# MS2690A/MS2691A/MS2692A
# and
# MS2830A/MS2840A/MS2850A
## Signal Analyzer
## Operation Manual
## Phase Noise Measurement Function
## Operation

## 11th Edition

- For safety and warning information, please read this manual before attempting to use the equipment.
- Additional safety and warning information is provided within the MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Mainframe Operation), MS2830A Signal Analyzer Operation Manual (Mainframe Operation), MS2840A Signal Analyzer Operation Manual (Mainframe Operation), or MS2850A Signal Analyzer Operation Manual (Mainframe Operation). Please also refer to this document before using the equipment.
- Keep this manual with the equipment.

# ANRITSU CORPORATION

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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.

MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A
Signal Analyzer
Operation Manual   Phase Noise Measurement Function Operation

25   April        2008 (First Edition)
30   October      2017 (11th Edition)

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# About This Manual

■ Associated Documents

The operation manual configuration of the MS2690A/MS2691A/MS2692A, MS2830A, MS2840A and MS2850A Signal Analyzer is shown below.

MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Main Frame Operation)

MS2830A Signal Analyzer Operation Manual (Main Frame Operation)

MS2840A Signal Analyzer Operation Manual (Main Frame Operation)

MS2850A Signal Analyzer Operation Manual (Main Frame Operation)

Or

MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A
Signal Analyzer Operation Manual (Main Frame Remote Control)

MS2690A/MS2691A/MS2692A
Signal Analyzer Operation Manual
(Signal Analyzer Function Operation)

Or

MS2830A/MS2840A/MS2850A
Signal Analyzer Operation Manual
(Signal Analyzer Function Operation)

MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A
Signal Analyzer Operation Manual (Signal Analyzer Function Remote Control)

MS2690A/MS2691A/MS2692A
Spectrum Analyzer Operation Manual
(Spectrum Analyzer Function Operation)

Or

MS2830A/MS2840A/MS2850A
Spectrum Analyzer Operation Manual
(Spectrum Analyzer Function Operation)

MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A
Signal Analyzer Operation Manual (Spectrum Analyzer Function Remote Control)

MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A
Signal Analyzer Operation Manual (Phase Noise Measurement Function Operation)

MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A
Signal Analyzer Operation Manual (Phase Noise Measurement Function Remote Control)

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

  Description of basic operations, maintenance procedures, common functions and common remote functions of the mainframe

- Signal Analyzer Operation Manual (Signal Analyzer Function)
- Signal Analyzer Operation Manual (Signal Analyzer Function Remote Control)

  Description of basic operations, common functions and common remote functions of the signal analyzer

- Signal Analyzer Operation Manual (Spectrum Analyzer Function)
- Signal Analyzer Operation Manual (Spectrum Analyzer Function Remote Control)

  Description of basic operations, common functions and common remote functions of the spectrum analyzer

- Signal Analyzer Operation Manual (Phase Noise Measurement Function) <This document>
- Signal Analyzer Operation Manual (Phase Noise Measurement Function Remote Control)

  Description of basic operations, common functions and common remote functions of the Phase Noise Measurement function

# Convention Used in This Manual

Throughout this document, the use of MS269x Series is assumed unless otherwise specified.

If using MS2830A, MS2840A or MS2850A change MS269xA to read MS2830A, MS2840A or MS2850A.

In this document, ⬭ indicates a panel key.

# Table of Contents

*IV.*

This chapter describes an overview of the Phase Noise Measurement function.

**1**

Overview

# 1.1   Overview of Phase Noise Measurement function

The MS2690A/MS2691A/MS2692A, MS2830A, MS2840A or MS2850A Signal Analyzer enables high-speed, high-accuracy, and simple measurements of transmission characteristics of base stations and mobile stations for various types of mobile communications.

The phase noise measurement function is provided for measuring phase noise, which is an important factor for evaluating the short-term stability of signals. With this application, the MS2690A/MS2691A/MS2692A, MS2830A, MS2840A or MS2850A can be used in various applications, including design verification, troubleshooting, and testing on production lines.

This function has following features:
● High speed, high accuracy phase noise measurement

# 1.2   Specification

Table 1.2-1 shows the specifications for Phase Noise Measurement Function Option.

**Table 1.2-1   Phase Noise Measurement Function Option Specifications**

| Item | Specification |
|------|---------------|
| Function | Displays the phase noise characteristics on a logarithmic scale. |
| Frequency | |
| Range | 10 MHz to Upper frequency limit |
| Offset frequency range | 10 Hz to 10 MHz |
| Marker Mode | Normal, Integral Noise, RMS Noise, Jitter, Residual FM, Off |

This chapter describes the preparations required for using the application you are using. Refer to the *MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Mainframe Operation)*, *MS2830A Signal Analyzer Operation Manual (Mainframe Operation)*, *MS2840A Signal Analyzer Operation Manual (Mainframe Operation),* or *MS2850A Signal Analyzer Operation Manual (Mainframe Operation)* for common features not included in this manual.

**2**

Preparation

# 2.1    Part Names

This section describes the panel keys for operating the instrument and connectors used to connect external devices. For general points of caution, refer to the *MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Mainframe Operation)*, *MS2830A Signal Analyzer Operation Manual (Mainframe Operation)*, *MS2840A Signal Analyzer Operation Manual (Mainframe Operation)*, or *MS2850A Signal Analyzer Operation Manual (Mainframe Operation)*.

## 2.1.1    Front panel

This section describes the front-panel keys and connectors.
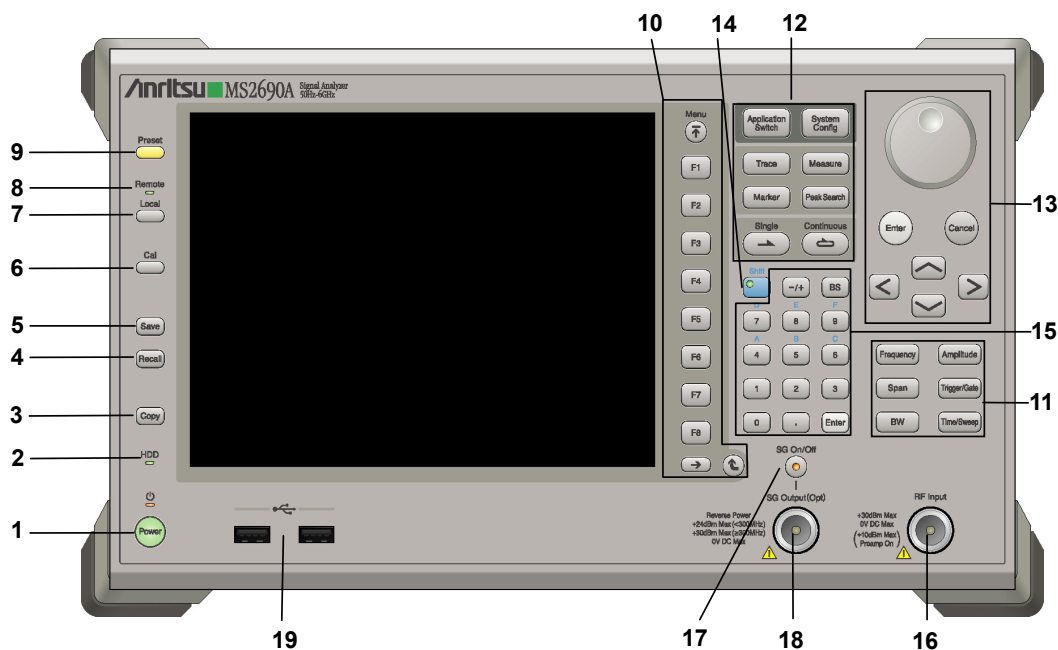


