Product Brochure

Anritsu

# MS2690A/MS2691A/MS2692A

## Signal Analyzer

MS2690A: 50 Hz to 6.0 GHz
MS2691A: 50 Hz to 13.5 GHz
MS2692A: 50 Hz to 26.5 GHz


Excellent Eco Product

The Signal Analyzer MS2690A/MS2691A/MS2692A (MS269xA) has the excellent general level accuracy, dynamic range and performance of a high-end spectrum analyzer. Its easy operability and built-in functions are perfect for tests of Tx characteristics. Not only can it capture wideband signals but FFT technology supports multifunction signal analyses in both the time and frequency domains. Behavior in the time domain that cannot be handled by a sweep type spectrum analyzer can be checked in the frequency domain. A wide frequency can be analyzed using sweep type spectrum analysis functions while detailed signal analysis of a specific frequency band is supported too. Moreover, the built-in signal generator function outputs both continuous wave (CW) and modulated signals for use as a reference signal source when testing Tx characteristics of parts and as a signal source for evaluating Rx characteristics.

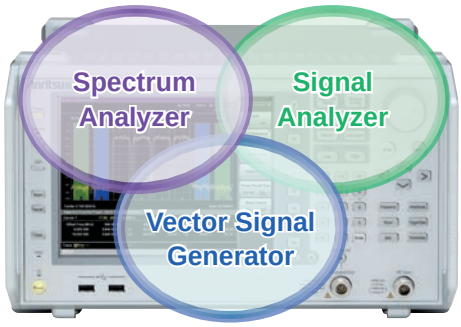
Wireless communications are tending toward use of higher frequencies above 3 GHz and wider bandwidths. However, general-purpose spectrum analyzers suffer from a degraded noise floor above 3 GHz due to the 3-GHz baseband, so they cannot be used to verify the true product performance. Because the MS269xA baseband can be extended up to 6 GHz it offers excellent level accuracy and modulation precision at frequencies from 50 Hz to 6 GHz. Adding the full line of versatile analysis software options eliminates the need for an external PC at wireless modulation analysis. Moreover, installing a preselector bypass option (MS2692A-067) enables use of the signal analyzer and modulation analysis functions up to 26.5 GHz (MS2692A). Waveform creation software generates modulation signal patterns for all common wireless technologies to output signals for the vector signal generator function.
The high-performance, multi-function MS269xA Signal Analyzer supports better analysis than more expensive standalone spectrum analyzers.

# MS2690A/MS2691A/MS2692A

## Signal Analyzer

MS2690A: 50 Hz to 6.0 GHz
MS2691A: 50 Hz to 13.5 GHz
MS2692A: 50 Hz to 26.5 GHz

# Key Features




## Basic Performance/Functions

■ **Frequency Range**
MS2690A: 50 Hz to 6.0 GHz
MS2691A: 50 Hz to 13.5 GHz
MS2692A: 50 Hz to 26.5 GHz

■ **Total Level Accuracy: ±0.3 dB (typ.)**
The Absolute Amplitude Accuracy specification described in catalogs of other spectrum analyzers ignores the important frequency characteristics, linearity, and attenuator switching errors. The MS269xA calibration technology supports excellent level accuracy over the wide frequency range from 50 Hz to 6 GHz even under measurement conditions including the above three errors.

■ **Dynamic Range*1: 177 dB**
TOI*2: ≥+22 dBm
DANL*3: –155 dBm/Hz

■ **Improved Level Linearity**

■ **Internal Reference Oscillator**
Pre-installed Reference Oscillator
Aging Rate: ±1 × $10^{-8}$/day
Start-up Characteristics: ±5 × $10^{-8}$ (5 minutes after power-on)
Rubidium Reference Oscillator (MS269xA-001)
Aging Rate: ±1 × $10^{-10}$/month
Start-up Characteristics: ±1 × $10^{-9}$ (7 minutes after power-on)

■ **Versatile Built-in Functions**

**[Standard]**
- Channel Power
- Occupied Bandwidth
- Adjacent Channel Leakage Power
- Spectrum Emission Mask*4
- Spurious Emission*4
- Burst Average Power
- Frequency Counter*4
- AM Depth*5
- FM Deviation*5
- Multi-marker & Marker List
- Highest 10 Markers
- Limit Line*4
- 2-tone 3rd-order Intermodulation Distortion*4
- Phase Noise
- Power Meter*6

**[Option]**
- Noise Figure*7

## Signal Analyzer Functions

■ **Analysis Bandwidth**
Standard: 31.25 MHz max.
(50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)
MS269xA-077: 62.5 MHz max.
(100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)
MS269xA-078*8, *9: 125 MHz max.
(200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)

■ **Capture Function**
Saves analysis Span × Time signal to internal memory and writes to hard disk.
Up to 100 Msamples per measurement can be saved to internal memory.
Examples: Span 1 MHz: Max. capture time 50 s
Span 10 MHz: Max. capture time 5 s
Span 100 MHz: Max. capture time 0.5 s

■ **Replay Function**
Reads saved data and replays using signal analyzer function.
Examples:
1. Data sharing between separate R&D and manufacturing
2. Later laboratory bench-top analysis of on-site signals

■ **Measurement with Sub-trace Display**
Splits screen and confirms both main and sub-traces at same time to check errors.
Main: Spectrum, Frequency vs. Time, Power vs. Time, Phase vs. Time, CCDF/APD, Spectrogram
Sub: Power vs. Time, Spectrogram

■ **Supports 125 MHz Wideband Measurements up to 26.5 GHz**
MS269xA-067 Microwave Preselector Bypass*10
MS269xA-078 Analysis Bandwidth Extension to 125 MHz*8
Bypassing preselector improves RF frequency characteristics and in-band frequency characteristics. Supports modulation analysis and signal analyzer measurements for signals up to 26.5 GHz.

