to switch the mode from Normal to Reverse.

Figure 2.2.5-1 RF Reverse display

"RF Reverse" is displayed on the right side of the frequency display to indicate that the RF signal spectrum is reversed.

2. Press F7 (RF Spectrum) again to switch the mode back from Reverse to Normal.

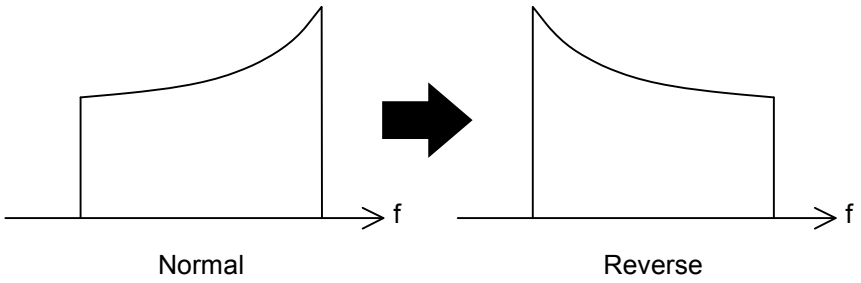


Figure 2.2.5-2 Status of RF signal spectrum

2.3 Setting Output Level

Pressing F2 (Amplitude) from page 1 of the main function menu, or pressing Amplitude displays the Amplitude function menu. A cursor will be displayed on one of the digits displaying the output level. This section describes operation methods for when the Amplitude function menu is displayed, unless otherwise specified.

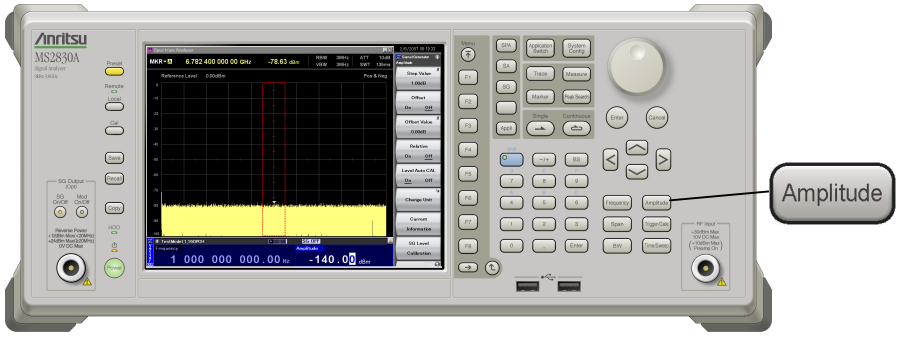


Figure 2.3-1 Amplitude key

The output level can be set using the following:

- Numeric keypad
- Rotary knob
- Step keys

Setting range, maximum resolution setting, and minimum resolution setting of the output level

Table 2.3-1 shows the output level setting range.

Table 2.3-1 Output level setting range

When Option 022/122 is NOT installed:

Units	Range
Power units	–40 to +20 dBm (>25 MHz) –40 to +2 dBm (≤ 25 MHz)
Voltage units (Open voltage display)	+73.01 to +133.01 dBμV (>25 MHz) +73.01 to +115.01 dBμV (≤ 25 MHz)
Voltage units (Termination voltage display)	+66.99 to +126.99 dBμV (>25 MHz) +66.99 to +108.99 dBμV (≤ 25 MHz)

When Option 022/122 is installed:

Units	Range
Power units	–136 to +15 dBm (>25 MHz) –136 to –3 dBm (≤ 25 MHz)
Voltage units (Open voltage display)	–22.99 to +128.01 dBμV (>25 MHz) –22.99 to +110.01 dBμV (≤ 25 MHz)
Voltage units (Termination voltage display)	–29.01 to +121.99 dBμV (>25 MHz) –29.01 to +103.99 dBμV (≤ 25 MHz)

Maximum resolution for output level: 100.00 dB
Minimum resolution for output level: 0.01 dB

2.3.1 Display description

This section describes the screen display in the output level setup mode.

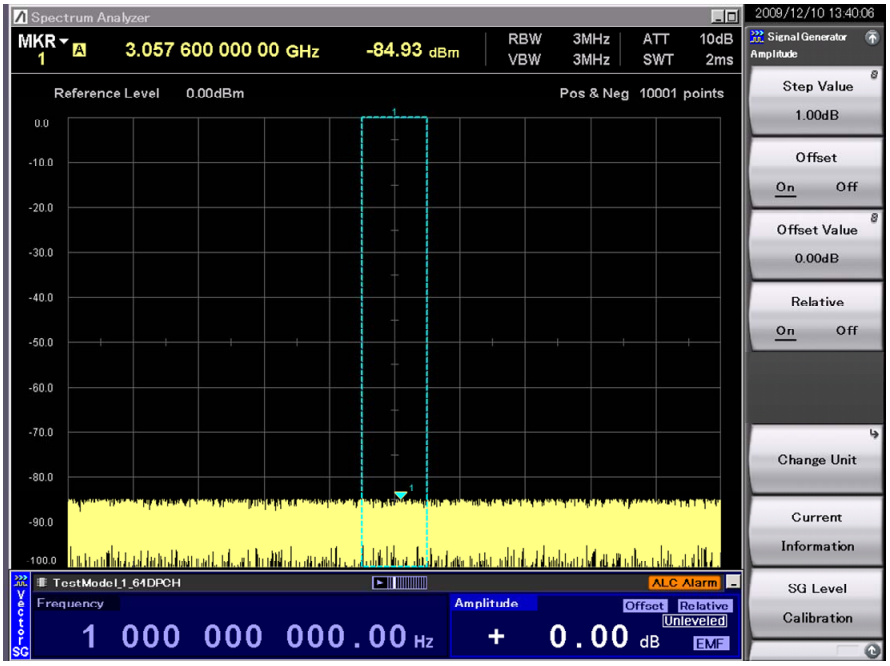


Figure 2.3.1-1 Output level setup screen

Table 2.3.1-1 Status display

Actual View	Display	Description
EMF	EMF	Indicates that the output level is set to open voltage display.
Term	Term	Indicates that the output level is set to termination voltage display.
Offset	Offset	Indicates that level offset is valid.
Relative	Relative	Indicates that the relative output level is displayed.
Unleveled	Unleveled	Indicates that the current output level is outside the performance guarantee range.

Table 2.3.1-2 Alarm display

Actual View	Display	Description
ALC Alarm	ALC Alarm	Indicates that the output level may not be a predetermined value.

Table 2.3.1-3 Amplitude function menu

Function Key	Menu Display	Function
F1	Step Value	Sets the incremental or decremental value (of the output level) that is used when a step key ( ) is pressed. 2.3.4 "Using step keys to change output level"
F2	Offset (On/Off)	Selects level offset function On/Off. 2.3.5 "Setting output level offset"
F3	Offset Value	Sets the level offset function offset value. 2.3.5 "Setting output level offset"
F4	Relative (On/Off)	Selects relative output level display function On/Off. 2.3.6 "Displaying relative level"
F6	Change Unit	Selects output level display unit (dBm, open voltage (EMF), termination voltage (Term)). 2.3.7 "Switching output level display unit"
F7	Current Information	Displays the RF output level (used when setting the offset or when the relative level is displayed). Also displays the reason when the status is "Unleveled." 2.3.8 "Displaying current amplitude"
F8	SG Level Calibration	Corrects the output level. 2.3.9 "Correcting RF output level"

2.3.2 Using numeric keypad to set output level

The numeric keypad can be used to set numeric values and their units for the output level.

Example: Setting the output level to –47 dBm

<Procedure>

1. Press one of the numeric keypad keys (first [−/+] in this example) to display the Level Value window. A [–] is displayed in the window at the same time. Each time [−/+] is pressed, switching between [+] (not shown) and [–] takes place. If a "–" is not displayed, press [−/+] again to display it.

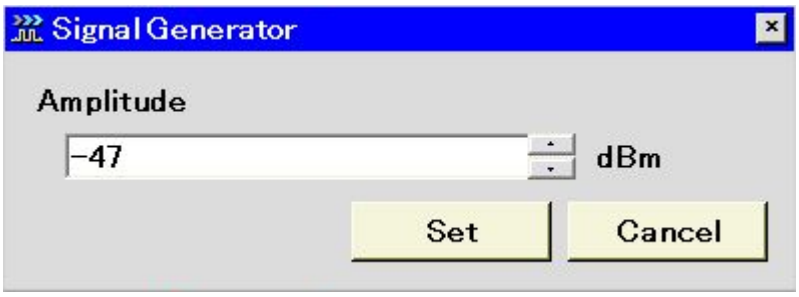


Figure 2.3.2-1 Output level setup window

2. Press [4] [7] to display "–47" in the window.
3. Press [F7] (Set) to set the numeric value and unit. The Level Value window closes at the same time. The output level setup screen displays the output level as "–47.00 dBm".

The digits past 0.01 dB are rounded down.

2.3.3 Using rotary knob to change output level

The rotary knob can be used to increment or decrement the numeric value of the resolution digit (at the cursor position) that has been selected using < >.

Initial setting of resolution digit (cursor position): 0.01 dB digit

Example: Changing the output level from the current value, –47 to –37 dBm in 1 dB steps.

<Procedure>

1. Move the cursor to the 1 dB digit using < > (pressing < twice moves the cursor to that digit).

Figure 2.3.3-1 Output level display

2. Turning the rotary knob clockwise increments the output level in 1 dB steps. Turning the knob counter-clockwise decrements the output level in 1 dB steps. Turn the rotary knob clockwise in this way to set the output level to –37 dBm.

2.3.4 Using step keys to change output level

[∧] [∨] can be used to increment or decrement the output level in steps of the preset output level.

Initial setting of output level step: 1 dB

Example: Setting the output level to −47 dBm, and incrementing or decrementing it in 6 dB steps.

<Procedure>

1. After pressing [−/+] [4] [7], press [F7] (Set) to set the output level to −47 dBm.
2. Press [F1] (Step Value) to display the output level step setup window.

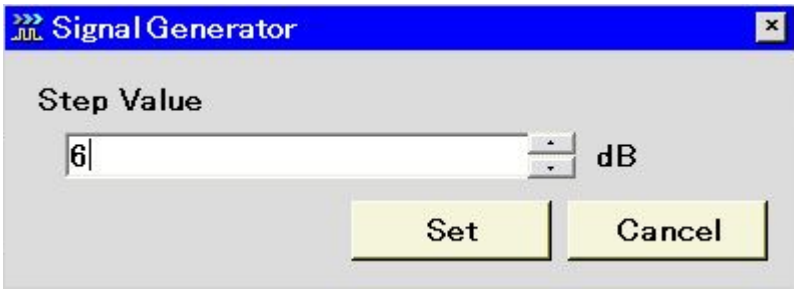


Figure 2.3.4-1 Output level step setup window

3. Press [6] and then [F7] (Set) to set the level step to 6 dB. The window closes at the same time the setup completes.
4. In the output level setup screen, pressing [∧] once increments the output level by 6 dB, changing it to −41 dBm. Pressing [∨] once in this state decrements the output level by 6 dB, returning it to −47 dBm. The output level can be incremented or decremented in the specified steps (6 dB in this example) by using [∧] [∨] in this manner.

2.3.5 Setting output level offset

The output level offset setting function offsets the RF output level by the offset level and displays the resulting level on the screen. This function is useful to correct the attenuation of the RF cable externally connected to the MS2830A.

[Resulting output level] = [Actual RF output level] + [Offset level]

Press F7 (Current Information) from the Amplitude function menu while the level offset function is On, to display and check the actual RF output level.

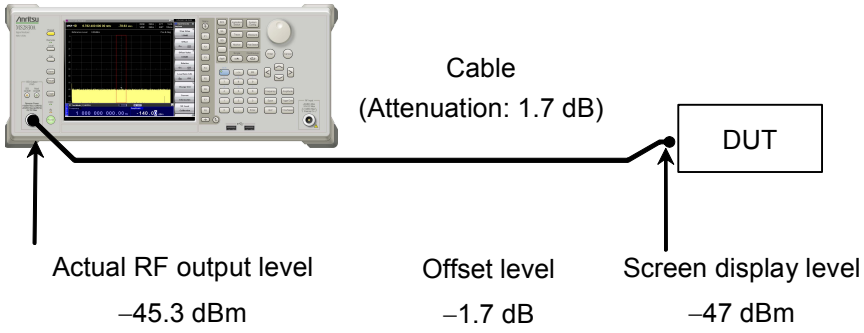


Figure 2.3.5-1 Outline of offset level

Setting range: –100.00 to +100.00 dB
Minimum resolution for offset level: 0.01 dB

Example: Setting the offset level to –1.7 dB and the output level after offset to –47 dBm

<Procedure>

1. Press F3 (Offset Value) to display the offset level setup window.

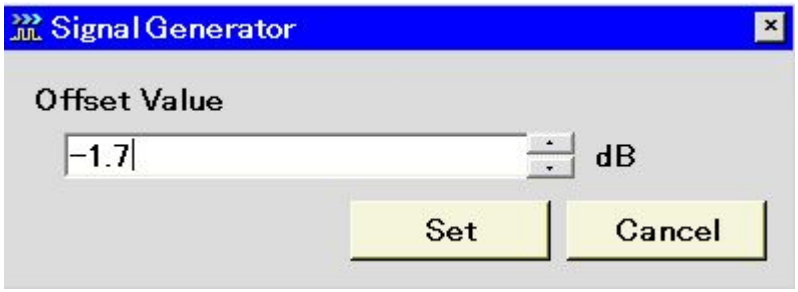


Figure 2.3.5-2 Offset level setup window

2. After pressing –/+ 1 . 7, press F7 (Set) to set the offset level to –1.7 dB. The window closes at the same time the setup completes.
3. Press F2 (Offset On/Off) to turn on the offset mode, unless the cursor is already moved to the On portion. "Offset" is displayed above the output level display, to indicate the offset setting state.
4. After pressing –/+ 4 7, press F7 (Set) to set the output level to –47 dBm. "–47.00 dBm" is displayed on the screen. At this time, the actual output level is –45.3 dBm.

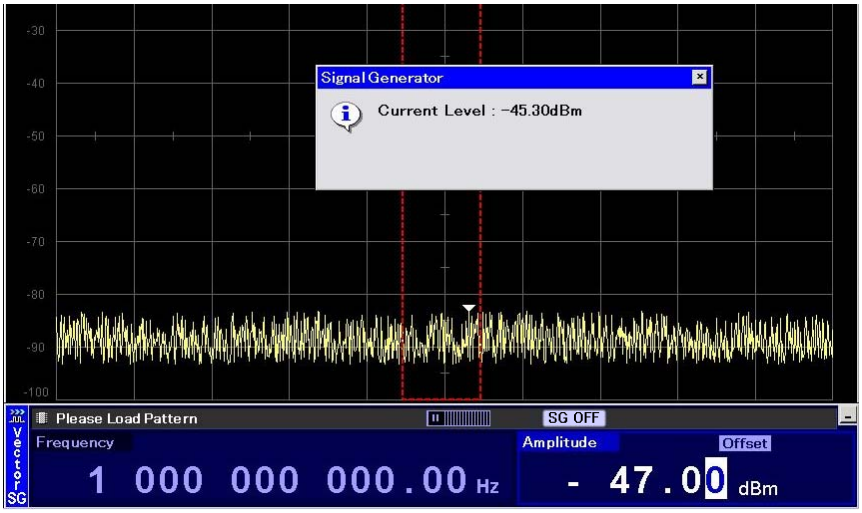


Figure 2.3.5-3 Output level confirmation window

2.3.6 Displaying relative level

The relative output level display function displays the output level as a relative value based on a reference output level regarded as 0 dB.