**Figure 2.1.1-1    MS269x series front panel**
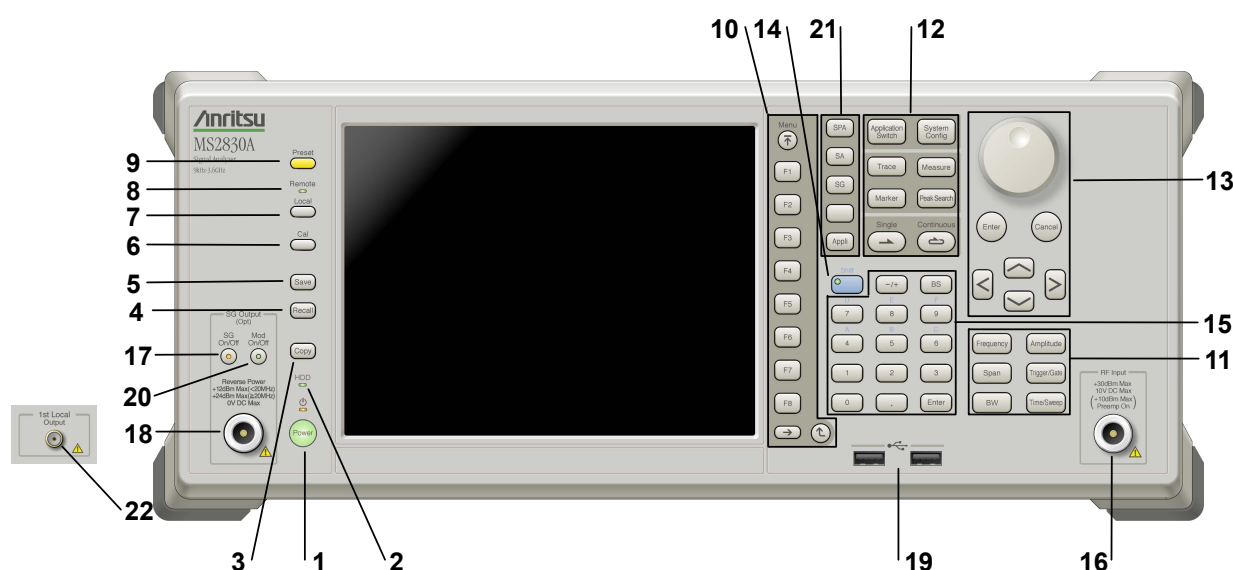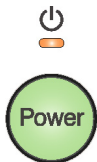
**Figure 2.1.1-2    MS2830A/MS2840A/MS2850A front panel (MS2830A Example)**

**1**

Power Switch

Press to switch between the standby state (AC power supplied) and power-on state. The Power lamp lights orange at Standby and green at Power On. Press the power switch for about 2 seconds.

**2**

HDD

Hard disk access lamp (MS269x series, MS2830A)

Lights up when accessing the internal hard disk.

SSD

SSD access lamp (MS2840A, MS2850A)

Lights up when accessing the internal SSD.

**3**   Copy

Copy key

Press to capture display screen and save to file.

**4**   Recall

Recall key

Press to recall parameter file.

**5**   Save

Save key

Press to save parameter file.

**6**   Cal

Cal key

Press to display the Calibration menu.

2

Preparation

**7**   Local

Local key

Press to return to local operation from remote control via GPIB, Ethernet, or USB (B), and enable panel settings.

**8**   Remote

Remote lamp

Lights when in remote-control state.

**9**   Preset

Preset key

Resets parameters to initial settings.

**10**   Menu

F1
F2
F3
F4
F5
F6
F7
F8
→   ↺

Function keys

Selects or configures function menu displayed on the right of the screen. The function menu is provided in multiple pages and layers.

Press ( → ) to fetch next function menu page. The current page number is displayed at the bottom of the function menu, as in "1 of 2".

Sub-menus may be displayed when a function menu is pressed. Press ↺ to go back to the previous menu. Press ↑ (Menu) to go back to the top menu.

**11**

Frequency  Amplitude
Span      Trigger/Gate
BW        Time/Sweep

Main function keys 1

Press to set or execute main functions.

<u>Executable functions vary with the current application. When nothing happens with the press, it indicates that the application in use does not support the key.</u>

Frequency  Press to set frequency parameters.

Amplitude  Press to set level parameters.

Span  No function is assigned to this key.

Trigger/Gate  Press to set trigger parameters.

BW  No function is assigned to this key.

Time/Sweep  Press to set measurement item parameters.

**12**

Application Switch   System Config
Trace               Measure
Marker              Peak Search
Single              Continuous

Main function keys 2

Press to set or execute main functions.

<u>Executable functions vary with the current application. When nothing happens with the press, it indicates that the application in use does not support the key.</u>

Application Switch  Press to switch application.

System Config  Press to display Configuration screen.

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

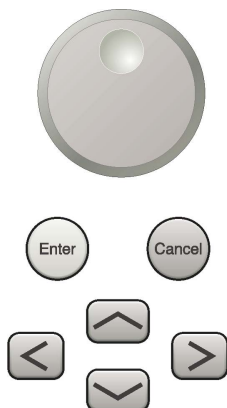Measure  Press to set measurement item parameters.

Marker  Use when switching graph marker operation.

Peak Search  Press to set parameters related to the peak search function.

Single  Press to start single measurement.

Continuous  Press to start continuous measurements.

**2**

Preparation

**13**

Rotary knob/Cursor key/Enter key/Cancel key

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

Press (Enter) to set the entered or selected data.

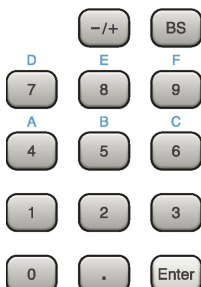Press (Cancel) to cancel input or selected data.

**14**

Shift

Shift key

Operates keys with functions in blue characters on panel. Press the Shift key so the key lamp is green and then press the target key.

**15**

Numeric keypad

Enters numbers on parameter setup screens.

Press [BS] to delete the last entered digit or character.

[A] to [F] can be entered by pressing keys [4] to [9] while the Shift key lamp [Shift] is green.