## Vector Signal Generator (MS269xA-020)

■ **Frequency Range: 125 MHz to 6 GHz**

■ **Pre-installed Baseband Generator**
Vector Modulation Bandwidth: 120 MHz
Sampling Clock: 20 kHz to 160 MHz

■ **Level Accuracy: ±0.5 dB**

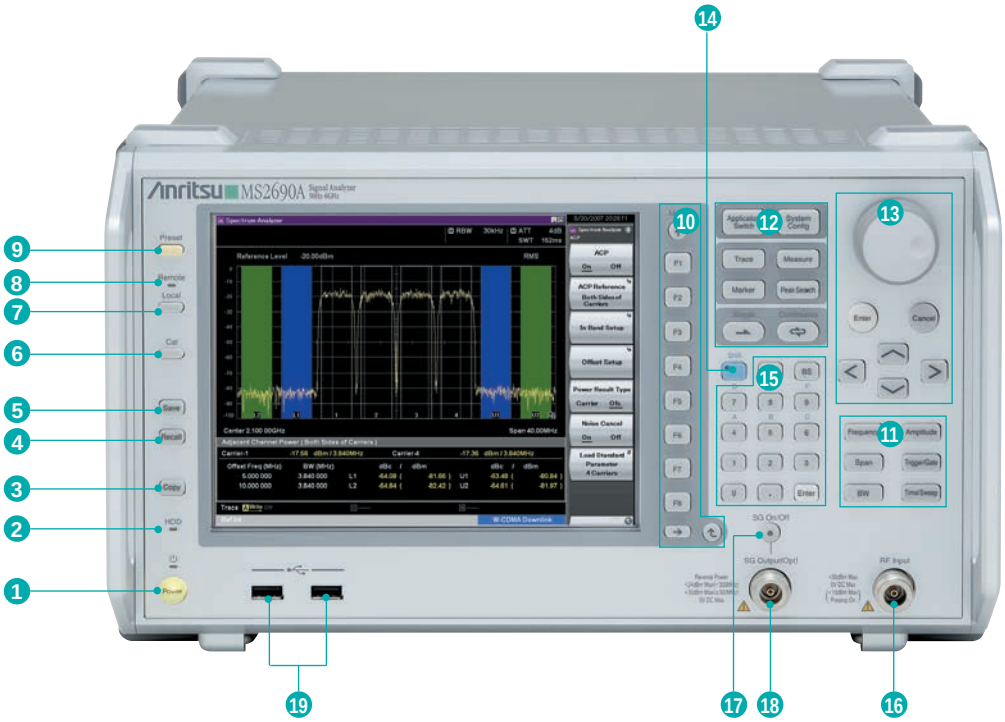
■ **Large-capacity Memory: 1 GB = 256 Msamples**

■ **Internal AWGN Generator**

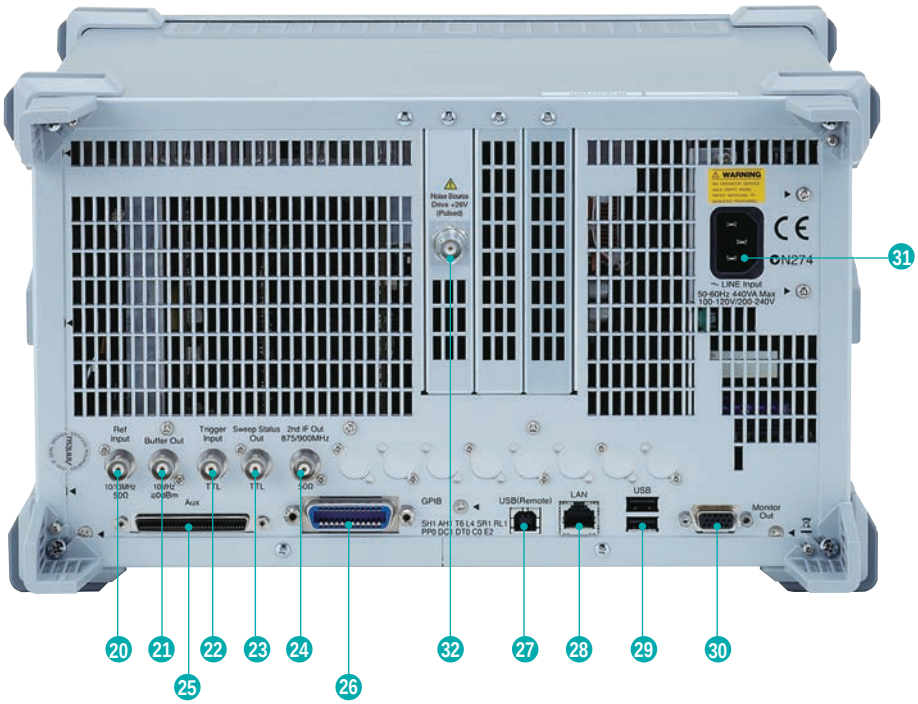
■ **Internal BER Measurement Function**
Bit Rate: 100 bps to 10 Mbps
Input Level: TTL

∗1: Difference between TOI and DANL as simple guide
∗2: TOI (Third Order Intercept)
∗3: DANL (Displayed Average Noise Level)
∗4: Spectrum Analyzer Functions
∗5: Signal Analyzer Functions
∗6: Use USB Power Sensors
∗7: Noise Figure Measurement Function (Requires MS269xA-017)
[Use Noise Sources (Noisecom, NC346 series)]
∗8: Requires MS269xA-077
∗9: Combining with MX269028A-002 wireless LAN IEEE 802.11ac (160 MHz) measurement software (only for MS269xA) supports modulation analysis up to 160-MHz bandwidth signals of the IEEE 802.11ac.
See measurement software catalog for more details.
∗10: MS269xA-067 can be installed in MS2692A