[RF output level] = [Screen display level]
+ [Output level for change to relative level display]

Example: Increasing the level by 7.5 dB in relation to –47 dBm

<Procedure>

1. After pressing [–/+] [4] [7], press [F7] (Set) to set the output level to –47 dBm.
2. Press [F4] (Relative On/Off) to turn on relative level display. The MS2830A enters the relative level display mode with the current output level (–47 dBm) as the reference level. The displayed output level, –47.00 dBm, changes to +0.00 dB. In addition, "Relative" is displayed on the right of the output level display, to indicate that the relative level is currently displayed.

Figure 2.3.6-1 "Relative" display

3. After pressing [7] [.] [5], press [F7] (Set) to set the relative level to 7.5 dB. Although the level displayed is 7.50 dB, the actual output level is –47 dBm + 7.5 dB, i.e., –39.5 dBm.

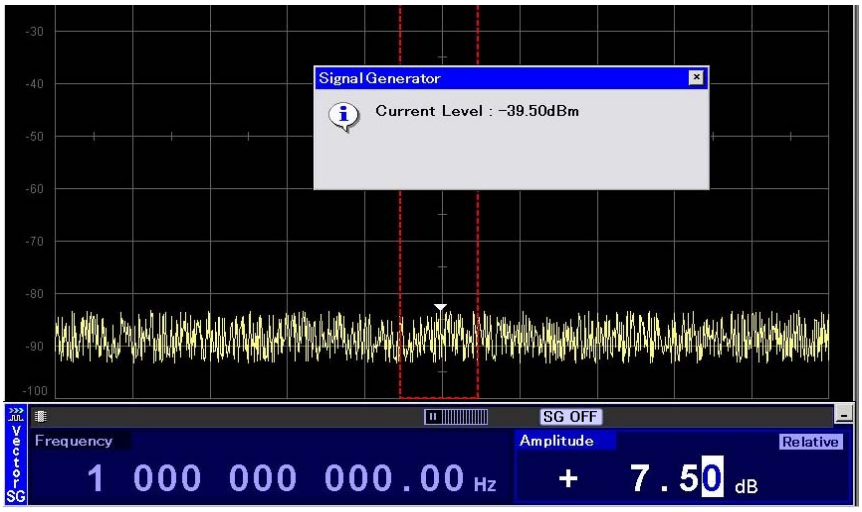


Figure 2.3.6-2 Output level confirmation window

2.3.7 Switching output level display unit

The output level display unit (dBm, open voltage (EMF), or termination voltage (Term)) can be selected.

Example: Setting the output level to –83.01 dBm in dBm display and then switching it to open voltage or termination voltage display

<Procedure>

1. After pressing [–/+] [8] [3] [.] [0] [1], press [F7] (Set) to set the output level to –83.01 dBm.
2. Press [F6] (Change Unit) to display the Change Unit function menu.
3. Press [F3] (dBμV (EMF)) to change the output level display to the open voltage display ("30.00 dBμV" is displayed in this example). "EMF" (abbreviation of Electro Motive Force) is displayed on the right of the output level display.

Figure 2.3.7-1 EMF display

4. Press [F6] (Change Unit) to display the Change Unit function menu.
5. Press [F2] (dBμV (Term)) to change the output level display to the termination voltage display ("23.98 dBμV" is displayed in this example). "Term" (Terminate) is displayed on the right of the output level display.

Figure 2.3.7-2 Term display

2.3.8 Displaying current amplitude

The current output level is displayed. The output level display unit will however be dBm, even if display unit switching, offset change, or relative change have been performed. In addition, the reason will be displayed if the Amplitude status is "Unleveled."

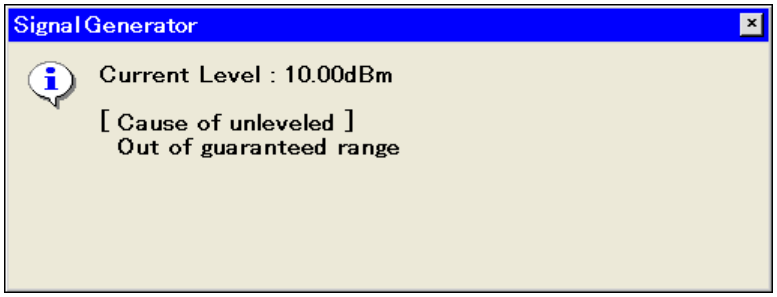


Figure 2.3.8-1 Output level display window

2.3.9 Correcting RF output level

In a normal operation status, signals are always output at a stable level thanks to the ALC loop circuit. If modulation is on, the ALC loop circuit will be held, but performing any of the following operations will enable automatic level calibration.

- Changing the frequency
- Changing the output level
- Selecting a pattern

If used with the same settings for a long time, level calibration is useful for removing temperature drifts. Pressing F8 (SG Level Calibration) starts output level calibration.

2.3.10 Turning RF output on/off

Pressing the On/Off key on the front panel, or pressing F8 (SG Output) from page 1 of the main function menu switches the RF output between On and Off. Once the RF output is turned on, the red SG On/Off key lamp lights up and the currently set signal is output.

Note:

It is recommended that the setting process of the MS2830A parameters be completed, with the RF output off, before the RF output be turned on. This prevents damage of the measured target that is connected to the RF output.

Initial setting of RF Output: Off

Example: Turning the RF output on an then off again

<Procedure>

1. Press F8 (SG Output) to turn on the RF output (the lamp lights up).
2. Press F8 (SG Output) to turn off the RF output (the lamp goes off).

2.4 Setting Modulation Function

The Signal Generator function is capable of reproducing waveform patterns and performing vector modulation with those patterns.

Waveform patterns are stored in the pattern files on the internal HDD/SSD. A folder that contains patterns classified by type is called a package.

To reproduce a waveform pattern, first, a package and patterns sorted on the internal HDD/SSD must be loaded into the waveform memory.

Next, select the patterns to be output from the patterns expanded on the waveform memory.

AWGN can be added to the selected waveform patterns.

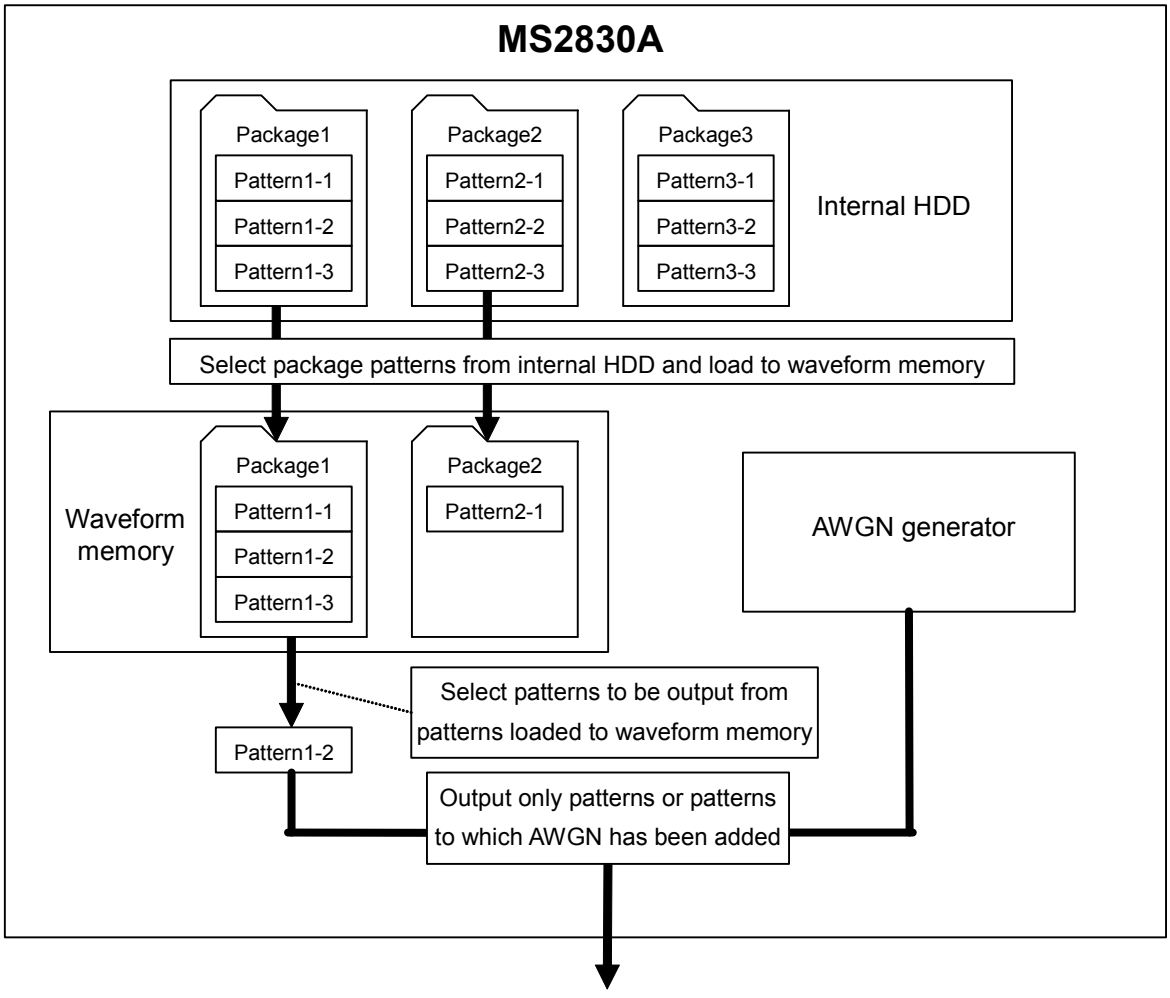


Figure 2.4-1 Outline of waveform pattern output

2.4.1 Loading waveform pattern(s) to memory

This section describes how to load waveform patterns to the waveform memory.

Note:

To load waveform patterns to the waveform memory, license files associated with each pattern must be installed. For installing license files, refer to the *MS2830A Signal Analyzer Operation Manual (Mainframe Operation)* or *MS2840A Signal Analyzer Operation Manual (Mainframe Operation)*.

Pressing F4 (Load Pattern) displays the waveform file load window. In this window, waveform files stored on the internal HDD/SSD are loaded to the waveform memory integrated in the MS2830A.

This section describes operation methods for when the waveform file load window is displayed, unless otherwise specified.

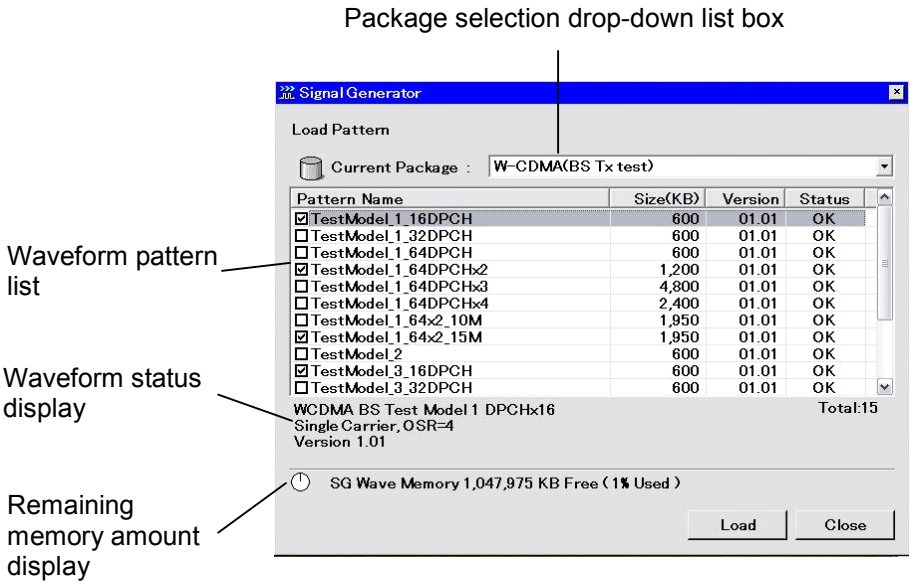


Figure 2.4.1-1 Waveform file load window

Table 2.4.1-1 Display items on waveform file load window

Display	Description
Package selection drop-down list box	Selects the package.
Waveform pattern list	Displays a list of the waveform patterns in the package.
Waveform status display	Displays comments and statuses of the waveform pattern.
Remaining memory amount display	Displays the amount of free memory space.

Example: Loading waveform files to the waveform memory of the MS2830A

<Procedure>

1. Press F4 (Load Pattern) from page 1 of the main function menu to display the waveform file load window.
2. Pressing Enter displays the package on the package selection list. Using the step keys or the rotary knob, align the cursor with the package that includes the desired waveform patterns and press Enter.
3. A list of waveform patterns is displayed. Using F1 (Change Focus), the step keys, or the rotary knob, align the cursor with the waveform pattern to be loaded and press Enter to select that pattern (if you press Enter again, the pattern check box will be cleared). To select all the pattern waveforms, press F2 (Select All).

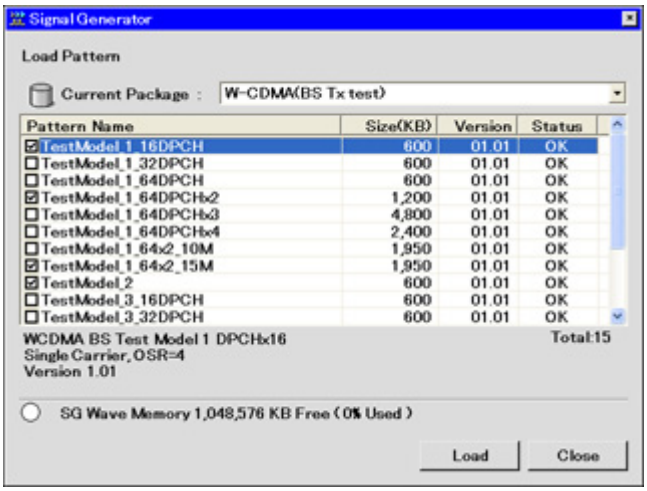


Figure 2.4.1-2 Checking waveform pattern check boxes

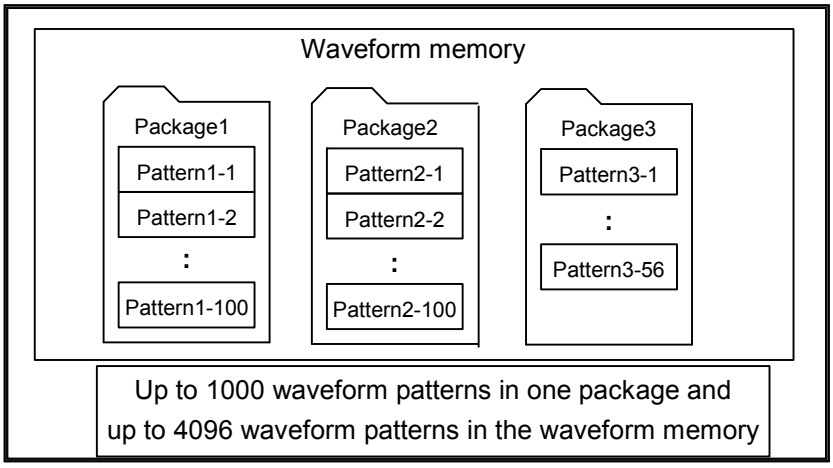
4. Press F7 (Load) to load patterns to the waveform memory.
5. During the loading of pattern files, the progress bar window is displayed.
   If Cancel is pressed while the progress bar window is displayed, the loading of pattern files is aborted.
6. Once the loading of waveform files is complete, the progress bar window closes. The remaining memory amount display changes according to the total amount of loaded waveform files.