**16**   RF Input

RF Input connector

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

This is a K type input connector when MS2830A-045, MS2840A-046 is installed or MS2850A.

**17**   SG On/Off

RF Output Control key (when MS269xA-020/120, MS2830A-020/120/021/121, MS2840A-020/120/021/121 is installed)

Press [SG On/Off] to switch on/off the modulation of RF signal when the Vector Signal Generator option is installed. The RF output control key lamp lights orange when the RF signal output is set to On.

This cannot be installed on any of these models: the MS2830A with MS2830A-044/045, the MS2840A with MS2840A-044/046, or the MS2850A.

**18** SG Output(Opt)

RF Output connector (when MS269xA-020/120, MS2830A-020/120/021/121, MS2840A-020/120/021/121 is installed)

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

This cannot be installed on any of these models: the MS2830A with MS2830A-044/045, the MS2840A with MS2840A-044/046, or the MS2850A.

**2**

Preparation

**19**

USB connector (type A)

Connect the accessory USB keyboard, mouse or USB memory.

**20** Mod On/Off

Modulation control key (when MS2830A-020/120/021/121, MS2840A-020/120/021/121 is installed)

Press to switch on/off the modulation of RF signal when the Vector Signal Generator option is installed. The lamp on the key lights up in green in the modulation On state.

This cannot be installed on any of these models: the MS2830A with MS2830A-044/045, the MS2840A with MS2840A-044/046, or the MS2850A.

**21**

Application key (MS2830A, MS2840A, MS2850A)

Press to switch between applications.

Press to display the Spectrum Analyzer main screen.

Press to display the Signal Analyzer main screen, when MS2830A-005/105/007/006/106/009/109/077/078 or MS2840A-005/105/006/106/009/109/077/177/078/178 is installed or MS2850A.

Press to display the Signal Generator main screen, when Vector Signal Generator option is installed. (MS2830A, MS2840A)

This is a blank key. Not used. (MS2830A, MS2840A)

Displays the main screen of the application that is selected using the Application Switch (Auto), or displays that of the pre-selected application (Manual).
For details, refer to 3.5.4 "Changing application layout" in *MS2830A Signal Analyzer Operation Manual (Mainframe Operation), MS2840A Signal Analyzer Operation Manual (Mainframe Operation),* or *MS2850A Signal Analyzer Operation Manual (Mainframe Operation)*.

**22**

1st Local Output connector (MS2830A, MS2840A, MS2850A)

This is available when MS2830A-044/045, MS2840A-044/046 is installed, or MS2850A.

Supplies local signal and bias current to the external mixer, and receives the IF signal with its frequency converted.

## 2.1.2   Rear panel
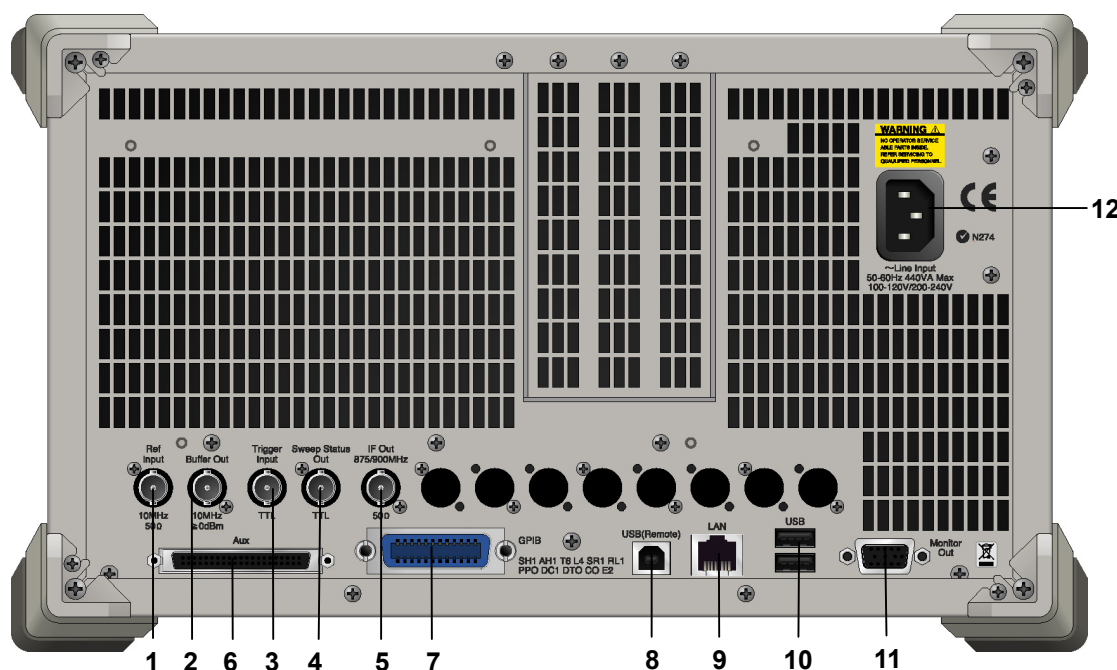
This section describes the rear-panel connectors.
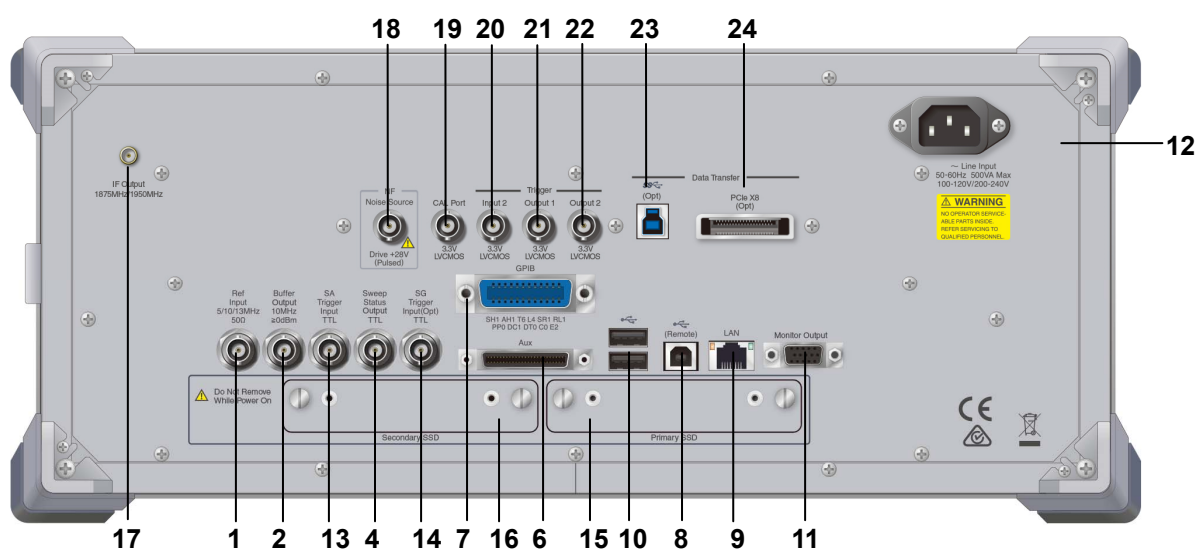