# Panel Layout




1. **Power switch:** Press to switch move between the standby state in which AC power is supplied and the Power On state in which the MS269xA in the operating mode.
2. **Hard disk access lamp:** Lights up when the MS269xA internal hard disk is being accessed.
3. **Copy key:** Press to capture a screen image from the display and save it to a file.
4. **Recall key:** Press to recall a parameter file.
5. **Save key:** Press to save a parameter file.
6. **Cal key:** Press to display the calibration execution menu.
7. **Local key:** Press to return to local operation from remote control operation through GPIB, Ethernet or USB (B), and enable panel settings.
8. **Remote lamp:** Lights up when the MS269xA is in a remote control state.
9. **Preset key:** Resets parameters to their initial settings.
10. **Function keys:** Used for selecting or executing function menu displayed on the right of the screen.
11. **Main function keys 1:** Used to set or execute main functions of the MS269xA.
    Executable functions vary depending on the application currently selected.
12. **Main function keys 2:** Used to set or execute main functions of the MS269xA.
    Executable functions vary depending on the application currently selected.
13. **Rotary knob/Cursor key/Enter key/Cancel key:** The rotary knob and cursor keys are used to select display items or change settings.
14. **Shift key:** Used to operate any keys with functions described in blue characters on the panel. First press the Shift key, then press the target key when the Shift key lamp lights up green.
15. **Numeric keypad:** Used to enter numbers on parameter setup screens.
16. **RF Input connector:** Inputs an RF signal.
17. **RF output control key:** If the MS269xA-020 Vector Signal Generator is installed, pressing enables (On) or disables (Off) the RF signal output. The lamp of the RF output control key lights up orange when the RF signal output is set to On.
18. **RF output connector (when MS269xA-020 installed):** Outputs an RF signal.
19. **USB connectors (type A):** Used to connect a USB keyboard or mouse or the USB memory supplied with the MS269xA.




20 **Ref Input connector (reference frequency signal input connector):** Inputs an external reference frequency signal (10 MHz/13 MHz). It is used for inputting reference frequency signals with accuracy higher than that of those inside the MS269xA, or for synchronizing the frequency of the MS269xA to that of another device.

21 **Buffer Out connector (reference frequency signal output connector):** Outputs the reference frequency signal (10 MHz) generated inside the MS269xA. It is used for synchronizing the frequencies between other devices and the MS269xA based on the reference frequency signal output from this connector.

22 **Trigger Input connector:** Inputs a trigger signal from an external device. Refer to the operation manual of each application for operations when a trigger signal is input.

23 **Sweep Status Out connector:** Outputs a signal that is enabled when an internal measurement is performed or measurement data is obtained.

24 **IF Out connector:** Outputs an IF signal. 874.988 MHz is specified as the center frequency during spectrum analyzer operations, and 875 or 900 MHz is specified during signal analyzer operations. (Bandwidth ≤31.25 MHz: 875 MHz, Bandwidth >31.25 MHz: 900 MHz) The IF signal is output without band limitation by RBW during both spectrum analyzer and signal analyzer operations.

25 **Aux connector:** Composite connector for Vector Signal Generator options with Marker 1 to 3 outputs, pulse modulation input, baseband reference clock signal input, and BER measurement Clock, Data, and Enable inputs. Converted to BNC using optional AUX Conversion Adaptor (J1373A).

26 **GPIB connector:** Used when controlling the MS269xA externally via GPIB.

27 **USB connector (type B):** Used when controlling the MS269xA externally via USB.

28 **Ethernet connector:** Used for connecting to a personal computer (PC) or for Ethernet connection.

29 **USB connectors (type A):** Used to connect a USB keyboard or mouse or the USB memory supplied with the MS269xA.

30 **Monitor Out connector:** Used for connection with an external display.

31 **AC inlet:** Used for supplying power.

32 **Noise Source Drive connector:** This is available when the MS269xA-017/117 is installed. Supply (+28 V) of the Noise Source Drive.

# Basic Performance

## Excellent Total Level Accuracy: ±0.3 dB (typ.)

**(Common to both Spectrum Analyzer and Signal Analyzer Functions)**

With a 6-GHz basic band and level calibration over a wide frequency range, the MS269xA has excellent total level accuracy.

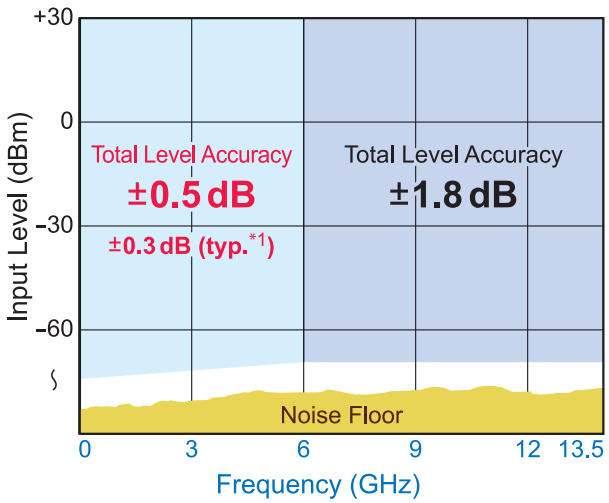
The Absolute Amplitude Accuracy specification described in catalogs of other spectrum analyzers ignores the important frequency characteristics, linearity, and attenuator switching errors. In contrast, the MS269xA Level Calibration technology assures excellent level accuracy over a wide frequency range from 50 Hz to 6 GHz even under measurement conditions including the above three errors. The level accuracy is assured even when the frequency and attenuator are switched.

**Advantage of 6 GHz Basic Band**
Conventional spectrum analyzers have a degraded noise floor above 3 GHz because they use a preselector at the 3-GHz basic band, which causes lowered measurement accuracy.
The MS269xA basic band of 6 GHz eliminates the degraded noise floor and improves measurement accuracy.

**Advantage of MS269xA Level Accuracy Technology**
Conventional spectrum analyzers perform level calibration at just one frequency point, which causes errors when the frequency changes. The MS269xA has two built-in signal generators for level calibration over a wide frequency range from 50 Hz to 6 GHz, minimizing measurement errors in this frequency range.