Figure 2.4.1-3 Remaining memory amount display

Up to 4096 pattern files and 100 packages can be loaded to the waveform memory.

Up to 1000 waveform files can be stored in one package on the waveform memory.

If the total amount of the waveform patterns to be loaded is larger than the remaining amount of waveform memory, loading fails and an error message will be displayed. In such a case, delete waveform patterns from the waveform memory to secure the required amount of waveform memory space.



Notes:

1. Do not insert or remove the USB memory during waveform pattern loading.

2. When Option 027/127 is installed, the maximum file size to be loaded to waveform memory is calculated as: 1 GByte – 8 Byte.

2.4.2 Selecting waveform pattern(s)

This section describes how to select waveform patterns loaded to the waveform memory.

Pressing F3 (Select Pattern) from page 1 of the main function menu displays the waveform file selection window. In this window, select the desired waveform patterns loaded to the waveform memory. The selected waveform patterns will then be output.

This section describes operation methods for when the waveform file load window is displayed, unless otherwise specified.

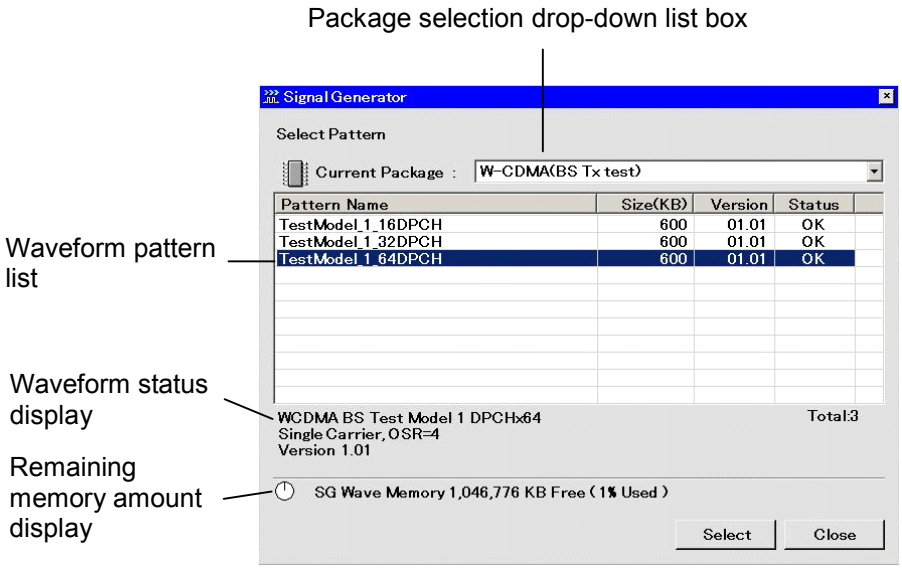


Figure 2.4.2-1 Waveform file selection window

Table 2.4.2-1 Display items on waveform file selection window

Display	Description
Package selection drop-down list box	Selects the package.
Waveform pattern list	Displays a list of the waveform patterns in the package.
Waveform status display	Displays comments and statuses of the waveform pattern.
Remaining memory amount display	Displays the amount of free memory space.

Example: Selecting waveform files from waveform memory of the MS2830A

<Procedure>

1. Press F3 (Select Pattern) from page 1 of the main function menu to display the waveform file selection window.
2. Pressing Enter displays the package on the package selection list. Using the step keys or the rotary knob, align the cursor with the package that includes the desired waveform patterns and press Enter.
3. A list of waveform patterns is displayed. Using F1 (Change Focus), the step keys, or the rotary knob, align the cursor with the waveform pattern to be loaded and press F7 (Select) or Enter to select that pattern.
4. When a waveform is selected, the status of the selected waveform pattern changes from **OK** to **Selected** on the waveform list.

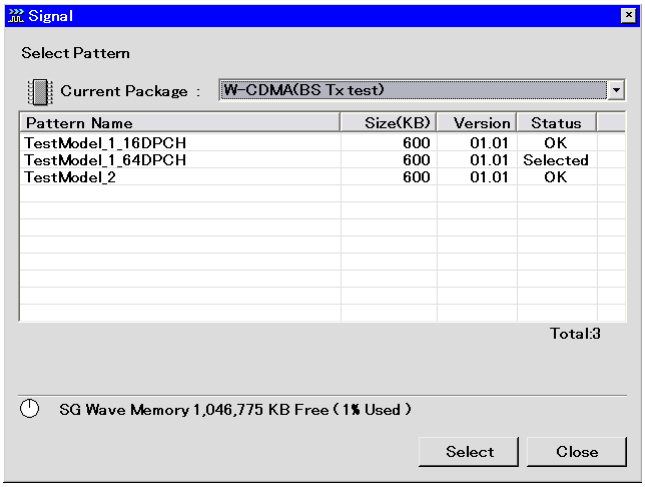


Figure 2.4.2-2 Status display of selected waveform patterns

AWGN can be added to a waveform pattern when outputting it. Refer to Section 2.5 “AWGN Addition Function” for details of the AWGN function.

After preset operations have been performed, the selection of waveform patterns is released and waveform patterns are left unselected. Waveform patterns that have been loaded to the waveform memory, however, are retained.

2.4.3 Deleting waveform file(s) from waveform memory

This section describes how to delete waveform files loaded to the waveform memory.

Pressing F3 (Select Pattern) from page 1 of the main function menu displays the waveform file selection window, and pressing F4 (Load Pattern) displays the waveform file load window. The deletion of waveform patterns from the waveform memory can be performed in the waveform file selection window or the waveform file load window.

This section describes operation methods for when the waveform file selection window is displayed, unless otherwise specified.

Example: Deleting a selected waveform file from the waveform memory

<Procedure>

1. Press F3 (Select Pattern) from page 1 of the main function menu to display the waveform file selection window.
2. Select from the package selection drop-down list box the package in which the desired waveform pattern is stored.
3. A list of waveform patterns will be displayed. Move the cursor to the waveform which is to be deleted.

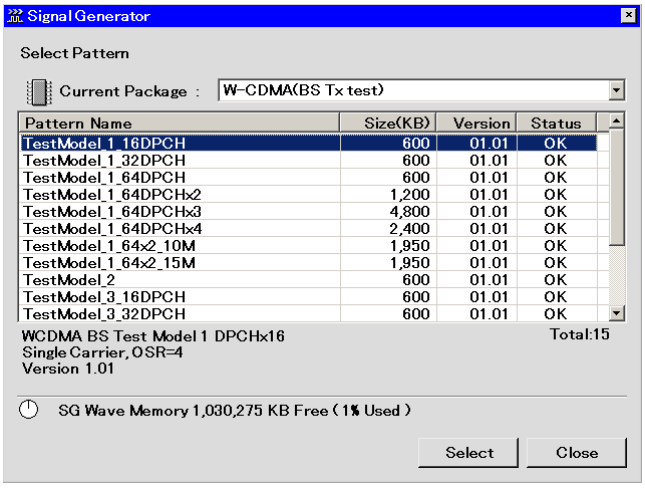


Figure 2.4.3-1 Selecting waveform pattern to be deleted

4. Press F3 (Delete Pattern) to delete the selected waveform pattern from the waveform memory.

   Even if a waveform pattern is deleted from the waveform memory, it can be reloaded as long as the deleted waveform file is stored on the HDD/SSD.

Example: Deleting all waveform files from the waveform memory

<Procedure>

1. Press F3 (Select Pattern) or F4 (Load Pattern) from page 1 of the main function menu to display the waveform file selection window or waveform load window.
2. Press F4 (Clear Wave Memory) to delete all waveform patterns from the waveform memory.

   Even if a waveform pattern is deleted from the waveform memory, it can be reloaded as long as the deleted waveform file is stored on the HDD/SSD.

2.4.4 Copying waveform file(s) to HDD/SSD

The patterns to be used are stored in the C drive of the MS2830A internal HDD/SSD. Patterns can be copied from other devices to this drive.

The D drive (of the MS2830A internal HDD/SSD) and subsequent drives (assigned to an external device, such as USB memory stick) can be used as a pattern copy source.

Store the pattern to be copied in the device as follows.

```
<Device root folder>
    |
    +---<Folder with the same name as the package>
            |
            +<Waveform pattern (*.wvi, *.wvd)>
```

Example: Copying a waveform file from USB memory to the internal HDD/SSD

<Procedure>

1. Insert the USB memory containing the waveform pattern into the USB slot of the MS2830A.
2. Press F6 (Copy Pattern File to HDD/SSD) from page 2 of the main function menu.
3. Press F1 (Device) to display the Device selection screen.
4. Select the Device corresponding to the USB memory and press F7 (Set).
5. Press F8 (Select Copy Package) to display the "Copy Package to HDD/SSD" screen.
6. Move the cursor to the package to be copied and press Enter to select the check box. Pressing F2 (Select All) selects all check boxes.
7. Press F7 (Copy).

Example: Copying a waveform file from the D drive of the MS2830A to the internal HDD/SSD

<Procedure>

1. Press F6 (Copy Pattern File to HDD/SSD) from page 2 of the main function menu.
2. Press F1 (Device) to display the Device selection screen.
3. Select the drive (D:) and press F7 (Set).
4. Press F8 (Select Copy Package) to display the "Copy Package to HDD/SSD" screen.
5. Move the cursor to the package to be copied and press Enter to select the check box. Pressing F2 (Select All) selects all check boxes.
6. Press F7 (Copy).

2.4.5 Deleting waveform file(s) from HDD/SSD

This section describes how to delete waveform files from the HDD/SSD.

Example: Deleting a waveform file from the internal HDD/SSD

<Procedure>

1. Press F7 (Delete Pattern File on HDD/SSD) from page 2 of the main function menu to display the internal HDD/SSD edit window.
2. Select the package in which the waveform file to be deleted is stored from the package selection drop-down list box.

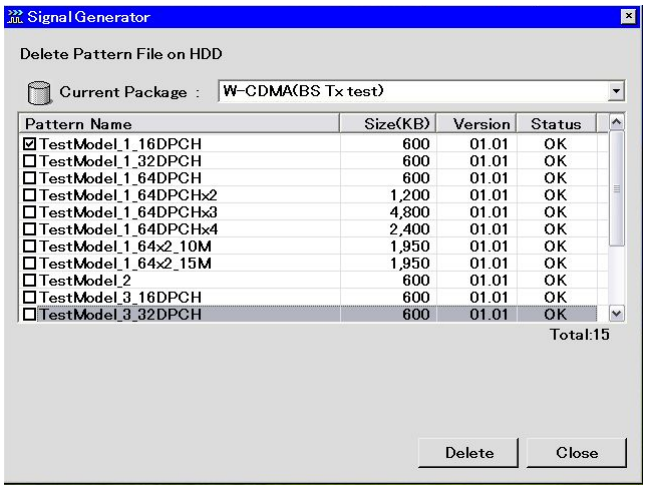


Figure 2.4.5-1 Internal HDD/SSD edit window

3. Move the cursor to the package to be deleted and press Enter to select the check box. Pressing F2 (Select All) selects all check boxes.
4. Press F7 (Delete) to display the confirmation window. Click [OK] to delete the checked waveform files from the internal HDD/SSD.

Do not power off the MS2830A while deleting waveform files.

Note that the waveform files deleted from the internal HDD/SSD cannot be restored.

2.4.6 Turning modulation signal on/off

Press the Mod On/Off key on the front panel, or the F7 (Modulation) button from page 1 of the main function menu to turn modulation on and off. When RF output is on, the green LED on the Mod On/Off key turns on and signals are modulated.

Initial setting value of Modulation: Off

Example: Turning Modulation on and then off again

<Procedure>

1. Press F7 (Modulation) to turn modulation on (the lamp lights up).
2. Press F7 (Modulation) again to turn modulation off (the lamp turns off).

2.4.7 Re-outputting Pattern Beginning at Head

When the tail of the waveform pattern is reached, control automatically returns to the head and the waveform pattern is output repeatedly if no trigger signal is input from the external system. By pressing F6 (Waveform Restart), the waveform pattern can be re-output, beginning at the head, at any time.

Condition for using Waveform Restart

This function can only be used when a waveform pattern is selected.

2.4.8 Displaying information of selected waveform pattern

Pressing F3 (Baseband Information) from page 2 of the main function menu displays the information of the currently selected waveform pattern. A blank will be displayed if no waveform is selected.

Figure 2.4.8-1 Information of selected waveform pattern

Table 2.4.8-1 Status display

Actual Display	Display	Description
Modulation	Modulation	Indicates that Modulation is turned on. Nothing will be displayed if Modulation is turned off.
Pulse Mod Int Pulse Mod Ext	Pulse Mod Int Pulse Mod Ext	Indicates the pulse modulation setting. Nothing will be displayed if pulse modulation is turned off.

2.5 AWGN Addition Function

When Option 028/128 is installed, AWGN can be digitally added to the selected waveform pattern. This function is useful when testing reception sensitivity.

This section describes how to use the AWGN addition function. In this section, the waveform currently selected is handled as the desired waveform.

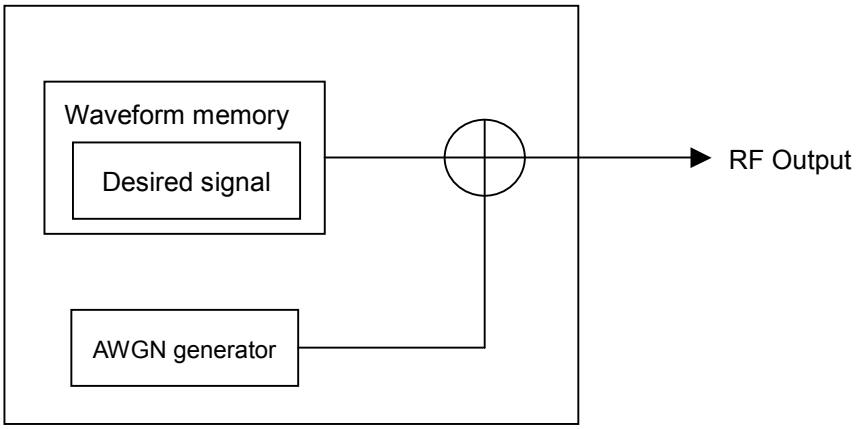
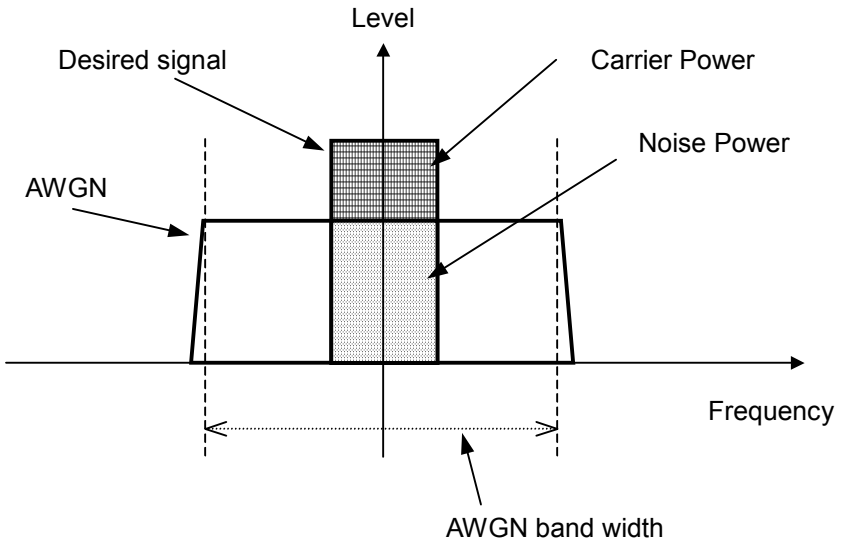


Figure 2.5-1 Outline of AWGN addition function

Specifications of AWGN to be added



Carrier Power:	Output level of the desired signal
Noise Power:	Value of the AWGN output level converted by the signal band of the desired signal (not displayed on the screen)
C/N Ratio:	Level ratio between Carrier Power and Noise Power
Amplitude:	Sum of the output level of the desired signal and the AWGN output level

Figure 2.5-2 AWGN specifications

The AWGN bandwidth is the sampling clock value of the desired signal.