**Figure 2.1.2-1    MS269x series rear panel**



**Figure 2.1.2-2    MS2830A/MS2840A/MS2850A rear panel (MS2850A Example)**

**1**   Ref
Input

Ref Input connector (reference frequency signal input connector)

Inputs external reference frequency signal. It is for inputting reference frequency signals with higher accuracy than the instrument's internal reference signal, or for synchronizing the frequency of the MS2690A/MS2691A/MS2692A, MS2830A, MS2840A, or MS2850A to that of other equipment. The following frequencies are supported:

MS269x series:                          10 MHz/13 MHz
MS2830A, MS2840A, MS2850A:  5 MHz/10 MHz/13 MHz

**2**   Buffer Out

Buffer Out connector (reference frequency signal output connector)

Outputs the internal reference frequency signal (10 MHz). It is for synchronizing frequencies between other equipment and the MS2690A/MS2691A/MS2692A, MS2830A, MS2840A, or MS2850A.

**3**   Trigger
Input

Trigger Input connector (MS269x series only)

Inputs trigger signal from external device.

**4**   Sweep Status
Out

Sweep Status Out connector

Outputs signal when internal measurement is performed or measurement data is obtained.

**5**   IF Out
875/900MHz

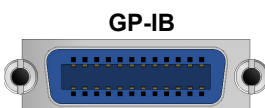IF Out connector (MS269x series only)

Not used.

**6**   Aux

AUX connector

Not used.

**7**   GP-IB

GPIB connector
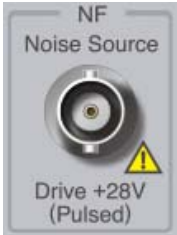
For external control via GPIB.

**8**   USB(Remote)

USB connector (type B)

For external control via USB.

| | | | | |
|---|---|---|---|---|
| **9** | LAN | Ethernet connector<br>Connects PC or Ethernet network. | | |

**10** USB — USB connector (type A)
Used to connect a USB keyboard or mouse or the USB memory supplied.

**11** Monitor Out — Monitor Out connector
Connects external display.

**12** — AC inlet
Supplies power.
~ Line Input

**13** SA Trigger Input TTL — SA Trigger Input connector (MS2830A, MS2840A, MS2850A)
This is a BNC connector for inputting external trigger signal (TTL) for SPA and SA applications.

**14** SG Trigger Input(Opt) TTL — SG Trigger Input connector (MS2830A, MS2840A)
This is a BNC connector for inputting external trigger signal (TTL) for Vector Signal Generator option.

| | | | |
|---|---|---|---|
| **15** | **HDD** or<br>**Primary HDD/SSD** | HDD slot (MS2830A)<br>SSD slot (MS2840A, MS2850A) | This is a standard HDD<br>This is a standard SSD slot. |
| **16** | **HDD(Opt)** or<br>**Secondary HDD/SSD** | HDD slot for Option (MS2830A)<br>SSD slot (MS2840A, MS2850A) | This is a HDD slot for the options.<br>This is a SSD slot for the options. |

**2**

Preparation

| | | |
|---|---|---|
| **17** |  IF Output 1875MHz/1950MHz | IF output connector (MS2830A, MS2840A, MS2850A) Monitor output of the internal IF signal. This is installed when MS2830A-044/045, MS2840A-044/046 is installed or MS2850A. |
| **18** |  NF Noise Source Drive +28V (Pulsed) | Noise Source connector Supply (+28 V) of the Noise Source Drive. This is available when the Option 017/117 is installed. |
| **19** |  CAL Port 3.3V LVCMOS | CAL Port connector (Future extensions) (MS2850A) |
| **20** |  Input 2 3.3V LVCMOS | Trigger Input 2 connector (MS2850A) Input the trigger signal (3.3 V LVCMOS) for SPA and SA applications. |
| **21** |  Output 1 3.3V LVCMOS | Trigger Output 1 connector (MS2850A) Output the trigger signal (3.3 V LVCMOS). |
| **22** |  Output 2 3.3V LVCMOS | Trigger Output 2 connector (MS2850A) Output the trigger signal (3.3 V LVCMOS). |
| **23** |  SS (Opt) | USB 3.0 connector (MS2850A) This is available when the MS2850A-054/154 is installed. |

24    PCIe X8 connector (MS2850A)

This is available when the MS2850A-053/153 is installed.

## 2.2   Signal Path Setup

As shown in Figure 2.2-1, connect the instrument and the DUT using an RF cable, so that the signal to be tested is input to the RF Input connector. To prevent an excessive level signal from being input, do not input the signal before setting the input level using this application.
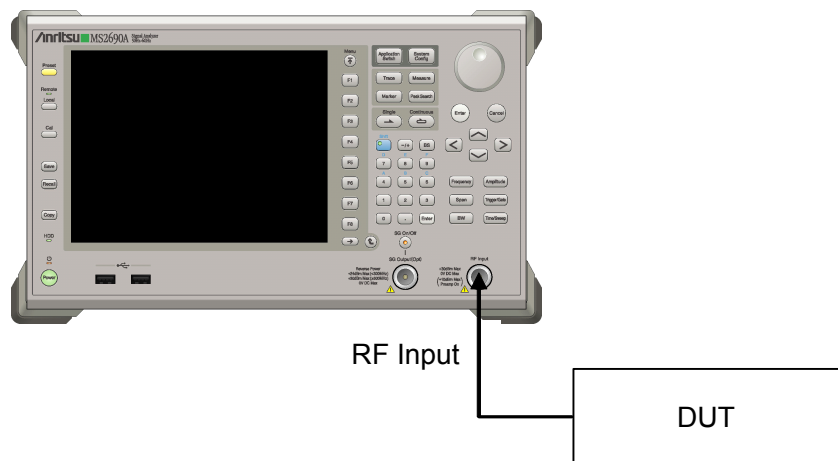


RF Input

DUT

**Figure 2.2-1   Signal path setup example**

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



Trigger signal (TTL)

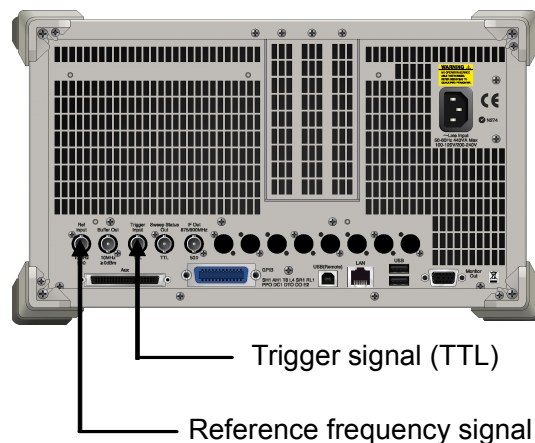Reference frequency signal

**Figure 2.2-2   External signal input**

# 2.3    Application Startup and Selection

To use this application, it is necessary to load (start up) and select the application.