The MS269xA total level accuracy includes:

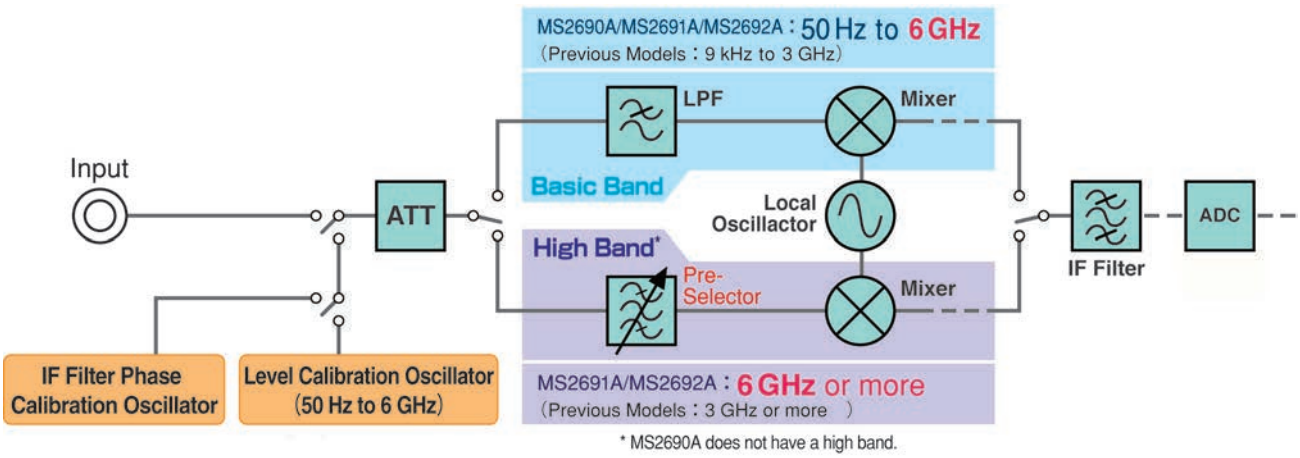
- **Frequency characteristics**
- **Linearity**
- **Attenuator switching error**




Note: Eliminates effect of noise floor
Used only when Uncal does not occur

∗1: Excluding Guard Band

**MS269xA Block Diagram**




**Preselector**
The MS269xA has a basic band that goes to 6 GHz without a preselector. Most spectrum analyzers may use a preselector in the high band to clean-up images but it is extremely difficult to stabilize the amplitude and frequency characteristics of the preselector. This instability is the main cause of degraded level accuracy and modulation precision in measuring instruments.
Additionally, the preselector passband frequency can cause limitations at analysis bandwidths. No preselector means greater measurement accuracy.

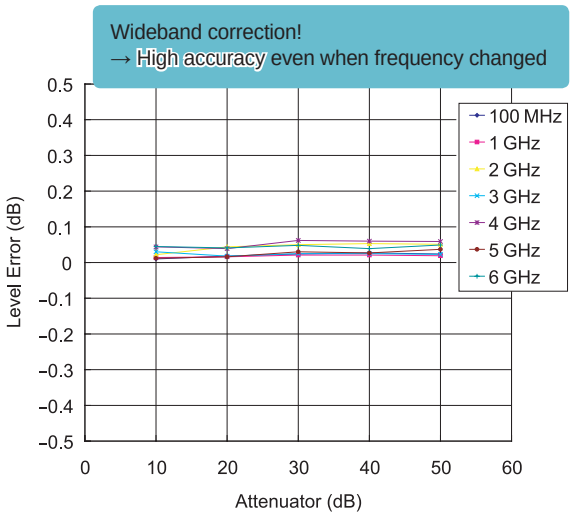
**MS2692A-067* Microwave Preselector Bypass**
Bypasses the preselector to improve the RF frequency characteristics and the in-band frequency characteristics. When the preselector option is set to On, the image response elimination filter is bypassed.
Therefore, this function is not appropriate for spurious measurement to receive the image response.

∗: MS269xA-067 can be installed in MS2692A.

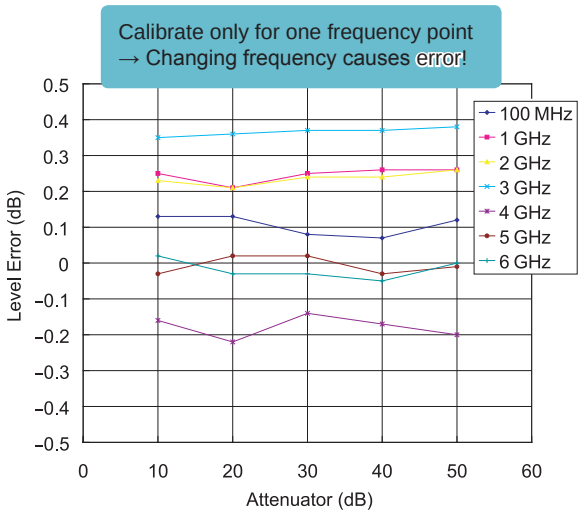
# Basic Performance

**Example: Level Error Comparison with Different Level Calibration Method**

**MS269xA**




**Conventional Spectrum Analyzer**




The MS269xA total level accuracy includes:

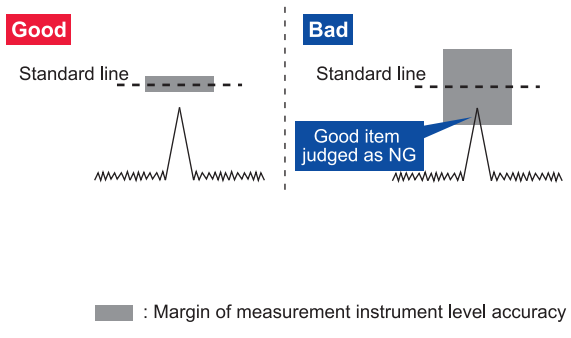
- **Frequency characteristics**
- **Linearity**
- **Attenuator switching error**

The absolute amplitude accuracy specifications of other spectrum analyzers excludes:

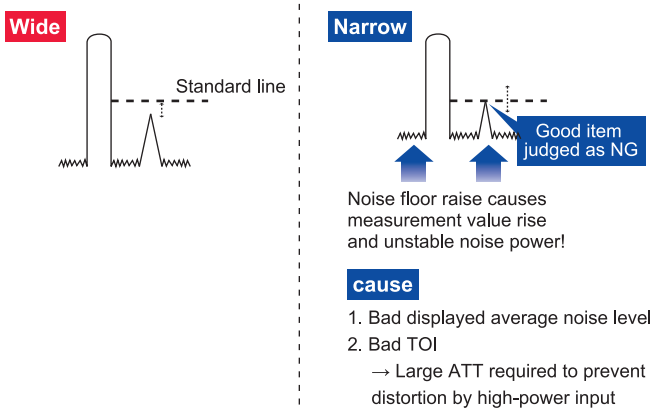
- **Frequency characteristics**
- **Linearity**
- **Attenuator switching error**

The measuring instrument level error cannot be said to really meet the specifications if measurement requires addition of a margin to the product test specification. Since specifications with added margin are severe, even genuinely passing products may sometimes be evaluated as failing due to this margin.