Example:
If the conditions of the desired signal are as follows:

- WCDMA
- Band width = 3.84 MHz
- Over sampling = 4 times

AWGN band width
= Sampling clock
= 3.84 MHz × 4
= 15.36 MHz

Restrictions on the AWGN addition function

The settable range of each parameter of the AWGN addition function is restricted as follows.

- –40 dB ≤ C/N Ratio ≤ +40 dB
- Amplitude = Output level of desired signal + AWGN output level ≤ 0 dBm

If the Amplitude is around 0 dBm, the settable range of the C/N Ratio will be restricted to a range in which the Amplitude does not exceed 0 dBm.

2.5.1 Display description

Pressing F5 (AWGN Setup) from page 1 of the main function menu displays the AWGN setup screen.

This section describes the AWGN addition function screen display.

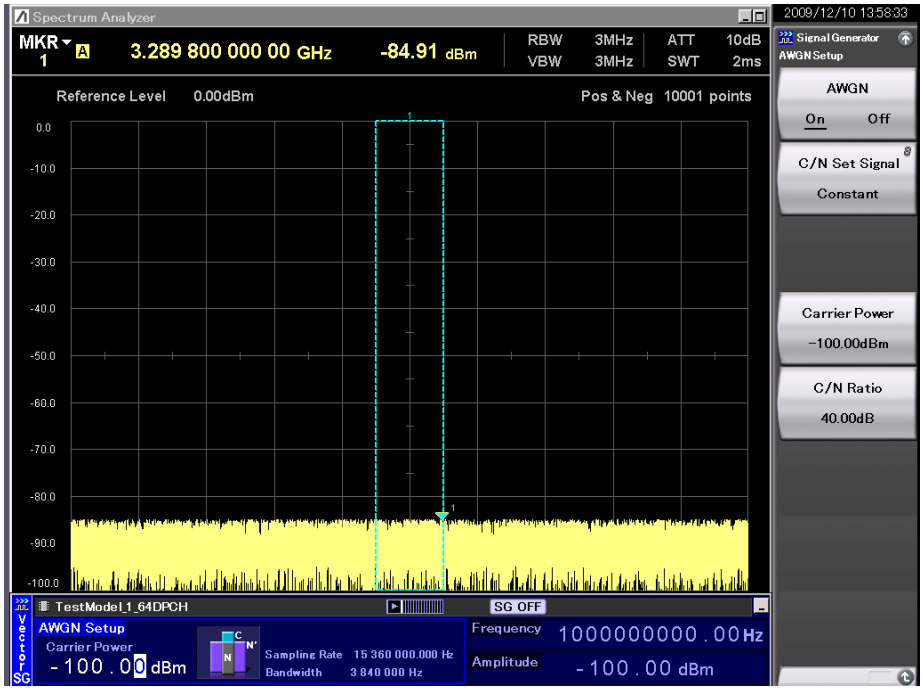


Figure 2.5.1-1 AWGN setup screen (Carrier Power display)

Figure 2.5.1-2 AWGN setup screen (C/N Ratio display)

Table 2.5.1-1 Display items on AWGN setup screen

Display	Description
Carrier Power display	Displays the output level of the desired signal.
C/N Ratio display	Displays the level ratio between the desired signal and band-converted AWGN.

Table 2.5.1-2 AWGN function menu

Function Key	Menu Display	Function
F1	AWGN (On/Off)	Switches between AWGN On and Off. ☞ 2.5.2 “Setting AWGN on/off”
F2	C/N Set Signal	Sets whether the C/N value is applied to Constant, Carrier, or Noise. ☞ 2.5.4 “Inputting C/N”
F4	Carrier Power	Sets the Carrier Power value. ☞ 2.5.3 “Inputting Carrier Power”
F5	C/N Ratio	Sets the C/N value. ☞ 2.5.4 “Inputting C/N”

2.5.2 Setting AWGN on/off

To add AWGN, set AWGN to On.

<Procedure>

1. Press F1 (AWGN On/Off) to select "On."
2. AWGN will be added to the desired signal and output.

To stop AWGN output, select Off in step 1 above.

The AWGN addition function can only be used if the following condition is met.

- Modulation is turned On

When AWGN is switched to On, the current RF output level value (Amplitude) is the output level value of the desired signal (Carrier Power). In addition, the RF output level itself increases because the AWGN output level value (Noise Power) has been added.

When AWGN is switched to Off, the current output level value of the desired signal (Carrier Power) is the RF output level value (Amplitude). The RF output level value itself, therefore, decreases.

2.5.3 Inputting Carrier Power

This function sets the output level of the desired signal.

Example: Setting Carrier Power to –100 dBm

<Procedure>

1. Press F4 (Carrier Power).
2. Then, press –/+ 1 0 0 to display the Carrier Power input window and press F7 (Set).

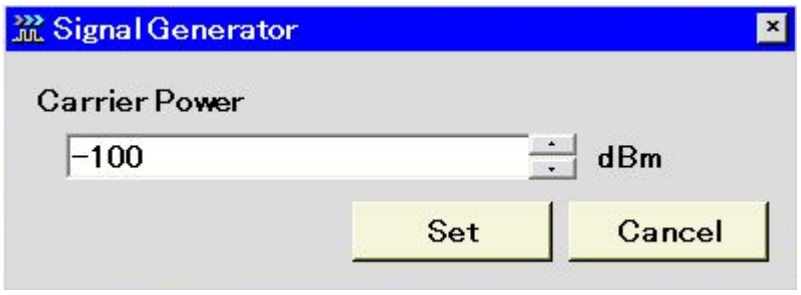


Figure 2.5.3-1 Carrier Power input window

2.5.4 Inputting C/N

This function sets the level ratio between Carrier Power and Noise Power. Depending on the C/N Set Signal setting, the input value will be reflected to the output level differently.

- C/N Set Signal: Carrier
  When the C/N Ratio is changed, Noise Power is fixed, and Carrier Power and the Amplitude change.
- C/N Set Signal: Noise
  When the C/N Ratio is changed, Carrier Power is fixed, and Noise Power and the Amplitude change.
- C/N Set Signal: Constant
  When the C/N Ratio is changed, the Amplitude is fixed, and Carrier Power and Noise Power change.

Note:

Noise Power will not be displayed on the screen.

Example: Setting C/N Set Signal Carrier to Carrier and C/N Ratio to –10 dB

<Procedure>

1. Press F2 (C/N Set Signal) to select Carrier.
2. Press F5 (C/N Ratio).
3. Then press –/+ 1 0 to display the C/N setup window and press F7 (Set).

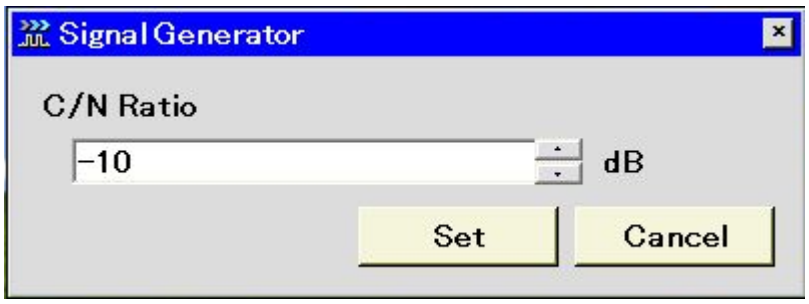


Figure 2.5.4-1 C/N setup window

2.6 Setting External I/O

Pressing F1 (Ext I/O Setup) from page 2 of the main function menu displays the Ext I/O Setup function menu, which is used to set the external I/O to be used for modulation or pattern reproduction.

2.6.1 Display description

This section describes the external I/O Setup screen display.

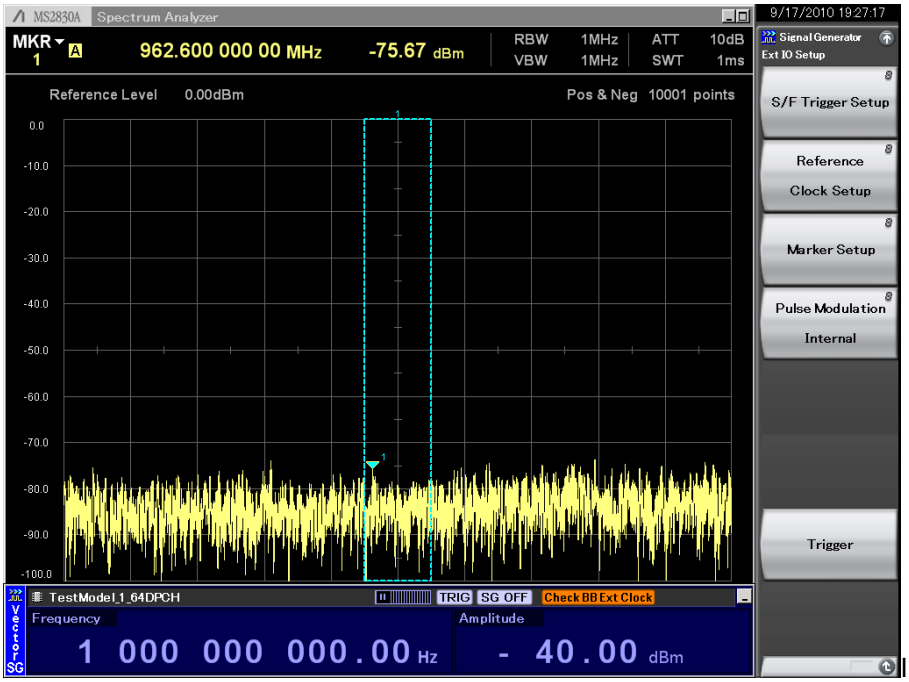


Figure 2.6.1-1 Ext I/O Setup screen

Table 2.6.1-1 Status display

Actual view	Display	Description
TRIG	TRIG	Indicates that the Start/Frame trigger is On. 2.6.2 "Setting Start/Frame trigger"

Table 2.6.1-2 Alarm display

Actual view	Display	Description
Check BB Ext Clock	Check BB Ext Clock	Indicates the state where frequency is not locked and the external reference signal source is in effect. 2.6.3 "Setting reference clock"

Table 2.6.1-3 Ext I/O Setup function menu

Function Key	Menu display	Function
F1	S/F Trigger Setup	Sets the Start/Frame trigger. ☞ 2.6.2 "Setting Start/Frame trigger"
F2	Reference Clock Setup	Sets the reference clock. ☞ 2.6.3 "Setting reference clock"
F3	Marker Setup	Sets the marker signal. ☞ 2.6.4 "Setting marker output"
F4	Pulse Modulation	Sets pulse modulation. ☞ 2.6.5 "Setting pulse modulation"
F7	Trigger	This becomes available when Trigger Source is Trigger Key. Pressingg this button will generate internal Trigger signal, and starts outputting Baseband signal.

2.6.2 Setting Start/Frame trigger

The Signal Generator function can output a waveform pattern in sync with a trigger signal incoming from an external system. This application can output waveform patterns which are in sync with external or internally-generated trigger signal. Either of two signals can be selected for the external trigger signal. One is Start Trigger, which specifies the output start position of the waveform pattern. The other is Frame Trigger, which specifies the output timing for each of the bursts when a burst signal is selected. The external trigger signal is input to the SG Trigger Input connector on the rear panel.

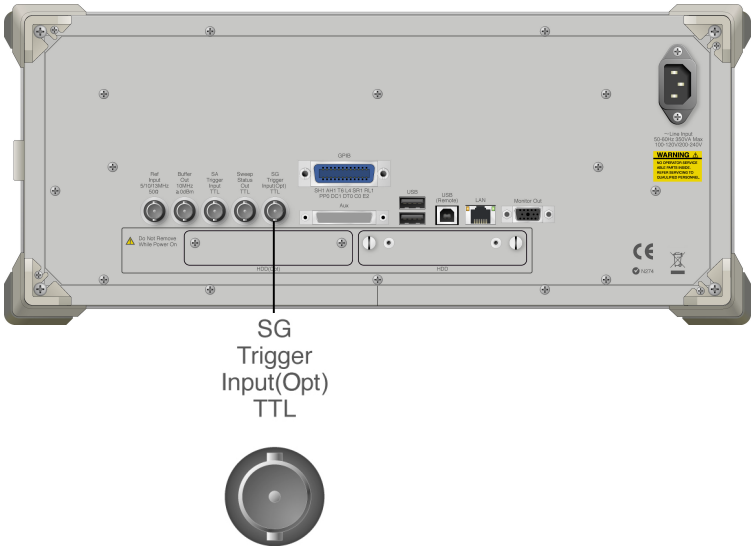


Figure 2.6.2-1 Connector connection location

Press F1 (S/F Trigger Setup) on the Ex IO Setup function menu to display the S/F Trigger Setup window. In this window, set the trigger. This section describes operation methods for when the Start/Frame Trigger Setup window is displayed, unless otherwise specified.

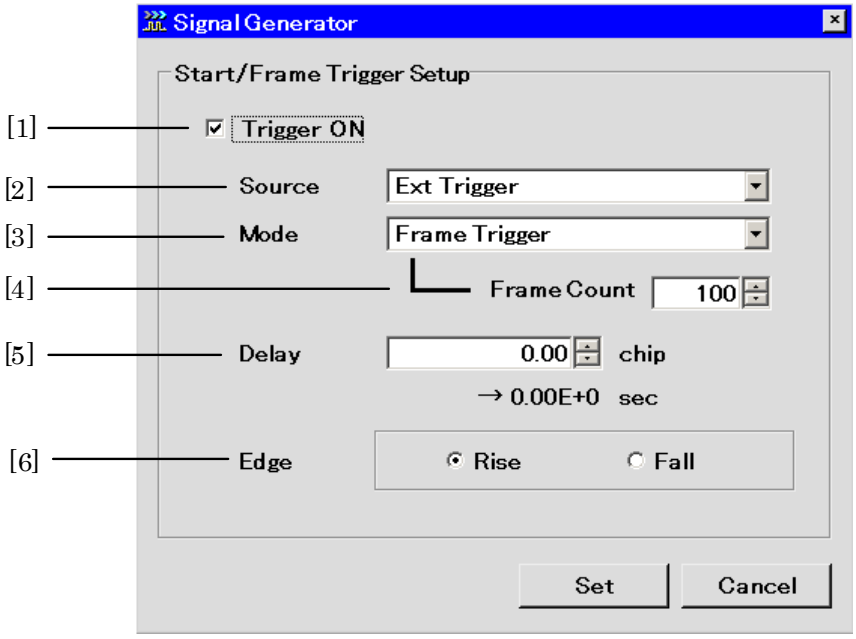


Figure 2.6.2-2 Start/Frame Trigger Setup window

This section describes each parameter.