## 2.3.1    Launching application

The application startup procedure is described below.

***Note:***

The XXX indicates the application name currently in use.

\<Procedure\>

1.    Press [ System Config ] to display the Configuration screen.

2.    Press [ F4 ] (Application Switch Settings) to display the Application Switch Registration screen.

3.    Press [ F1 ] (Load Application Select), and move the cursor to "XXX" in the **Unloaded Applications** list.
     If "XXX" is displayed in the **Loaded Applications** list, this means that the application is already loaded.
     If "XXX" appears in neither the **Loaded Applications** nor **Unloaded Applications** list, this means that the application has not been installed.

4.    Press [ F7 ] (Set) to load the application. If "XXX" is displayed in the **Loaded Applications** list, this means that the application is already loaded.

## 2.3.2    Selecting application

The selection procedure is described below.

\<Procedure\>

1.    Press [ Application Switch ] to display the Application Switch menu.

2.    Press the menu function key displaying "XXX".

The application can also be selected with mouse, by clicking "XXX" on the task bar.

# 2.4   Initialization and Calibration

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

## 2.4.1   Initialization

After selecting this application, first perform initialization. Initialization returns the settable parameters to their default value in order to clear the measurement status and measurement results.

***Note:***

> When another software application is switched to or this application is unloaded (ended), the application keeps the parameter settings at that time. The parameter values that were last set will be applied when this application is selected next time.

The initialization procedure is as follows.

<Procedure>
1.   Press ⬤ (Preset) to display the Preset function menu.
2.   Press [F1] (Preset).

## 2.4.2   Calibration

Perform calibration before performing measurement. Calibration sets the level accuracy frequency characteristics for the input level to flat, and adjusts level accuracy deviation caused by internal temperature fluctuations. Calibration should be performed when first performing measurement after turning on power, or if beginning measurement when there is a difference in ambient temperature from the last time calibration was performed.

<Procedure>
1.   Press ⬤ (Cal) to display the Application Cal function menu.
2.   Press [F1] (SIGANA All).

For details on calibration functionality only executable with this instrument, refer to the *MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Mainframe Operation)* , *MS2830A Signal Analyzer Operation Manual (Mainframe Operation)*, *MS2840A Signal Analyzer Operation Manual (Mainframe Operation)*, or *MS2850A Signal Analyzer Operation Manual (Mainframe Operation)*.

This chapter describes the measurement function, the parameter contents and the setting methods for the MS2690A/MS2691A/MS2692A, MS2830A, MS2840A, or MS2850A.

**3**

Measurement

# 3.1   Basic Operation

## 3.1.1   Screen layout

This section describes the screen layout of the phase noise measurement function.
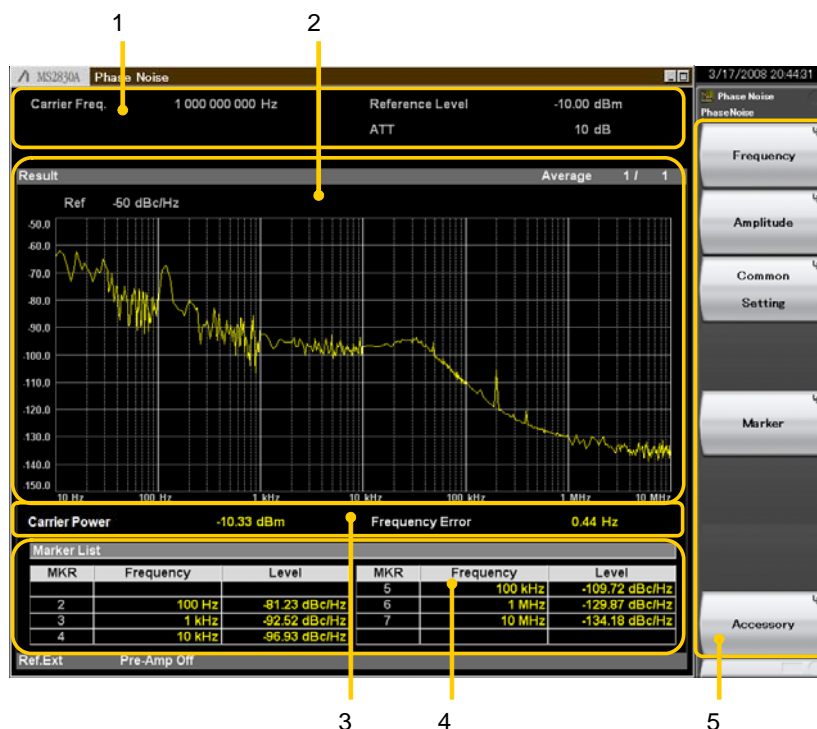


**Figure 3.1.1-1   Screen Layout**

1.   Measurement parameter window

Displays the currently set measurement parameters.

2.   Graph window

Displays the results in a log plot graph.

3.   Numeric result window

Displays the numeric results.

4.   Marker list window

Displays the numeric results at each marker.

5.   Function menu

Displays the functions executable with function keys.

## 3.1.2 Function menu

This section describes the main function menu on the main screen.
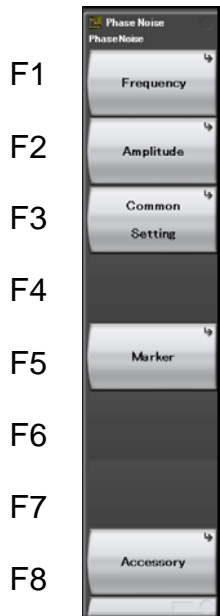


**Figure 3.1.2-1    Main function menu**

**Table 3.1.2-1    Main function menu**

| Menu Display | Function |
|---|---|
| Frequency | Sets frequency<br>☞ 3.2 "Setting Frequency" |
| Amplitude | Sets level.<br>☞ 3.3 "Setting Level" |
| Common Setting | Sets common items.<br>☞ 3.4 "Setting Common Items" |
| Marker | Sets a marker.<br>☞ 3.5 "Setting Markers" |
| Accessory | Sets other functions.<br>☞ 4.1 "Selecting Other Functions" |

**3**

Measurement

### 3.1.3  Performing Measurement

There are two measurement modes: single and continuous. Measurement is performed once in the single measurement mode, and continuously in the continuous measurement mode.

Single
The selected measurement items are measured only once before measurement is stopped.

\<Procedure\>
Press ⬭.

Continuous
The selected measurement items are measured continuously. Measurement will continue even if parameters are changed or the window display is changed. Measurement stops if other applications are selected.

\<Procedure\>
Press ⬭.

# 3.2 Setting Frequency

Configures settings related to frequency. Pressing [F1] (Frequency) on the main function menu displays the Frequency function menu and opens the Carrier Frequency dialog box.

Carrier Frequency
■ Summary
Sets a carrier frequency.

■ Setting range
10 MHz to the upper limit, depending on the main unit

Start Offset
■ Summary
Sets an offset lower limit.