**Level accuracy**




**Dynamic range**



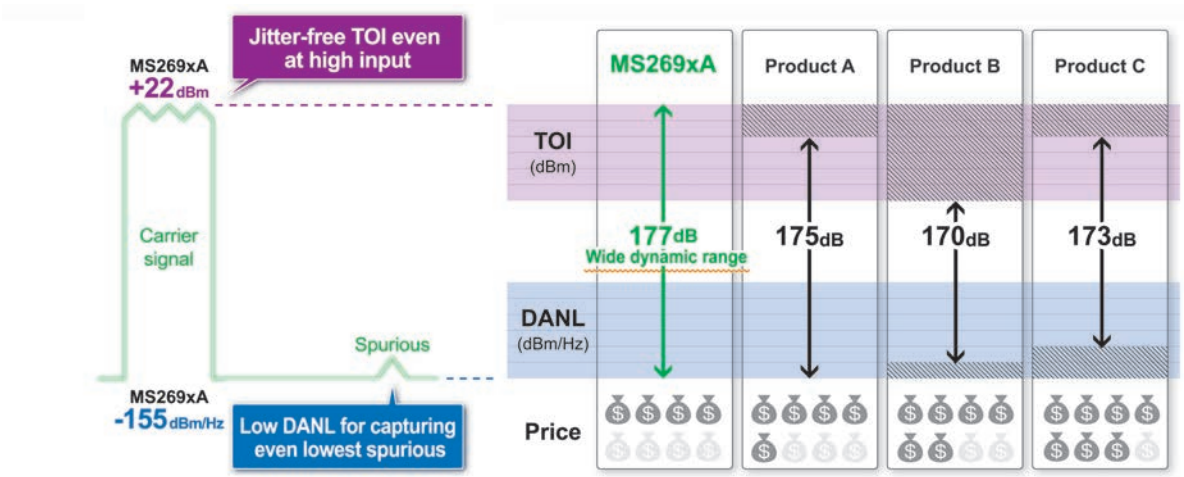
## Top Class Dynamic Range

**Dynamic range*1: 177 dB**
**TOI*2: ≥+22 dBm (700 MHz to 4 GHz)**
**DANL*3: –155 dBm/Hz (30 MHz to 2.4 GHz)**

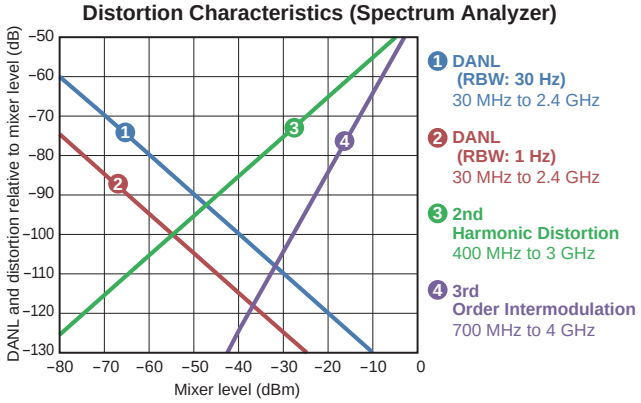
∗1: Difference between TOI and DANL as simple guide.
∗2: TOI (Third Order Intercept)
∗3: DANL (Displayed Average Noise Level)

Dynamic range is a key specification for spectrum analyzers. Low displayed average noise level (DANL) as well as high TOI are important too.
Low TOI may cause distortion with high-level carrier signals. Inserting an attenuator can lower the carrier level but this has the effect of lowering the level of weak spurious, making it hard to measure.

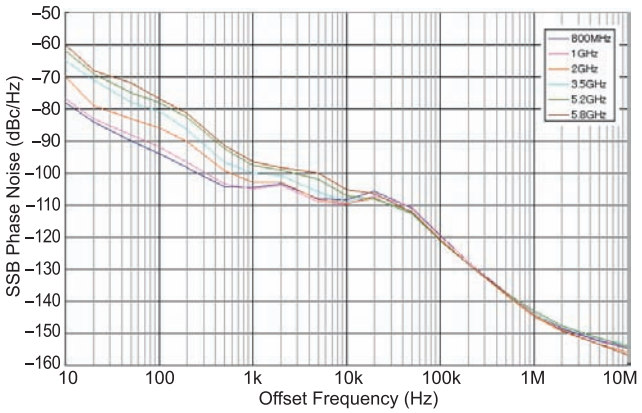
The MS269xA has an excellent dynamic range supporting true performance measurements of devices, such as base stations, requiring wideband measuring instruments.
For example, the 3GPP category-B spurious measurement specification requires a measuring instrument with severe dynamic range specifications. If the measurement is within the MS269xA dynamic range, measurement jigs such as filters and amplifiers are unnecessary and troublesome calibration is omitted, helping simplify setup and cut costs.