The following are only valid when a waveform pattern is selected.

[1] Trigger (On/Off)
Enables the trigger.

The following are all enabled only when Trigger is set to [On].

[2] Source (Ext Trigger/Trigger Key/Bus/)
Selects trigger signal to use.

Ext Trigger :External Trigger Signal
Trigger Key :Pressing the Trigger function key generates trigger signal.
☞ Table 2.6.1-3 Ext I/O Setup function menu
Bus: Generates trigger signal with the reception of remote command "SFTGGENBUS" (Native mode) or with the "[:SOURce]:RADio:ARB:TRIGger:GENerate" (SCPI mode).

[3] Mode (Start/Frame)
Selects whether the trigger is used as a start or frame trigger.

[4] Frame Count
Signal is output for the number of specified frames. This is available when Mode is Frame Trigger.
Setting Range: 1 to 32767 (Default: 1)

[5] Delay
Sets the trigger delay amount.
Setting range: Depends on the selected pattern.
Minimum resolution setting: Depends on the waveform.
Displays the value calculated by converting the delay amount to the delay time.

[6] Edge (Rise/Fall)
Sets the trigger detection edges, and switches between rising and falling operations.

When the Mode or Delay setting is changed, the pattern operation will restart and await trigger inputs from the external system.

Trigger signal input conditions

The following are input conditions for the trigger signal that is used.

External trigger signal input conditions

Input level: TTL level

Polarity: Rise or Fall can be selected.

Waveform: Figure 2.6.2-3 shows a waveform for the rising edge.

T1: 40 ns or more

T2: 40 ns or more

Reference values T1 and T2 vary depending on the drive current impedance of the outputting source, the quality and length of the cable connected to the MS2830A.

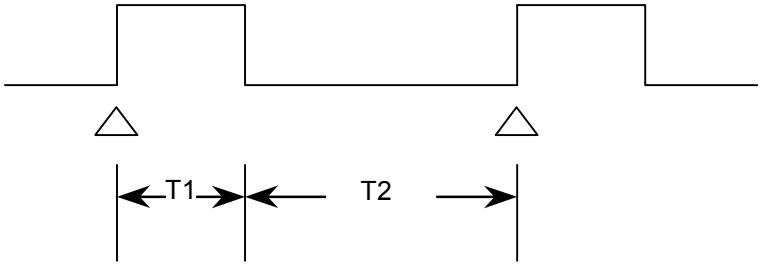


Figure 2.6.2-3 Trigger signal input conditions

Start Trigger Operation

Output of the Start Trigger operation starts with the rising timing of the first external trigger signal after the waveform pattern is selected. Any trigger signal being input from the second time or later will be disabled. The relationship between the external trigger signal and the waveform pattern output can be set in the Delay field. If Delay is set to [0], output of the waveform pattern is delayed by the one-frame* period (relative to the rise of the external trigger signal) that depends on the waveform pattern.

*: One-frame period refers to the following value:

(1) If the waveform pattern was generated using the IQproducer™ Convert function:
The number of samples of one frame is determined according to the Frame Length (L_f) and Gap Length (L_g) settings of Burst Setting. One-frame period indicates the number of samples within one frame, which equals $L_f + L_g$.

Example: If over sampling data of four times of W-CDMA is to be converted, set the following:
Frame Length = 3.84×10^6 [sample/s] × 0.01 [s] × 4 [Over sample ratio] = 153600

For details, refer to the *MS2690A/MS2691A/MS2692A and MS2830A/MS2840A Signal Analyzer Vector Signal Generator Operation Manual (IQproducer™)*.

(2) If the waveform pattern is generated using any of a number of IQproducer™ option signal generation applications:
The frame length matching each communication system is set automatically. In this case, the L_f and L_g values vary as follows, depending on whether your system is using continuous or burst signals.

- If the system is using continuous signals
  L_f = The number of samples of one frame for the system is set.
  L_g = 0 is set.
- If the system is using burst signals
  L_f = The number of samples of one slot or frame is set.
  L_g = [Number of samples of one frame] – [number of samples of one slot] or 0 is set.

Although the above details depend on the system, the resulting value is the number of samples of one frame where the value of [$L_f + L_g$] is determined depending on the system.

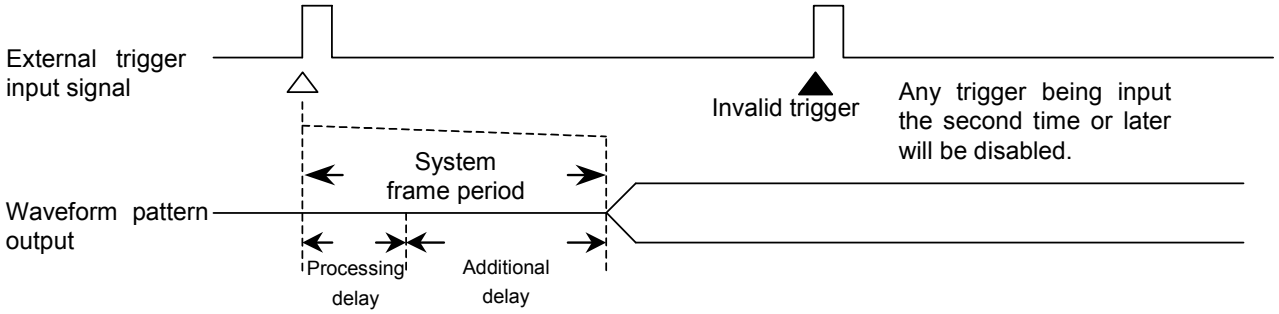


Figure 2.6.2-4 Start Trigger operation

Notes:

1. If Delay is set to 0, a delay is added internally to the processing delay that occurs between when the trigger is input and when the waveform pattern is output (added delay), causing the output of the waveform pattern to be delayed by one system Frame period.

2. The Frame period varies depending on the system. Refer to the operation manual of the currently selected waveform pattern.

Frame Trigger Operation

The Frame Trigger operation outputs one burst of the waveform pattern with the rising timing of the external trigger signal. The relationship between the external trigger signal and the waveform pattern output is the same as Start Trigger. The following figure shows operation that takes place when the external trigger signal is input with the frame period, with Delay set to [0].

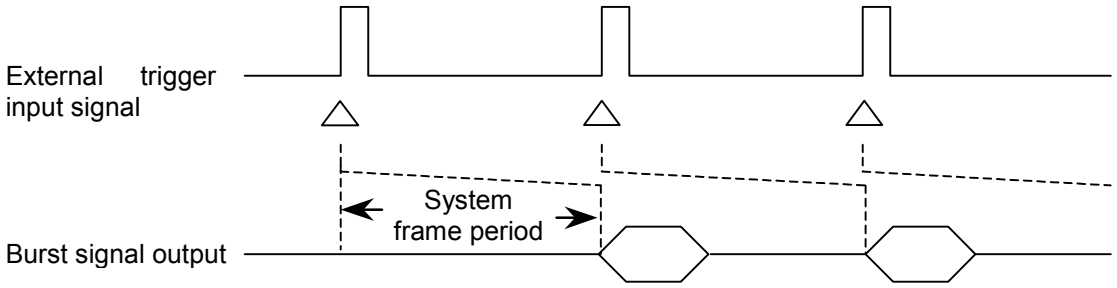


Figure 2.6.2-5 Frame Trigger operation

If the input period of the external trigger signal is N samples shorter than the frame period, it is masked to be a disabled trigger. A burst signal matching the trigger signal cannot be obtained in this case.

N [samples] = $(L_f + L_g) - (L_f + 1)$

Notes:

1. For L_f, and L_g, refer to the "Start Trigger Operation" description.

2. If Delay is set to the positive side, the frame period will increase by the number of samples set in Delay.

3. The maximum value of N (N_{max}) can be calculated from the expression shown below, in accordance with the interpolation ratio (IPLR) that is determined by the sampling clock (fs).

   Nmax = 28/IPLR
   IPLR: 2^n value that satisfies 160 MHz≥ IPLR × fs > 80 MHz (n is an integer of 3 or higher)

4. If N exceeds Nmax as the result of the above expression, assign Nmax to it.

For example, suppose that L_f = 140 symbols, L_g = 280 symbols, and the sampling clock = 50 MHz. In this case, because the right-hand side of the N formula above exceeds N_{max}, N = 28. In Figure 2.6.2-6, if a trigger signal is input with a period 28 samples shorter than the frame period (L_f + L_g), it will be disabled.

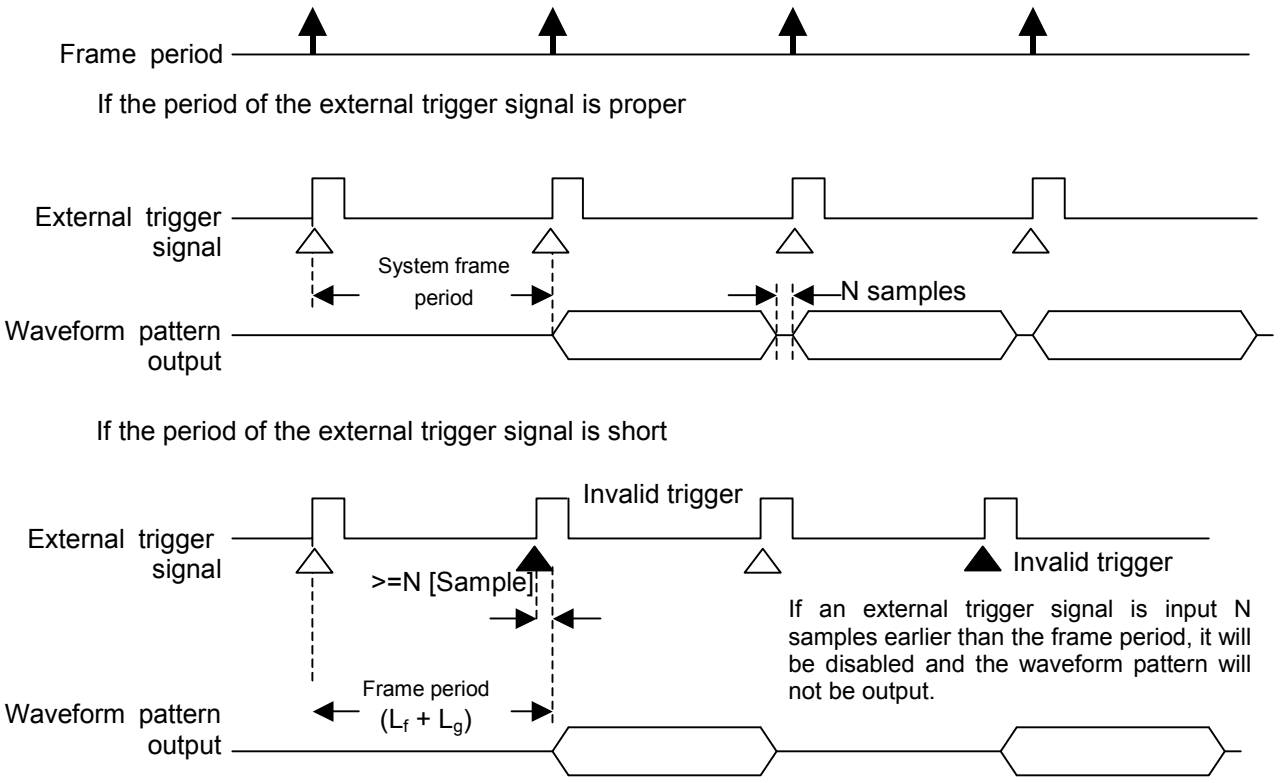


Figure 2.6.2-6 Example of Frame Trigger operation

2.6.3 Setting reference clock

This function sets the reference clock of the internal arbitrary waveform generator.

For the reference clock of the internal arbitrary waveform generator, select either the same reference signal source that is used for the carrier or the signal that is input externally. When using an external signal, input it to BB_REF_CLK of the AUX connector on the rear panel. Refer to Appendix C “AUX Connector” for details on pin assignment.

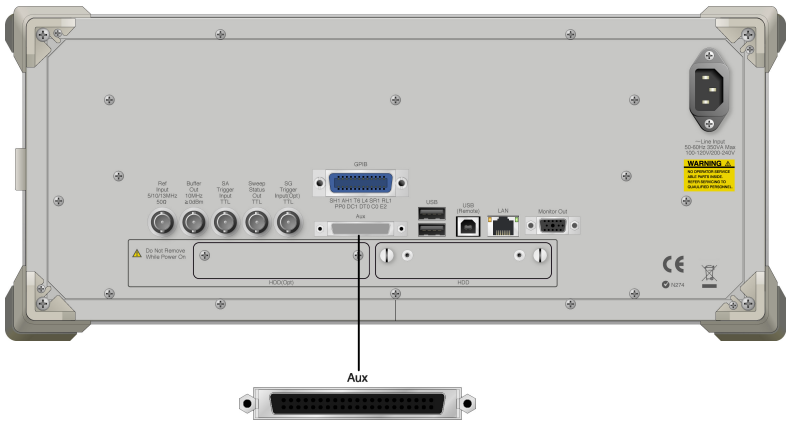


Figure 2.6.3-1 Connector connection location

Pressing F2 (Reference Clock Setup) from the Ext I/O Setup function menu displays the Reference Clock Setup window. In this window, set the reference clock. This section describes operation methods for when the Reference Clock Setup window is displayed, unless otherwise specified.

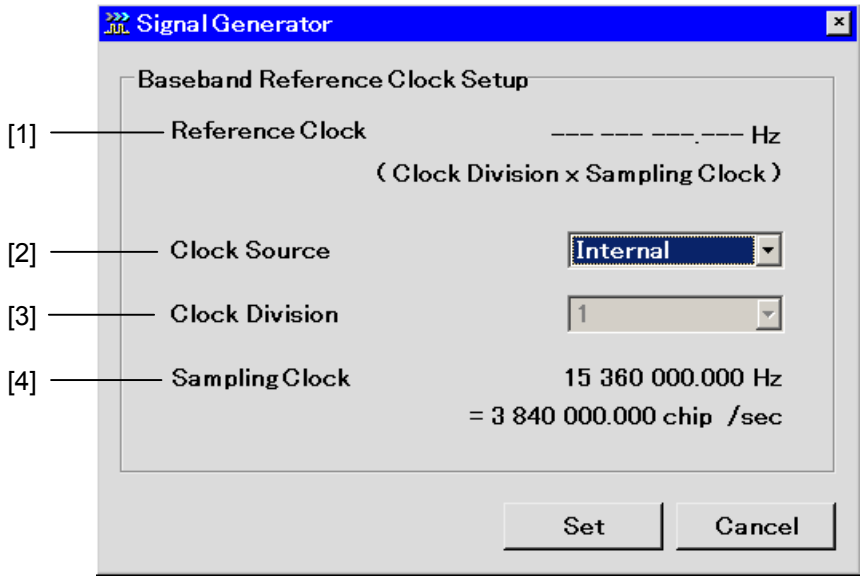


Figure 2.6.3-2 Reference Clock Setup window

This section describes each parameter.

The following are only valid when a waveform is selected.

[1] Reference Clock
The current reference clock value is displayed only when External is selected for Clock Source.

[2] Clock Source
For the reference clock of the MS2830A, select either the same reference signal source that is used for the carrier or the signal that is input to the baseband reference clock signal input connector. If Internal is selected for the Clock Source, use the same reference signal source that is used for the carrier. The signal from this signal source will be a 10 or 5 MHz external input signal that will be input to the 10 MHz internal reference oscillator or the reference frequency signal input connector (Ref Input).
If External is selected for Clock Source, the input signal to the baseband reference clock signal input pin of the AUX connector will be used as the reference signal source.