■ Setting range
10 Hz to 1 kHz

Stop Offset
■ Summary
Sets an offset upper limit.

■ Setting range
100 kHz to 10 MHz

External Mixer On/Off
■ Summary
Sets High Performance Waveguide Mixer to On.

■ Options
On    Enables the External Mixer function.
Off   Disables the External Mixer function.

■ Remarks
External Mixer function is MS2830A-044/045, MS2840A-044/046, MS2850A dedicated function. MA2806A and MA2808A are products designed for exclusive use with MS2830A or MS2840A or MS2850A.

**Table 3.2-1    High Performance Waveguide Mixer**

| Model | Name | Frequency Range | Waveguide Flange |
|-------|------|-----------------|------------------|
| MA2806A | High Performance Waveguide Mixer (50 to 75 GHz) | 50 to 75 GHz | UG385/U |
| MA2808A | High Performance Waveguide Mixer (60 to 90 GHz) | 60 to 90 GHz | UG387/U |

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Measurement

To set the parameters of High Performance Waveguide Mixer, use the Spectrum Analyzer function of the mainframe.
For details, refer to Chapter 8 "External Mixer" in the
*MS2830A/MS2840A/MS2850A Signal Analyzer Operation Manual (Spectrum Analyzer Function Operation)*.

External Mixer Select
■  Summary
Selects the band for High Performance Waveguide Mixer.

■  Options
Band V+ High Performance          50 to 75 GHz
Band E– High Performance          60 to 90 GHz

# 3.3  Setting Level

Configures settings related to level. Pressing [F2] (Amplitude) on the main function menu, or pressing [Amplitude] displays the Amplitude function menu.
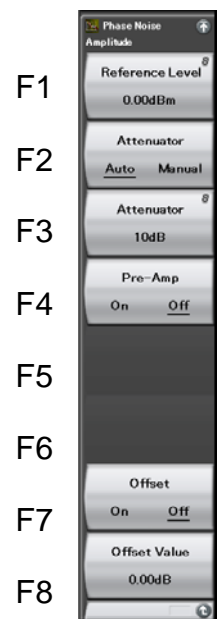
**Figure 3.3-1   Amplitude function menu**

**Table 3.3-1   Amplitude function menu**

| Menu Display | Function |
|---|---|
| Reference Level | Sets reference level.<br>☞ 3.3.1 "Setting Reference Level" |
| Attenuator (Auto/Manual) | Selects whether to set input attenuator automatically or manually.<br>☞ 3.3.2 "Setting Input Attenuator" |
| Attenuator | The input attenuator can be set.<br>☞ 3.3.2 "Setting Input Attenuator" |
| Pre-Amp (On/Off) | Sets Pre-Amp function On/Off.<br>☞ 3.3.3 "Pre-Amp" |
| Scale | Sets scale.<br>☞ 3.3.4 "Setting scale" |
| Offset (On/Off) | Sets reference level offset function On/Off.<br>☞ 3.3.5 "Setting Reference Level Offset" |
| Offset Value | Sets reference level offset value.<br>☞ 3.3.5 "Setting Reference Level Offset" |

### 3.3.1 Setting Reference Level

Reference Level

■ Summary

Sets the input level from the target DUT.

■ Setting range

For Pre-Amp: On :

(–120.00 + Offset Value) to (30.00 + Offset Value) dBm

For Pre-Amp: Off:

(–120.00 + Offset Value) to (50.00 + Offset Value) dBm

### 3.3.2 Setting Input Attenuator

1    Auto

Sets the input attenuator automatically according to the reference level setting. When a signal having the same level as the reference level is input, the input attenuator is automatically set so that the input level to the internal mixer is –10 dBm or less.

2    Manual setting

When measuring a minute-level signal, select Manual and set the input attenuator manually.

The setting range of the input attenuator in Manual setting is as follows.

Setting range and resolution for input attenuator

Input attenuator setting range: Refer to Table 3.3.2-1 or Table 3.3.2-2.

Input attenuator minimum resolution: 2 dB

**Table 3.3.2-1   Input attenuator setting range (When Pre-Amp is set to Off)**

| Attenuator Manual | |
|---|---|
| **Lower Limit** | **Upper Limit** |
| Logic* ($\alpha a = 0$, $\beta = 1$, $\gamma = 2$) The minimum value is 0 dB. | 60 dB |

**Table 3.3.2-2   Setting range for input attenuator**
**(When Pre-Amp is set to On)**

| Attenuator Manual | |
|---|---|
| **Lower Limit** | **Upper Limit** |
| Logic* ($\alpha$ = 20, $\beta$ = 21, $\gamma$ = 22)<br>The minimum value is 0 dB. | 60 dB |

*:  Can be obtained as follows, according to the setting condition.

[1]   When the reference level can be divided by 2:
Attenuator (dB) = RL*1+$\alpha$

[2]   Other than [1] above, and when INT (RL)*2 is an odd number:
Attenuator (dB) = INT (RL)*2 + $\beta$

[3]   Other than [1] above, and when INT (RL)*2 is an even number:
Attenuator (dB) = INT (RL)*2+$\gamma$

 *1:  Reference level (dBm)
 *2:  Integer part of reference level

## 3.3.3  Pre-Amp

Pre-Amp
■ Summary
Turns the Pre-Amp function On/Off. This is available when
MS2830A-008/108/068/168, MS2840A-008/108/068/168/069/169, or
MS2850A-068/168 is installed.

■ Selection options
On     Enables the Pre-Amp function.
Off    Disables the Pre-Amp function.

## 3.3.4  Setting scale

Log Scale Line (10/16)
■ Summary
Sets the number of log scale lines.

■ Selection options
10     10 scale lines (–150 dBc/Hz to Reference Value)
16     16 scale lines (–180 dBc/Hz to Reference Value)
Reference Value
■ Summary
Sets the upper limit value of vertical graph axis.

■ Selection options

Log Scale Line: 10

–140 to –50 dBc/Hz

Log Scale Line: 16
–170 to –20 dBc/Hz

## 3.3.5 Setting Reference Level Offset

Offset

■ Summary

Turns the Offset function On/Off.

■ Selection options

On    Enables the offset function.

Off    Disables the offset function.


Offset Value

■ Summary

Sets the level offset coefficient.

■ Setting range
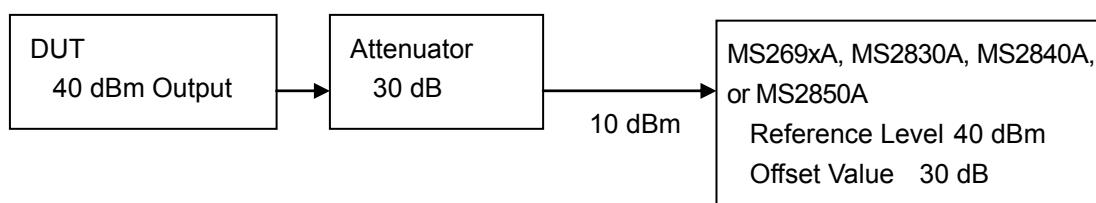
−99.99 to + 99.99 dB

■ Setting example



**Figure 3.3.5-1    Reference Level and Offset Value setting example**

# 3.4   Setting Common Items

This section describes the settings for the common items. Pressing [F3] (Common Setting) on the main function menu displays the Common Setting function menu.