**Distortion Characteristics (Spectrum Analyzer)**




**Example: SSB Phase Noise (Spectrum Analyzer/Signal Analyzer Common)**

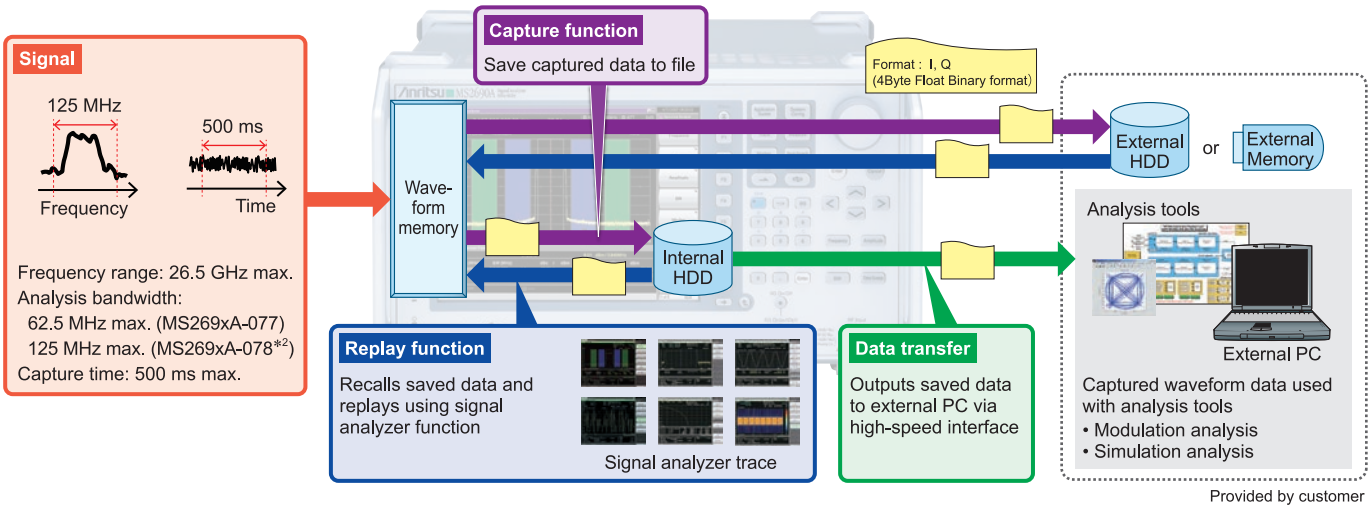


## Supports 125 MHz Wideband Measurements up to 26.5 GHz

**MS2692A-067 Microwave Preselector Bypass*1 + MS2692A-078 Analysis Bandwidth Extension to 125 MHz*2**

∗1: Can be installed in MS2692A.
∗2: Require MS2692A-077.

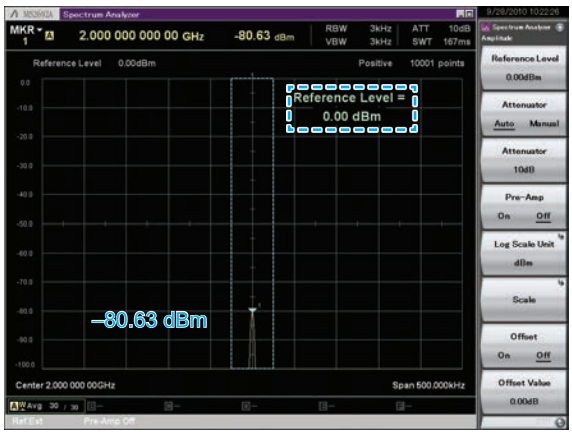
Supports wideband analysis with high frequencies for satellite communications
Microwave preselector bypass frequency range: 6 GHz to 26.5 GHz (MS2692A)
Installing the microwave preselector bypass supports signal analyzer measurement functions in the above frequency range.

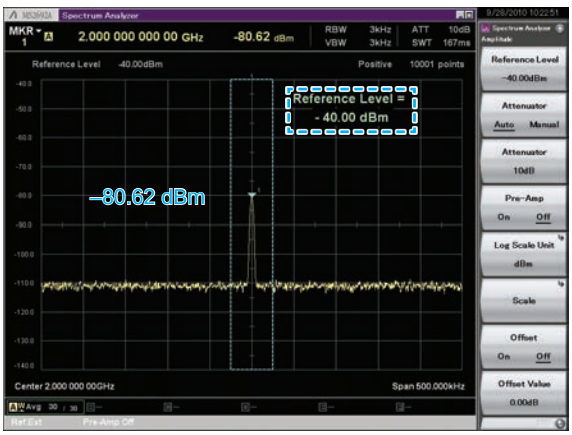


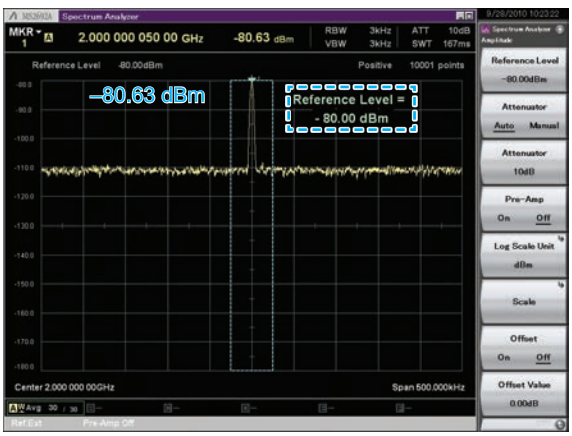
## Improved Level Linearity

Conventional spectrum analyzers use an analog IF and log amp to achieve good level accuracy at points near the log scale reference level, but the accuracy degrades at points that are further away. The MS269xA uses a digital IF instead of a log amp, which supports measurements with excellent accuracy at any point.

**Example: Level Stability by Switching Reference Level**




**Level Linearity:**

The MS269xA total level accuracy is better than that of conventional spectrum analyzers but sometimes a power meter is used when wanting to measure with even higher accuracy. However, use of a power meter narrows the dynamic range and errors may also occur easily when switching the power range. Since a power meter has no frequency selection, the total power of the input signal is measured. In other words, the power of the target frequency components cannot be separated out.
Measurement can be performed with a wide dynamic range after checking the MS269xA level measurement reference value with a power meter.

The MS269xA total level accuracy includes:

- **Frequency characteristics**
- **Linearity**
- **Attenuator switching error**

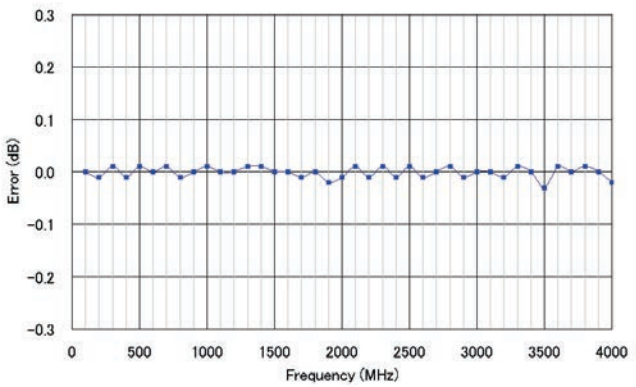
And supports excellent:

- **Log scale stability**

## Dual Sweep Speed: Normal/Fast

When sweep time is set to [Auto], Normal (normal sweep) or Fast mode (high-speed sweep) can be set. The Fast mode sweeps six times faster than the Normal mode.