[3] Clock Division
Determined from the currently set sampling clock and the factor that is set here.

[Reference clock] = [Sampling clock] × [Factor]
↑ To be set here.

The selectable factor range varies with the sampling clock value.

[4] Sampling Clock
The current sampling rate is displayed only when a waveform is selected. The value converted in time will also be displayed at the same time.

Table 2.6.3-1 Selectable factor range

Sampling clock f (Hz)	Baseband Reference Clock setting								
	16	8	4	2	1	1/2	1/4	1/8	1/16
20 k ≤ f ≤ 24414.062	√	√	√	√	√				
24414.062 < f ≤ 48828.125	√	√	√	√	√	√			
48828.125 < f ≤ 97656.25	√	√	√	√	√	√	√		
97656.25 < f ≤ 195312.5	√	√	√	√	√	√	√	√	
195312.5 < f ≤ 2.5 M	√	√	√	√	√	√	√	√	√
2.5 M < f ≤ 5 M		√	√	√	√	√	√	√	√
5 M < f ≤ 10 M			√	√	√	√	√	√	√
10 M < f ≤ 20 M				√	√	√	√	√	√
20 M < f ≤ 40 M					√	√	√	√	√
40 M < f ≤ 80 M						√	√	√	√
80 M < f ≤ 160 M							√	√	√

2.6.4 Setting marker output

This section describes how to set marker signals output by the Signal Generator function. There are two types of marker signals output by the Signal Generator function: one based on information described in waveform patterns and another set by this setting. Marker signals are output from MARKER 1 to 3 of the AUX connector on the rear panel. Refer to Appendix C "AUX Connector" for details on pin assignment.

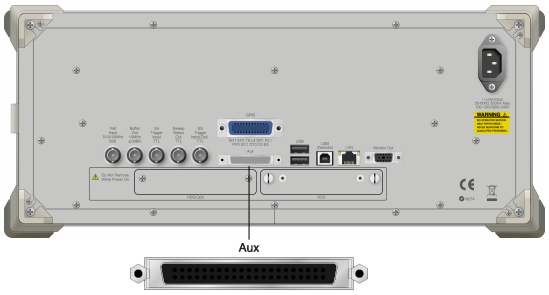


Figure 2.6.4-1 Output connector location

Modulation must be on and a waveform must be selected to perform this setting.

Pressing F3 (Marker Setup) from the Ext I/O Setup function menu displays the Marker Setup window. In this window, set the trigger. This section describes operation methods for when the Marker Setup window is displayed, unless otherwise specified.

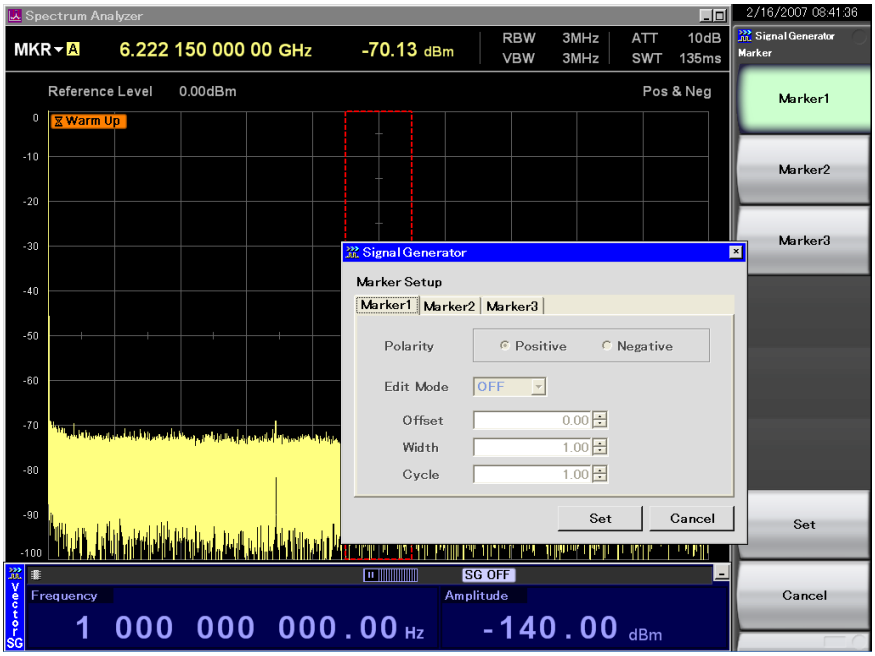


Figure 2.6.4-2 Marker output setup screen

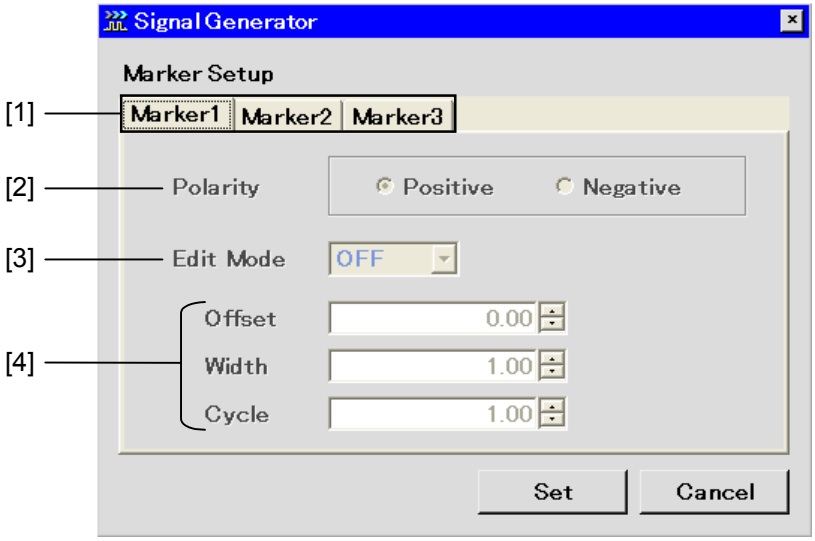


Figure 2.6.4-3 Marker Setup window

This section describes each parameter.

[1] Markers 1 to 3
Selects the number of the marker to be edited. This can be performed from the tabs in the Marker Setup window or using the function keys. The settings in steps [2] to [4] below are to be set separately for Markers 1 to 3.

[2] Polarity
Selects the polarity of the marker signal selected in [1].

[3] Edit Mode
Switches the marker signal to be output. When Edit Mode is set to Off, a marker signal based on information described in waveform patterns is output. When Edit Mode is set to On, the marker signal set with this setting is output. When Edit Mode is set to SYNC, the marker signal set with this setting is output from the beginning of a frame.

When a waveform with a resolution of 15 or 16 bits is selected, the following restriction applies:

15-bit resolution: Markers 2 and 3 cannot be turned off.
16-bit resolution: Markers 1 to 3 cannot be turned off.

[4] Offset/Width/Cycle
Set the marker signal to be output. These settings are valid when Edit Mode is set to On or SYNC. When Edit Mode is set to SYNC, however, Cycle is invalid. Parameter details are described later.

Marker signal based on information in waveform pattern

When Edit Mode is set to Off, marker signals based on information in waveform patterns, such as clocks and gate signals are output. At this time, the marker signal depends on the content of the currently selected waveform pattern. Refer to the operation manual of the selected waveform pattern for details.

Marker signal to be set with this setting

Set Edit Mode to On or SYNC to define the marker signal with this setting. The following are parameters to set the marker signal.

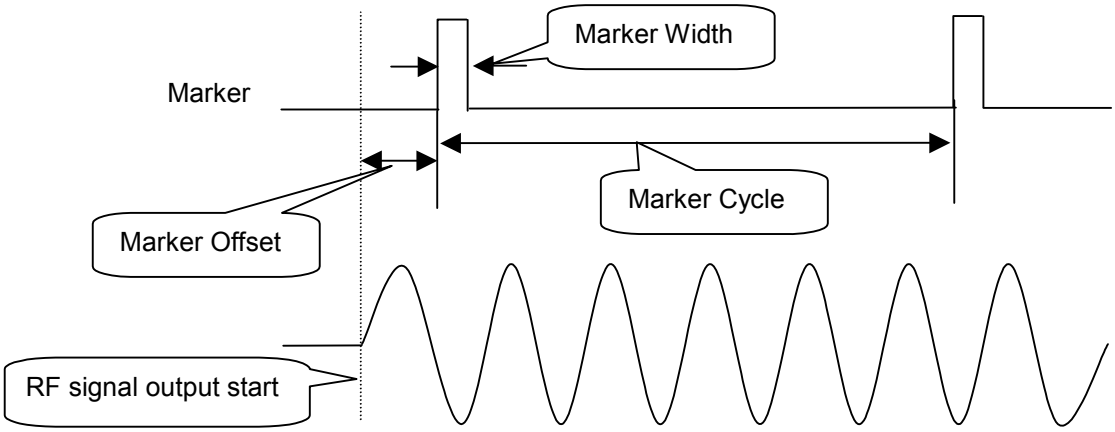


Figure 2.6.4-4 Outline of marker parameters

This section describes the details of each parameter. Set each parameter in Chip/Over Sampling units.

<1> Offset

Delays the marker signal by the set value from the head of the waveform pattern.

<3> Width

Sets the pulse width of the marker signal.

<3> Cycle

Sets the cycle of the marker signal. This cannot be set when Edit Mode is set to SYNC.

Conditions when inputting Edit Mode, Offset, Width, or Cycle

To set Offset, Width, or Cycle, Edit Mode must be set to On or SYNC.

Example: Setting Edit Mode to On, Offset to 1000 chips, Width to 1000 chips, and Cycle to 1000 chips

<Procedure>

1. Press F3 (Marker Setup) to display the Marker Setup screen. This is valid only when a waveform pattern is selected.
2. Move the cursor to Edit Mode and set it to On.
3. Move the cursor to Offset, press 1 0 0 0, and then press Enter.
4. Move the cursor to Cycle, press 1 0 0 0, and then press Enter.
5. Move the cursor to Width, press 1 0 0 0, and then press Enter.
6. Press F7 (Set).

The operation in each Edit Mode setting is as follows.

When Edit Mode is set to Off

Offset, Width, and Cycle cannot be set.

When Edit Mode is set to On

Offset, Width, and Cycle can be set.

Tables 2.6.4-1 and 2.6.4-2 show the setting range and set resolution of Offset, Width, and Cycle.

Table 2.6.4-1 Setting range of Offset, Width, and Cycle

Item	Setting Range
Offset	0.00 to $(2^{24} - 1)$/Over Sampling
Width	1/Over Sampling to $(2^{24} - 1)$/Over Sampling*
Cycle	1/Over Sampling to $(2^{24} - 1)$/Over Sampling

*: The maximum value of Width varies depending on the value of Cycle. The actual setting range is "1/Over Sampling to Cycle value."

Table 2.6.4-2 Setting resolution of Offset, Width, and Cycle

Item	Setting Resolution
Offset	1/Over Sampling
Width	1/Over Sampling
Cycle	1/Over Sampling

When Edit Mode is set to SYNC

Offset and Width can be set.

Tables 2.6.4-3 and 2.6.4-4 show the setting range and setting resolution of Offset and Width.

Table 2.6.4-3 Setting range of Offset and Width

Item	Setting Range
Offset	0.00 to $(2^{24} - 1)$/Over Sampling
Width	1/Over Sampling to Data Point/Over Sampling

Table 2.6.4-4 Setting resolution of Offset and Width

Item	Setting resolution
Offset	1/Over Sampling
Width	1/Over Sampling

2.6.5 Setting pulse modulation

For pulse modulation, use an internal or external signal.

By default, it is designed to use an internal signal to perform pulse modulation. It is possible to modify it so that an external signal is used for modulation, or so that no pulse modulation is performed.

Pressing F4 (Pulse Modulation) from the Ext I/O Setup function menu displays the pulse modulation setup window. In this window, set pulse modulation.

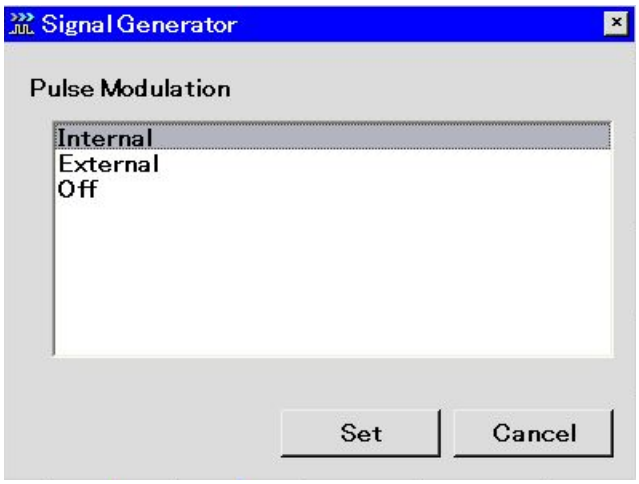


Figure 2.6.5-1 Pulse modulation setup window

This section describes the parameter.

<1> Pulse Modulation
Selects the pulse modulation reference.

Using Internal signal

This function is useful to load patterns for pulse modulation. When an internal signal is generated, the pulse modulator is controlled by the pulse modulation control bit (RF Gate), which has been added to the waveform pattern. Refer to the *MS2690A/MS2691A/MS2692A and MS2830A/MS2840A Signal Analyzer Vector Signal Generator Operation Manual (IQproducer™)* for details.

Using External Signal

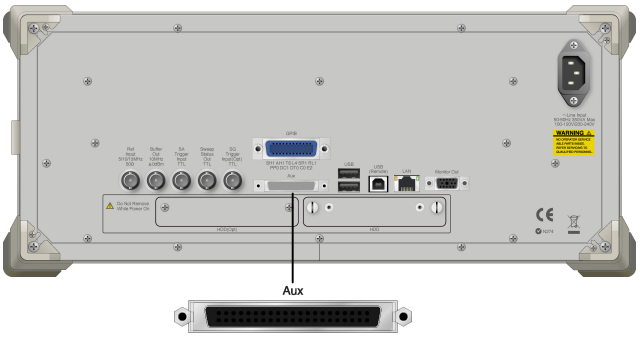


Figure 2.6.5-2 Input connector

To perform pulse modulation using an external signal, input the external signal to PULS_MOD of the AUX connector.

For details about the pin configuration, refer to Appendix C “AUX Connector”. The pulse modulation polarity is fixed to Positive. In other words, if the external modulation signal is High, the RF signal is output, and if the external modulation signal is Low, the RF signal is not output. The input level is the TTL level.

Disabling Pulse Modulation

Select Off for Pulse Modulation to disable pulse modulation.

2.7 BER Measurement Function

Note:

This function is available only when Option 026/126 is installed.

Pressing F4 (BER Test Control) from page 2 of the main function menu displays the BER measurement control function menu, which is used to control the starting and stopping of BER measurement.

2.7.1 Display description

This section describes the BER measurement control screen display.