### Average

■ Summary

Sets the averaging count (the number of times to repeat measurements internally per one measurement result).

■ Setting range

1 to 999

### Phase Noise Optimization

■ Summary

Selects the optimization mode of the phase noise measurement.
Only MS2840A, MS2850A is displayed.

■ Options

| | |
|---|---|
| Auto | Performs measurement by automatically switching the best loop filters for the phase noise measurement near and far from the carrier respectively. |
| Best Close-in | Performs measurement by using the best close-in loop filter for the phase noise measurement near the carrier. |
| Best Wide-offset | Performs measurement by using the best wide-offset loop filter for the phase noise measurement far from the carrier. |
| Balance | Performs measurement by using a balanced loop filter for the phase noise measurement both near and far from the carrier. |

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Measurement

# 3.5 Setting Markers

Configures settings related to marker. Pressing [F5] (Marker) on the main function menu or [Marker] displays the Marker function menu.
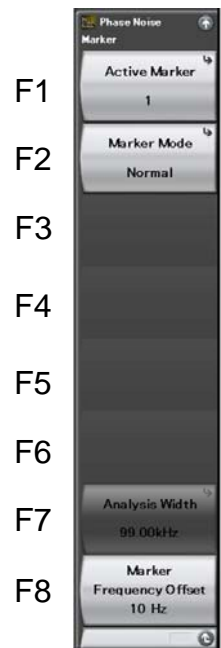
F1
F2
F3
F4
F5
F6
F7
F8

**Figure 3.5-1    Marker function menu**

**Table 3.5-1    Marker function menu**

| Menu Display | Function |
|---|---|
| Active Marker | Sets the active marker.<br>☞ 3.5.1 "Setting marker mode" |
| Marker Mode | Sets the marker mode.<br>☞ 3.5.2 "Setting marker mode" |
| Analysis Width | Sets the marker range (integral bandwidth).<br>☞ 3.5.2 "Setting marker mode" |
| Marker Frequency Offset | Sets the marker offset frequency<br>☞ 3.5.2 "Setting marker mode" |

## 3.5.1  Setting Active Marker

Active Marker

■ Summary

Selects the active marker.

■ Setting range

Marker1 to Marker8

## 3.5.2  Setting marker mode

Maker Mode

■ Summary

Selects the marker function.

■ Options

Normal:          Normal marker. Displays the phase noise level with the specified frequency offset.

Integral Noise:  Calculates the Integral Noise with the specified integral bandwidth.

RMS Noise:       Calculates the RMS Noise with the specified integral bandwidth.

Jitter:          Calculates the Jitter with the specified integral bandwidth.

Residual FM:     Calculates the residual FM with the specified integral bandwidth.

Off:             Turns Off the active marker.

Marker Frequency Offset

■ Summary

Sets the offset frequency of the marker.

■ Resolution

1 Hz (For offset frequency of 10 to 100 Hz)

10 Hz (For offset frequency of 100 Hz to 1 kHz)

100 Hz (For offset frequency of 1 to 10 kHz)

1 kHz (For offset frequency of 10 to 100 kHz)

10 kHz (For offset frequency of 100 kHz to 1 MHz)

100 kHz (For offset frequency of 1 MHz to 10 MHz)

■ Remarks

Enabled for the marker mode of Normal or OFF.

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Measurement

Analysis Width

■ Summary

Displays the integral bandwidth (Start to Stop).

Start and Stop set Analysis Width,

■ Setting range

1 to 9999990 Hz

■ Remarks

Enabled for the marker mode of Integral Noise, RMS Noise, Jitter, or Residual FM.

Start, Stop

■ Summary

Sets Start or Stop frequency of Analysis Width.

■ Setting range

Start Offset to Stop Offset

however, Start < Stop

☞ 3.2 "Setting Frequency"

■ Resolution

Same as Marker Frequency Offset.

# 3.6   Measurement Results

Displays the measurement results of tested signals.

Graphic result



Numeric result          Marker list
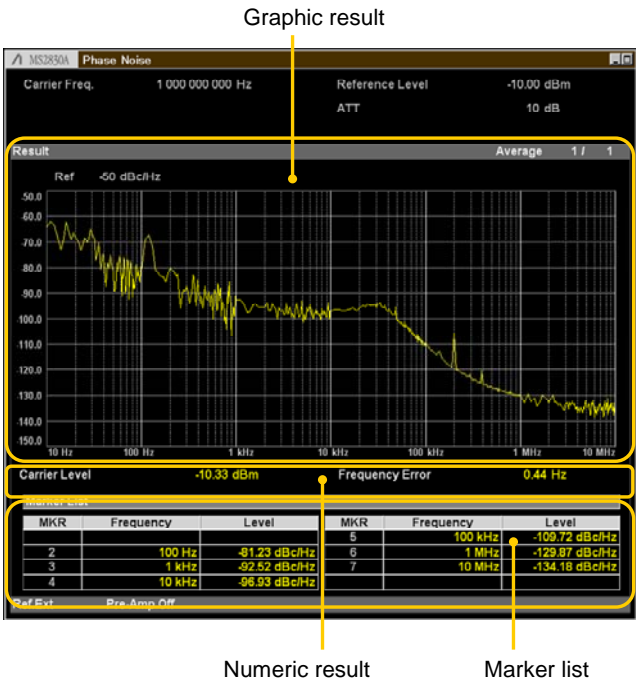
**Figure 3.6-1    Marker function menu (Marker mode: Normal and OFF)**

Graphic result



Numerical result          Marker list
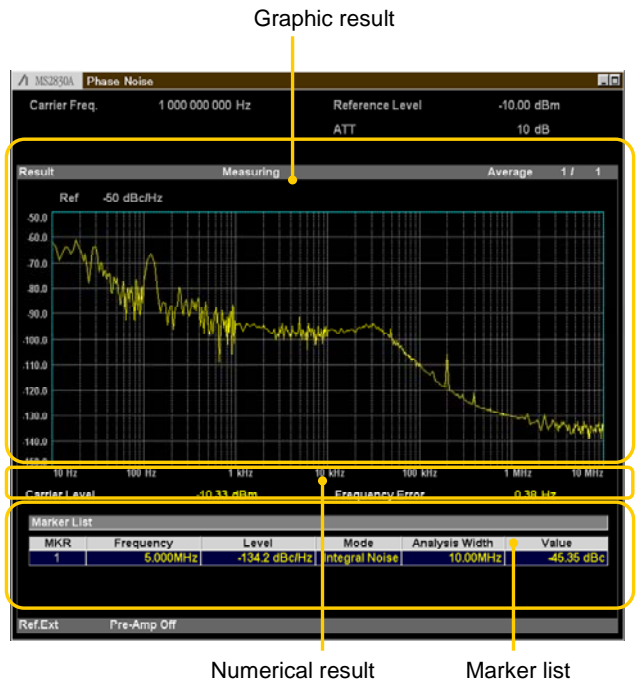
**Figure 3.6-2    Marker function menu (Marker mode: Integral Noise, RMS Noise, Jitter, and Residual FM)**

### 3.6.1 Graphical Results

Displays the result of single-sideband phase noise measurement in a log frequency graph.