**Example of Sweep Mode Switch Error: (CW –10 dBm input)**
**Level Error when Switching from Normal to Fast**



## Resolution Bandwidth (RBW)

**Setting Range (Spectrum Analyzer):**
**30 Hz to 3 MHz (1-3 sequence),**
**50 kHz, 5 MHz, 10 MHz, 20 MHz, 31.25 MHz**[*1]
**Setting Range (Spectrum trace in signal analyzer mode):**
**1 Hz to 1 MHz (1-3 sequence), 3 MHz**[*2, *3]**, 10 MHz**[*3]

When monitoring two adjacent signals, the frequency resolution can be increased by reducing the resolution bandwidth (RBW). This also has the effect of reducing the noise level. Conversely, to confirm level variations of 20-MHz band signals such as LTE and WiMAX, set the RBW to 31.25 MHz.

∗1: Instead of Gaussian filter, 31.25 MHz RBW uses filter with flat top characteristics above 31.25 MHz.
∗2: With MS269xA-077 installed and bandwidth setting ≥50 MHz
∗3: With MS269xA-077+078 installed and bandwidth setting ≥50 MHz

## Trigger Function

Trigger sweep executes sweeping using the specified trigger condition as the start point. In particular, “SG Marker” starts analyzer measurement in synchrony with the signal output by installing MS269xA-020. Using this function supports simple synchronized measurement even when evaluating signals with large level variation over time, such as modulation signals.

- Video trigger:
  Trigger sweeping starts in synchronization with the rise or fall of the waveform. A trigger level indicator showing the trigger level is displayed on the screen.
- Wide IF video trigger:
  An IF signal with a wide passing band of about 50 MHz is detected, and sweeping starts in synchronization with either the rise or fall of the detected signal.
- External trigger:
  Sweeping starts in synchronization with the rise or fall of the signal input via the Trigger Input connector.
- SG Marker trigger (Requires MS269xA-020):
  Sweeping starts in synchronization with the rise or fall of the marker signal output of MS269xA-020. This function supports measurement in synchronization with the output signal of MS269xA-020.

## Gate Sweep

Gate sweep executes sweeping only for the length of time specified by the gate length, starting from when the trigger condition is met. A delay time until sweeping starts after the trigger condition is met can be set using trigger delay.

- The gate source can be selected from the following
  - Wide IF video trigger
  - External trigger
  - SG marker trigger (Requires MS269xA-020)
- Setting range and resolution for gate delay
  - Setting range: 0 to 1 s
  - Resolution: 20 ns
- Setting range and resolution for gate length
  - Setting range: 50 µs to 1 s
  - Resolution: 20 ns

## Three Built-in External Interfaces

The built-in Gigabit Ethernet, USB2.0, and GPIB interfaces support remote operation.

GPIB: IEEE 488.2, Rear panel, IEEE 488 bus connector
Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2

Ethernet: 10/100/1000BASE-T, Rear panel, RJ-45

USB (B): USB2.0, Rear panel, USB-B connector

## Saving Measurement Results

Measurement results can be saved to internal hard disk or external USB memory. Screen dumps and trace data can be saved too.

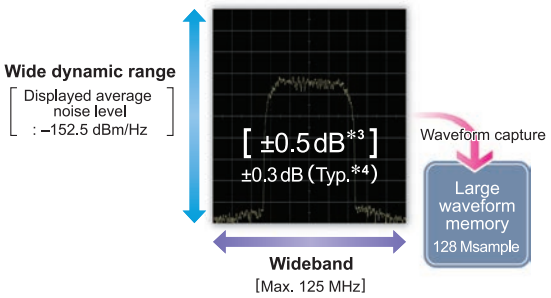
- Screen dump file type
  - BMP
  - PNG
- The color of the screen hard copy can be set as follows:
  - Normal (same as screen display)
  - Reverse
  - Monochrome
  - Reversed Monochrome

# Signal Analyzer: Basic Performance/Functions

## Wide bandwidth × High Accuracy FFT Analysis

**Standard: 31.25 MHz max.**
**(Sampling rate 50 MHz max = Resolution 20 ns, ADC resolution 16 bits)**
**MS269xA-077: 62.5 MHz max.**
**(Sampling rate 100 MHz max = Resolution 10 ns, ADC resolution 14 bits)**
**MS269xA-078[*1, *2]: 125 MHz max.**
**(Sampling rate 200 MHz max = Resolution 5 ns, ADC resolution 14 bits)**

Based on the excellent level accuracy and wide dynamic range of the MS269xA, a signal with an FFT analysis bandwidth of up to 125 MHz can be captured with a level accuracy of ±0.3 dB.




∗1: Requires MS269xA-077
∗2: Combining with MX269028A-002 wireless LAN IEEE 802.11ac (160 MHz) measurement software (only for MS269xA) supports modulation analysis up to 160-MHz bandwidth signals of the IEEE 802.11ac.
See measurement software catalog for more details.
∗3: 50 Hz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal
∗4: Excluding Guard Band

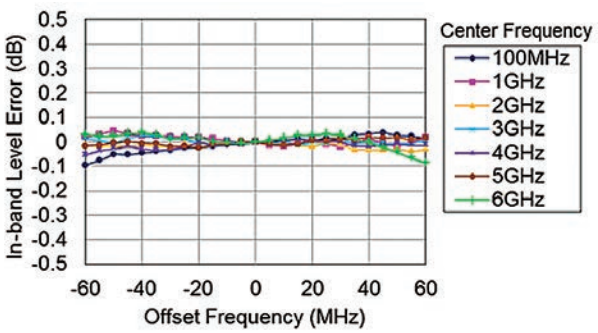
## Excellent Frequency Characteristics in Analysis Bandwidth

The Signal Analyzer Extra Band Cal function using the built-in oscillator for calibration supports analysis bandwidth calibration at the set frequency.
The excellent in-band frequency characteristics support wideband modulation analysis with less error.

**Extra Band Cal Frequency Range**
Span ≤ 31.25 MHz (Standard): 30 MHz to 6 GHz
Span > 31.25 MHz (MS269xA-077/078): 100 MHz to 6 GHz

∗: Setting center frequency after Extra Band Cal, requires re-execution of Extra Band Cal.