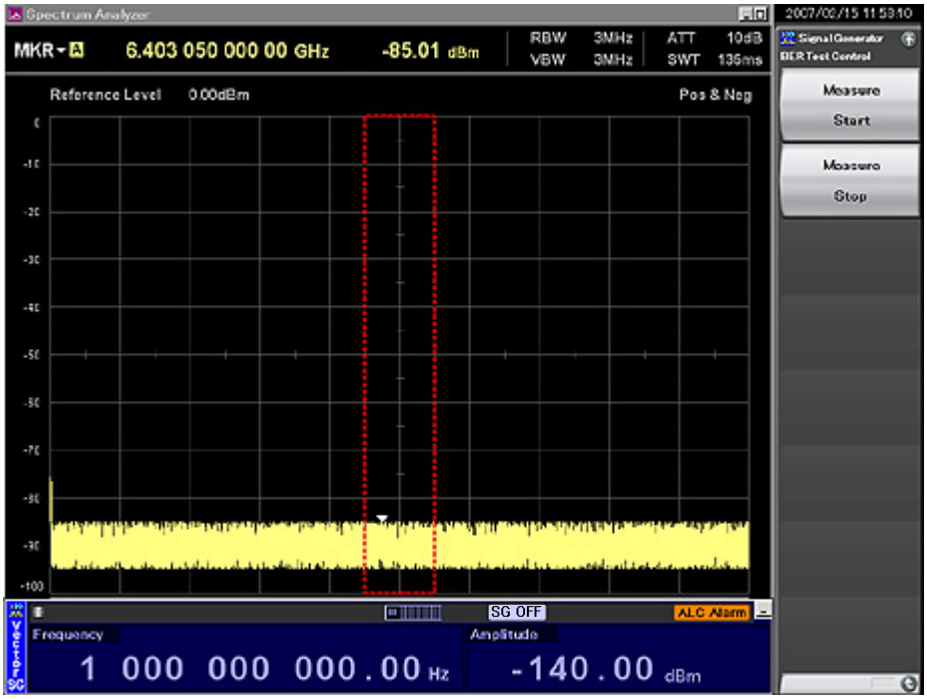


Fig. 2.7.1-1 BER measurement control screen

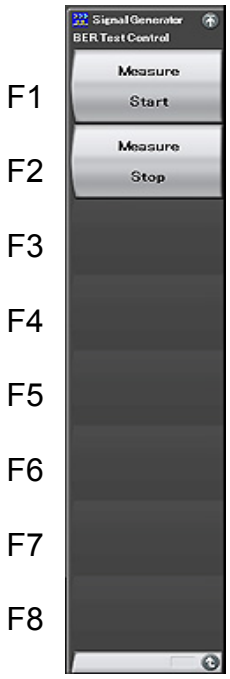


Fig. 2.7.1-2 BER measurement control function menu

Table 2.7.1-1 BER measurement control function menu

Menu Display	Function
Measure Start	Starts BER measurement.
Measure Stop	Stops BER measurement.

2.8 Selecting SA Trigger

Select the type of the trigger to be output for the Spectrum Analyzer function (hereinafter referred to as "SPA") or the Signal Analyzer function (hereinafter referred to as "SA").

Operate SA/SPA at the head of the waveform pattern or in sync with Markers 1 to 3 as set in Section 2.6.4 "Setting maker output."

To enable this function, Trigger Source of Trigger/Gate must be set to SG Marker on the SA/SPA side. Refer to the *MS2830A Signal Analyzer Operation Manual (Mainframe Operation)*, *MS2840A Signal Analyzer Operation Manual (Mainframe Operation),* or each application operation manuals for details.

Pressing F2 (SA Trigger Out) from page 2 of the main function menu displays the SA Trigger Out setup window.

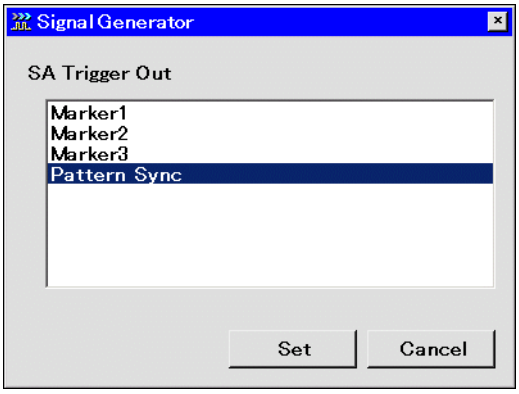


Figure 2.8-1 SA Trigger Out setup window

This section describes the parameters.

<1> SA Trigger Out

Marker1: Outputs Marker 1 for SA/SPA.
Marker2: Outputs Marker 2 for SA/SPA.
Marker3: Outputs Marker 3 for SA/SPA.
Pattern Sync: Outputs the trigger at the head of the waveform pattern.

2.9 Other Functions

This section describes other functions that can be executed from the main function menu.

2.9.1 Display description

Pressing F8 (Accessory) from page 2 of the main function menu displays the Accessory setup screen.

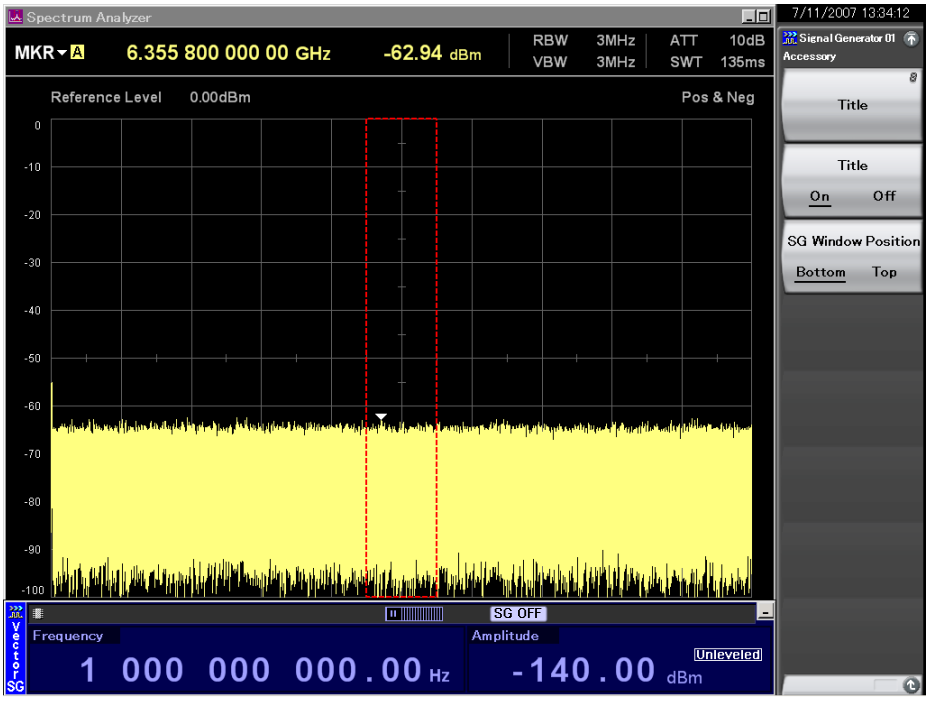


Figure 2.9.1-1 Accessory setup screen

Table 2.9.1-1 Accessory function menu

Function Key	Menu Display	Function
F1	Title	For entering the application title. 2.9.2 "Entering application title"
F2	Title (On/Off)	Selects between displaying and not displaying the application title. 2.9.2 "Entering application title"
F3	SG Window Position (Bottom/Top)	Switches the display position of the Signal Generator screen. The Signal Generator screen is displayed at the lower portion when Bottom is selected, and displayed at the upper portion when Top is selected.

2.9.2 Entering application title

This is for setting the application title. The character string entered will be displayed on the top part of the function menu (17 characters maximum).

Example: Entering the application title

<Procedure>

1. Press F1 (Title) to display the Title Entry window.
2. Select the characters using the rotary knob and press Enter.
   Enter the title character string and press F7 (Set).

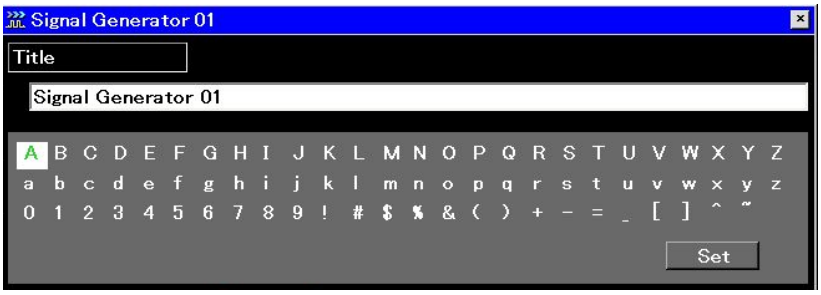


Figure 2.9.2-1 Title Entry window

3. The title entered will be displayed on the top part the function menu.

Figure 2.9.2-2 Title display

This section describes the procedure for switching between displaying and hiding the application title.

Example: Setting the title display to On/Off

<Procedure>

1. Press F2 (Title On/Off) to select Off. The title will be hidden.
2. Press F2 (Title On/Off) to select On. The title will be displayed.

Even if the title is hidden, the set title character string will be retained.

Chapter 3 Performance Test

This chapter describes measurement devices, setup methods, configuration procedures, and performance test procedures required for performing performance tests as preventive maintenance of the MS2830A or MS2840A.

3.1 Overview of Performance Test

3.1.1 Performance Test

Performance tests are performed as part of preventive maintenance in order to prevent the performance of the MS2830A or MS2840A from being degraded before it occurs. Use performance tests when required for acceptance inspection, routine inspection and performance verification after repairs.

If items that do not meet the required level are detected during performance testing, contact an Anritsu Service and Sales office.

⚠ CAUTION

Warm up the subject testing device and measuring instruments for at least 30 minutes, in order to stabilize them sufficiently before running performance tests. Demonstrating maximum measurement accuracy requires, in addition to the above, conducting performance tests under ambient temperatures, little AC power supply voltage fluctuations (100 to 120 VAC, 200 to 240 VAC), as well as the absence of noise, vibrations, dust, humidity or other problems.

3.1.2 Performance test items and instruments used

Table 3.1.2-1 lists the performance test items for the MS2830A or MS2840A and measuring instruments used for testing each of these test items.

Table 3.1.2-1 List of performance test items and measuring instruments

Test Items		Summary	Main Instruments Used (Anritsu Model Name)
Frequency	Frequency	A frequency is set and the output frequency is measured.	Counter (MF2412C)
Output level	Output level frequency characteristics	The absolute accuracy is measured using a power meter (frequency characteristics).	Power Meter (ML2437A) Power Sensor (MA24002A)
Vector modulation	Vector accuracy	A modulated pattern signal is generated through internal modulation and the vector accuracy is measured by using a signal analyzer.	Signal Analyzer (MS2690A/91A/92A) W-CDMA/HSPA Downlink Measurement Software (MX269011A)

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

3.2 Frequency Performance Test

3.2.1 Frequency

This test consists of setting the frequency of the MS2830A or MS2840A, and counting the frequency with a counter (MF2412C) in order to check that the set frequency is output normally.

Test standards

Frequency Range

Option 020/120: 250 kHz to 3600 MHz
Option 021/121: 250 kHz to 6000 MHz

Frequency setting resolution 0.01 Hz

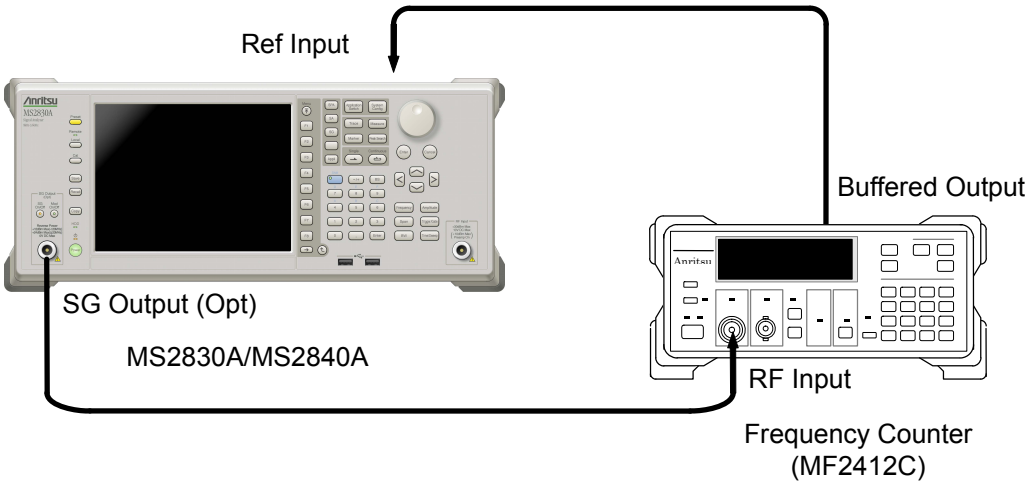


Figure 3.2.1-1 Frequency test

Test procedure

When option 020/120 is installed, set the frequency in the range of 250 kHz to 3600 MHz.
When option 021/121 is installed, set the frequency in the range of 250 kHz to 6000 MHz.

1. Connect the reference signal output (10 MHz) of the MF2412C to the external reference input connector (Ref input) of the MS2830A or MS2840A to establish frequency synchronization.
2. Set the measuring resolution of the MF2412C to 10 MHz.
3. Press Preset to preset the MS2830A or MS2840A.
4. Set the output level of the MS2830A or MS2840A to 0 dBm.

5. Set the output frequency of the MS2830A or MS2840A to the FR(1) value in Table 3.2.1-1.
6. Check that the frequency set for the MS2830A or MS2840A is the same as the frequency displayed by the MF2412C.
7. Repeat the above measuring sequence, changing the frequency FR(x) according to Table 3.2.1-1.

Table 3.2.1-1 Frequency settings

x	FR(x) (MHz)
1	0.25
2	100
3	300
4	600
5	1000
6	1500
7	2000
8	2500
9	3000
10	3600
11	3600.001
12	4000
13	4500
14	5000
15	5500
16	6000

X can be set to 11 or higher only when the option 021/121 option is installed.

3.3 Output Level Performance Test

3.3.1 Output level frequency characteristics

Using a power meter (ML2437A) and a power sensor (MA24002A), measure the level for each frequency of the MS2830A or MS2840A at the reference level.

The measurement result is the absolute accuracy for the reference level, and the absolute accuracy below the reference level is obtained through combination with the linearity error measurement result at each frequency.

Test standards

Absolute accuracy (23 ±5°C, in CW mode)

Table 3.3.1-1 Test specifications

Configuration	Output Level	Frequency	
		375 MHz≤Frequency ≤3.6 GHz	3.6 GHz<Frequency ≤6 GHz
Option 022/122 Not Installed	–10 dBm	±0.5 dB	±0.8 dB
Option 022/122 Installed	–15 dBm	±0.5 dB	±0.8 dB

A frequency setting of 3.6 GHz < Frequency ≤ 6 GHz is possible only when the option 021/121 option is installed.