### 3.6.2 Numerical Results

Displays the numeric results.

Carrier Power
■ Summary
Displays the carrier power.

Frequency Error
■ Summary
Displays the difference between the set carrier frequency and the measured carrier frequency.

### 3.6.3 Marker List

For the marker mode: Normal and OFF
Lists the measurement results at each marker. The list contains the marker number, marker offset frequency, and marker phase noise level.

**Table 3.6.3-1  Displayed items for marker list**

| Item | Description |
|------|-------------|
| MKR | Displays the marker number. |
| Frequency | Displays the marker offset frequency. |
| Level | Displays the marker phase noise level. |

For the marker mode: Integral Noise, RMS Noise, Jitter, and Residual FM
Lists the measurement results at each marker. The list contains the marker number, offset frequency of the center of marker range, phase noise level, marker mode, integral bandwidth, and calculation result.

**Table 3.6.3-2  Displayed items for marker list**

| Item | Description |
|------|-------------|
| MKR | Displays the marker number. |
| Frequency | Displays the offset frequency of the center of marker range. |
| Level | Displays the phase noise level of the offset frequency. |
| Mode | Displays the marker mode. |
| Analysis Width | Displays the integral bandwidth. |
| Value | Displays the calculation result of the set marker mode. |

# 3.7   Saving Measurement Results

This section describes how to save the measurement results to internal hard disk/SSD or USB memory stick.

<Procedure>

1.  Press ⌊Save⌋ in the Phase Noise screen to display the Save menu shown in Figure 3.7-1.

2.  Press ⌊F1⌋ (Device) to change the save destination.

3.  When the Setting window is displayed, select the target drive and then press ⌊F7⌋ (Set) to set.

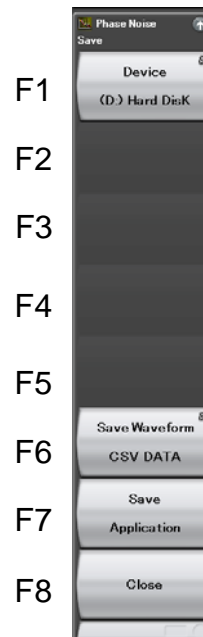4.  With the save destination set, press ⌊F6⌋ (Save Waveform CSV DATA).



**Figure 3.7-1    Save menu**

The sequential numbers suffixed to a file name are 0 to 999. No more files can be saved if the sequential numbers up to 999 are all used.

The saved files are stored in a folder according to the application. The application folders are located under the following directory in the saving target drive specified by ⌊F1⌋ (Device).

\Anritsu Corporation\Signal Analyzer\User Data\Trace Data\Phase Noise

Up to 1000 files can be saved in one folder.

# *Chapter 4   Other Functions*

This chapter describes other functions of this application.

**4**

Other Functions

# 4.1  Selecting Other Functions

Pressing [F8] (Accessory) on the main function menu displays the Accessory function menu.

**Table 4.1-1   Accessory function menu**

| Function Keys | Menu Display | Function |
|---|---|---|
| F1 | Title | Sets the title character string. |
| F2 | Title (On/Off) | Displays (On) or hides (Off) the title character string. |
| F4 | Erase Warm Up Message | Erases the warmup message display. |

# 4.2  Setting Title

A title of up to 32 characters can be displayed on the screen. (Character strings of up to 17 characters can be displayed on a function menu. The maximum number of characters to be displayed on the top of the function menu varies according to character string.)

<Procedure>

1.   Press [F8] (Accessory) on the main function menu.

2.   Press [F1] (Title) to display the character string input screen. Select a character using the rotary knob, and enter it by pressing (Enter). Enter the title by repeating this operation. When the title is entered, press [F7] (Set).

3.   Press [F2] (Title) and then select "Off" to hide the title.

# 4.3  Erasing Warmup Message

The warmup message ( ⚠ Warm Up ), which is displayed upon power-on and indicates that the level and frequency are not stable, can be deleted.

<Procedure>
1.   Press [F8] (Accessory) on the main function menu.
2.   Press [F4] (Erase Warm Up Message) to erase the warmup message.

# *Appendix A   Error Message*

**Table A-1    Message Processing and Status**

| Message | Description |
|---|---|
| Out of range | The settable range is exceeded. |
| No file to read | There is no file that can be read. |
| File read error | File reading has failed. |
| File format error | The file format is invalid. |
| Empty Title Name | The title name is empty. |
| Empty File Name | The file name is empty. |
| Invalid character | – |
| Invalid operation because model names do not match. | – |

Common Parameter

Frequency

| | | |
|---|---|---|
| Carrier Frequency | 2.000 GHz |
| Start Offset | 10 Hz |
| Stop Offset | 10 MHz |
| External Mixer | Off |
| Band Select | VHP |

Amplitude

| | |
|---|---|
| Reference Level | 0.00 dBm |
| ATT | 10 dB |
| Level Offset On/Off | Off |
| Level Offset Value | 0.00 dB |
| Pre-Amp | Off |

Amplitude-Scale

| | |
|---|---|
| Log Scale Line | 10 |
| Reference Value | –50 dBc/Hz |

Phase Noise Basic Parameter

Common Setting

| | |
|---|---|
| Average Count | 1 |
| Phase Noise Optimization (MS2840A, MS2850A) | Auto |

Marker

| | | |
|---|---|---|
| Active Marker | | 1 |
| Marker1 | Marker Mode | Normal |
| | Marker Frequency Offset | 10 Hz |
| Marker2 | Marker Mode | Normal |
| | Marker Frequency Offset | 100 Hz |
| Marker3 | Marker Mode | Normal |
| | Marker Frequency Offset | 1 kHz |
| Marker4 | Marker Mode | Normal |
| | Marker Frequency Offset | 10 kHz |
| Marker5 | Marker Mode | Normal |
| | Marker Frequency Offset | 100 kHz |
| Marker6 | Marker Mode | Normal |
| | Marker Frequency Offset | 1 MHz |
| Marker7 | Marker Mode | Normal |
| | Marker Frequency Offset | 10 MHz |
| Marker8 | Marker Mode | Off |
| | Marker Frequency Offset | 10 MHz |
| Analysis Width | | 99 kHz |
| | Start | 1 kHz |
| | Stop | 100 kHz |

Accessory

Accessory
Title                            On
Title Entry                   Phase Noise

References are to section numbers.

**Index**