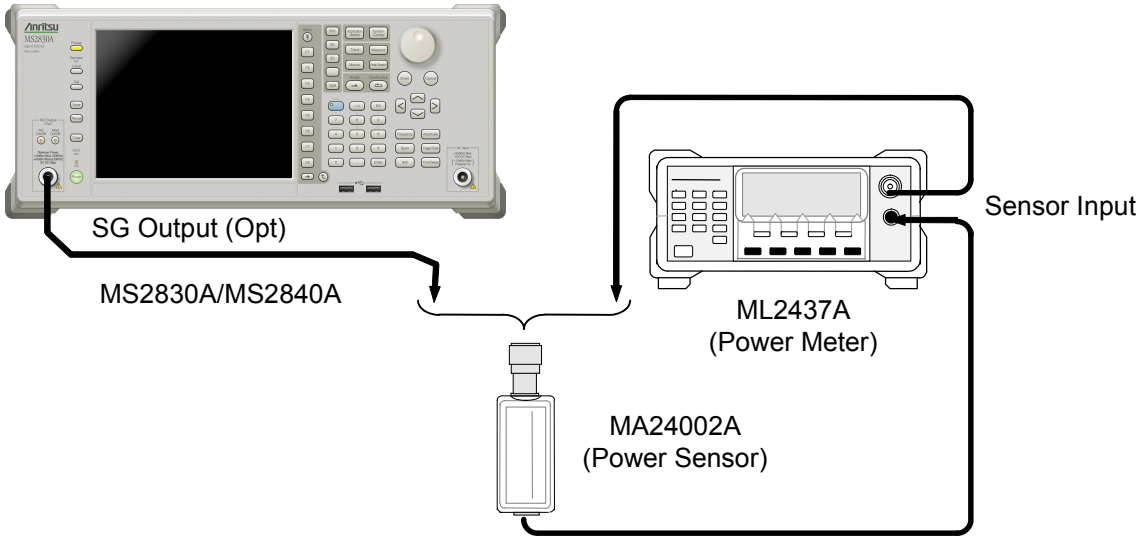


Figure 3.3.1-1 Output level frequency characteristics test

Perform level measurement according to the frequency table shown in Table 3.3.1-2.

Test procedure

1. Turn on the RF output of the MS2830A or MS2840A.
2. Set the output level of the MS2830A or MS2840A according to the frequency settings in Table 3.3.1-1.
3. Execute sensor calibration (zero point, sensitivity) for the ML2437A.
4. Set the frequencies of the MS2830A or MS2840A, and the ML2437A to the FR(1) value in Table 3.3.1-2.
5. Measure the level with the ML2437A.
6. Repeat Step 4, changing the frequency setting FR(x) according to Table 3.3.1-2, to obtain measurement values.

Table 3.3.1-2 Frequency settings for absolute accuracy measurement

x	FR(x) (MHz)
1	375
2	500
3	1000
4	1500
5	2000
6	2500
7	3000
8	3600
9	3600.001
10	4000
11	4500
12	5000
13	5500
14	6000

X can be set to 9 or higher only when the option 021/121 is installed.

3.4 Vector Modulation Performance Test

3.4.1 Vector accuracy

This test consists of generating a baseband signal from the internal waveform pattern, and performing vector modulation with the MS2830A or MS2840A. The vector error in the modulated RF signal is measured by using a signal analyzer (MS2690A/91A/92A) in which signal analysis software has been installed.

Test standards (23 ±5°C)

Vector accuracy

≤1.4% (rms): (Output frequency: 800 to 2700 MHz, W-CDMA 1code modulation)

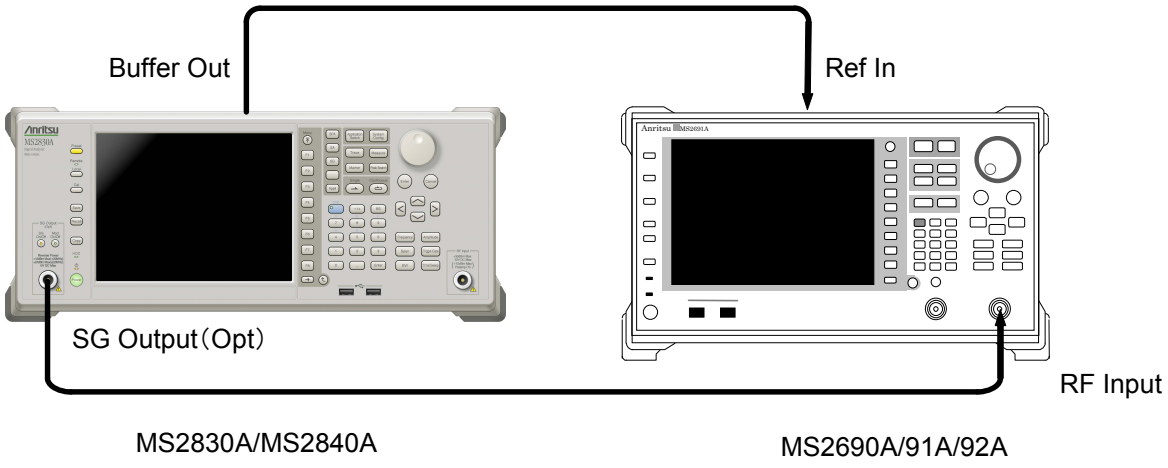


Figure 3.4.1-1 Vector accuracy test

Test procedure (W-CDMA 1code)

1. Turn SG Output of the MS2830A or MS2840A on and set the output level as follows:
   When option 022/122 is not installed: 0 dBm
   When option 022/122 is installed: –5 dBm
2. Turn on the vector modulation of the MS2830A or MS2840A and perform modulation with the W-CDMA DL_CPICH of the standard waveform pattern.
3. Set the measurement condition according to the waveform pattern of W-CDMA 1code with the MS2690A/91A/92A mode as TX Tester and System as WCDMA.
4. Set the frequencies of the MS2830A or MS2840A, and MS2690A/91A/92A to the FR(1) value in Table 3.4.1-1.
5. Measure the vector error with the MS2690A/91A/92A.

6. Repeat Step 3 to obtain the measurement values, changing the frequency setting FR(x) according to Table 3.4.1-1.

Table 3.4.1-1 W-CDMA 1code modulation accuracy measurement frequencies

x	FR(x) (MHz)
1	800
2	1000
3	1800
4	2000
5	2200
6	2400
7	2700

Appendix A Message Display

A.1 Error Messages

Table A.1-1 Signal Generator function errors

Message	Description
Out of range	The settable range is exceeded.
Invalid parameter	Invalid parameter
Invalid status	Invalid status
Invalid status Not available in Relative Off.	This operation is invalid when Relative is set to Off.
Invalid status Not available in AWGN Off.	This operation is invalid when AWGN is set to Off.
Invalid status Not available in Modulation Off.	This operation is invalid when Modulation is set to Off (CW).
Invalid status Not available in Reference Clock Source Internal.	This operation is invalid when Reference Clock Source is set to Internal.
Invalid status Not available in Start/Frame Trigger Off.	This operation is invalid when Start/Frame Trigger is set to Off.
Invalid status Not available in Marker Edit Mode Off.	This operation is invalid when Edit Mode in the Marker Setup screen is set to Off.
Invalid status Not available in Marker Edit Mode Pattern Sync.	This operation is invalid when Edit Mode in the Marker Setup screen is set to Pattern Sync.
Invalid status Not available if no Pattern is loaded.	This operation is invalid when no pattern is loaded.
Invalid status Not available if no Pattern is selected.	This operation is invalid when no pattern is selected.
Cannot find checked pattern	The specified pattern cannot be found.
Invalid status Not available if not selected valid pattern	The specified pattern cannot be loaded.
Cannot find pattern on HDD/SSD	The specified pattern cannot be found.
Pattern not found The pattern is not found on memory.	The specified pattern cannot be found on memory.
Pattern not found The pattern is not found on HDD/SSD.	The specified pattern cannot be found on the HDD/SSD.
Pattern not found The pattern is not found on the device.	The specified pattern cannot be found on the device.
Invalid pattern information file	The pattern information file is invalid.

Table A.1-1 Signal Generator function errors (Cont'd)

Message	Description
Invalid pattern file name	The pattern file name is invalid.
Insufficient pattern information parameter	The pattern parameters are insufficient.
Invalid pattern information parameter	The pattern parameter is invalid.
Invalid pattern license	The pattern license is invalid.
Not match pattern version	The pattern version does not match.
Invalid pattern data size	The pattern data size is invalid.
Pattern data file not found	The pattern data file cannot be found.
The number of pattern files is full in the package.	The maximum number of patterns loadable in one package is exceeded.
The number of pattern files is full on memory.	The maximum number of patterns loadable in waveform memory is exceeded.
The number of packages is full on memory.	The maximum number of packages loadable in waveform memory is exceeded.
Pattern load is finished. Some problems occurred.	An error occurred when loading a pattern.
BER Test application is not found.	BER test application cannot be found.
No function	Invalid function with Signal Generator.
Pattern data over waveform memory size. Free area of the waveform memory is not enough.	Free space in waveform memory is insufficient.
Not available in Current Pattern Resolution.	Invalid operation with the waveform pattern resolution currently selected.
Not available if not AWGN option.	Option 028/228 AWGN is required.
ARB Memory Upgrade is required.	Option 027/227 ARB Memory Upgrade 256Msamples is required to load this pattern.
Invalid character	—
Not available because Trigger source is not Trigger Key.	Invalid operation as Trigger Source is not set for Trigger Key.
Not available because Trigger source is not BUS.	Invalid operation as Trigger Source is not set for Bus.

Table A.1-2 Load Pattern screen errors

Message	Description
Invalid pattern data size	The pattern data size is invalid.
Pattern information file is not found on HDD/SSD.	The pattern information file cannot be found on the HDD/SSD.
Pattern data file is not found on HDD/SSD.	The pattern data file cannot be found on the HDD/SSD.
Not available because of mismatch licensed version	Invalid because the license version does not match.
No pattern license	The required license is not installed in the mainframe.
Invalid pattern license	The pattern license is invalid.
Invalid pattern information parameter	The pattern parameter is invalid.
Insufficient pattern information parameter	The pattern parameters are insufficient.
Invalid pattern file name	The pattern file name is invalid.
Invalid pattern information file	The pattern information file is invalid.
Invalid format	The format cannot be analyzed.
Unknown error!	Unknown error

A.2 Confirmation Messages

Table A.2-1 Confirmation messages

Message	Description
Overwrite the current pattern data in the waveform memory?	Prompts the user to load and overwrite the currently selected pattern.
Clear all pattern data in the waveform memory?	Prompts the user to delete all patterns loaded in memory.
Delete checked pattern data in the HDD/SSD?	Prompts the user to delete the selected pattern from the HDD/SSD.
Delete checked pattern data in the waveform memory?	Prompts the user to delete the selected pattern from memory.
Cancel loading?	Prompts the user to cancel loading the pattern.
Cancel copying?	Prompts the user to cancel copying the pattern.

Appendix B Initial Value List

<Frequency functions>

Frequency		1 GHz
Cursor display digits		0.01 Hz (least significant digit)
Frequency step		100 kHz
RF spectrum		Normal

<Output level main functions>

Output level	–40 dBm	Option 022/122 NOT installed
	–136 dBm	Option 022/122 installed
Display unit		dBm
Cursor display digits		0.01 dB (least significant digit)
Output level step		1 dB
Offset On/Off		Off
Offset level		0 dB
Relative display On/Off		Off
SG output On/Off		Off

<Modulation main functions>

Mod On/Off	Off
Output pattern	Not selected
AWGN	
AWGN	Off
C/N Set Signal	Constant
Carrier Power	Same as output level
C/N Ratio	40.00 dB

Ext I/O Setup

Start/Frame Trigger

On/Off	Off
Source	Ext Trigger
Mode	Start Trigger
Delay	0.00
Edge	Rise

Reference Clock

Clock Source	Internal
Clock Division	1

Markers 1 to 3

Polarity	Positive
Edit Mode	Off
Offset	0.00
Width	1.00
Cycle	1.00

(The values given here for Start/Frame Trigger, Reference Clock, and Markers 1 to 3 are initial values before a waveform is selected.)

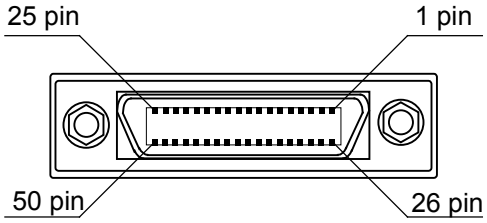
Pulse Modulation	Internal
SA Trigger Out	Pattern Sync

<Display function>

SG Window Position	Bottom

Appendix C AUX Connector

Figure C-1 and Table C-1 show the pin configuration and the signals output from each pin for the AUX connector located on the rear panel of the MS2830A.



DX10A-50S (50)

Figure C-1 AUX connector

Table C-1 AUX connector

Function	Pin No.	Signal name	Function
BER*	24	BER_CLK	BER_CLK Input
	25	GND	Grounding
	48	BER_EN	BER_EN Input
	45	GND	Grounding
	49	BER_DATA	BER_DATA Input
	50	GND	Grounding
SG	13	MARKER1	Outputs Marker1.
	11	GND	Grounding
	38	MARKER2	Outputs Marker2.
	36	GND	Grounding
	39	MARKER3	Outputs Marker3.
	16	GND	Grounding
	42	PULS_MOD	Output signals for pulse modulation.
	41	GND	Grounding
	22	BB_REF_CLK	Inputs the baseband reference clock.
	20	GND	Grounding

Do not connect anything to connectors not listed in Table C-1 because they are interfaces for equipment maintenance.

*: The signals can be used only with the J1556A AUX conversion adaptor.

The adapter to convert the AUX connector to BNC is sold separately.

Model name: J1487A(for Signal Generator)
Product name: AUX conversion adapter

Model name: J1556A(for Signal Generator and BER Measurement function)
Product name: AUX conversion adapter

Refer to Section 1.2.3 “Applicable parts” in the *MS2830A Signal Analyzer Operation Manual (Mainframe Operation)* or *MS2840A Signal Analyzer Operation Manual (Mainframe Operation)*.

Performance Test Result Form

Test Location _____ Report No. _____

Date _____

Test person in charge _____

Equipment Name: MS2830A/MS2840A Signal Analyzer Option 020/120, 021/121: Vector Signal Generator

Serial No. _____ Ambient temperature _____ °C

Power frequency _____ Relative humidity _____ %

Remarks: _____

Output Frequency (Section 3.2.1)

Setting	Results	
0.25 MHz	☐ OK	☐ NG
100 MHz	☐ OK	☐ NG
300 MHz	☐ OK	☐ NG
600 MHz	☐ OK	☐ NG
1000 MHz	☐ OK	☐ NG
1500 MHz	☐ OK	☐ NG
2000 MHz	☐ OK	☐ NG
2500 MHz	☐ OK	☐ NG
3000 MHz	☐ OK	☐ NG
3600 MHz	☐ OK	☐ NG
3600.001 MHz	☐ OK	☐ NG
4000 MHz	☐ OK	☐ NG
4500 MHz	☐ OK	☐ NG
5000 MHz	☐ OK	☐ NG
5500 MHz	☐ OK	☐ NG
6000 MHz	☐ OK	☐ NG

Output Level Frequency Characteristics (Section 3.3.1)

Setting		Min. limit	Results	Max. limit	Measurement Uncertainty
Frequency	**Output Level**				
375 MHz 500 MHz 1000 MHz 1500 MHz 2000 MHz 2500 MHz 3000 MHz 3600 MHz	Option 022/122 Not installed: –10 dBm Installed: –15 dBm	Option 022/122 Not installed: –10.5 dBm Installed: –15.5 dBm		Option 022/122 Not installed: –9.5 dBm Installed: –14.5 dBm	±0.25 dB
3600.001 MHz 4000 MHz 4500 MHz 5000 MHz 5500 MHz 6000 MHz		Option 022/122 Not installed: –10.8 dBm Installed: –15.8 dBm		Option 022/122 Not installed: –9.2 dBm Installed: –14.2 dBm	±0.38 dB

Vector Accuracy (Section 3.4.1)

Setting		Maximum Rating	Results	Measurement Uncertainty
Frequency	**Output Level**			
800 MHz 1000 MHz 1800 MHz 2000 MHz 2200 MHz 2400 MHz 2700 MHz	Option 022/122 Not installed: 0 dBm Installed: –5 dBm	W-CDMA 1 code 1.4% (rms)		±0.0%

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