**Example of frequency characteristics in analysis bandwidth after Extra Band Cal**
(With MS269xA-078, Reference Level: –10 dBm, Input attenuator: 10 dB, Preamp: Off, Span: 125 MHz)




## Save Signals in Internal Memory

**Max. Capture Time: 0.5 s to 2000 s**
**Max. Number of Samples: 100 Msamples**

The “Analysis bandwidth × Analysis time” signal is held in internal memory and saved to hard disk.
Up to 100 Msamples of data can be saved to memory for one measurement. The frequency span determines the sampling rate. The following chart shows the maximum capture time per frequency span.

| Span | Sampling Rate | Capture Time | Max. Sampling Data |
|---|---|---|---|
| 1 kHz | 2 kHz | 2000 s | 4M |
| 2.5 kHz | 5 kHz | 2000 s | 10M |
| 5 kHz | 10 kHz | 2000 s | 20M |
| 10 kHz | 20 kHz | 2000 s | 40M |
| 25 kHz | 50 kHz | 2000 s | 100M |
| 50 kHz | 100 kHz | 1000 s | 100M |
| 100 kHz | 200 kHz | 500 s | 100M |
| 250 kHz | 500 kHz | 200 s | 100M |
| 500 kHz | 1 MHz | 100 s | 100M |
| 1 MHz | 2 MHz | 50 s | 100M |
| 2.5 MHz | 5 MHz | 20 s | 100M |
| 5 MHz | 10 MHz | 10 s | 100M |
| 10 MHz | 20 MHz | 5 s | 100M |
| 25 MHz | 50 MHz | 2 s | 100M |
| 31.25 MHz | 50 MHz | 2 s | 100M |
| 50 MHz* | 100 MHz | 500 ms | 50M |
| 62.5 MHz* | 100 MHz | 500 ms | 50M |
| 100 MHz* | 200 MHz | 500 ms | 100M |
| 125 MHz* | 200 MHz | 500 ms | 100M |

∗: With MS269xA-077: 50/62.5 MHz
With MS269xA-077/078: 50/62.5/100/125 MHz

## Replay Function for Comparison Evaluation

This function reads saved data and replays it using the signal analyzer measurement function.

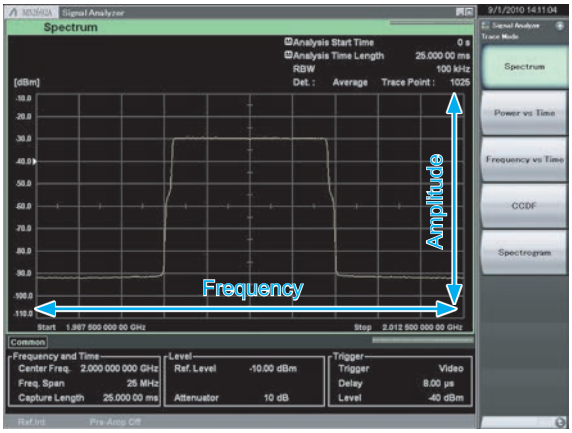
Examples:
1. Data sharing between separate R&D and manufacturing
2. Later laboratory bench-top analysis of on-site signals
3. Save data at shipment and re-verify if problem occurs

**Captured Waveform Data: Selection Screen**

# Signal Analyzer: Trace

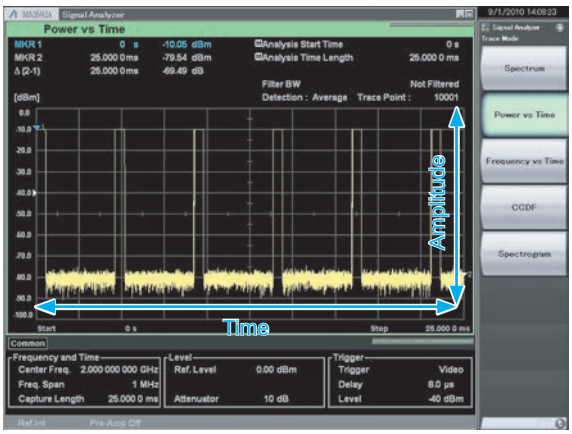
## Spectrum

The Spectrum trace displays a graph with amplitude on the y-axis and frequency on the x-axis. The captured IQ data is FFT processed (fast Fourier transformed) and converted from the time domain to the frequency domain for display as a spectrum.



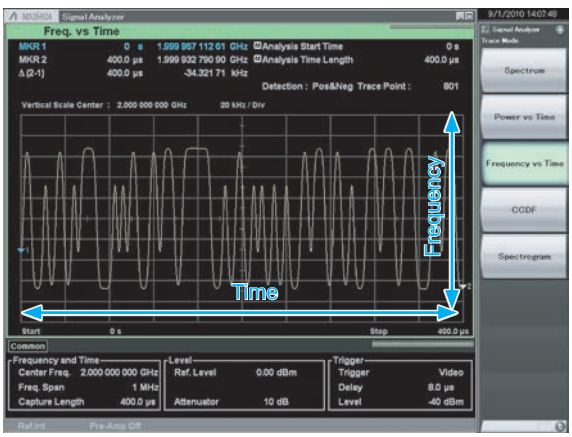

## Power vs. Time

The Power vs. Time trace displays a graph with amplitude on the y-axis and time on the x-axis to confirm changes in power with time of measured signals.



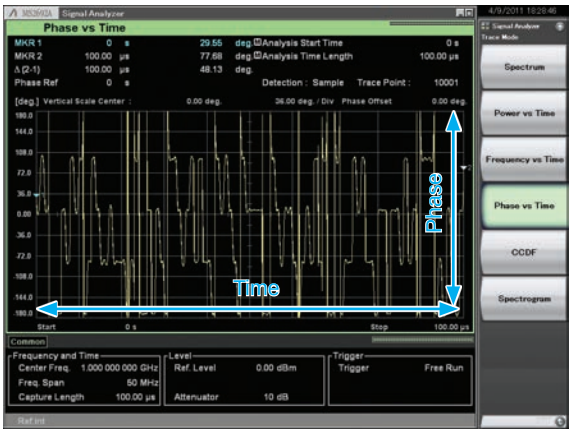

## Frequency vs. Time

The Frequency vs. Time trace displays a graph with frequency on the y-axis and time on the x-axis to confirm time variation of the measured signal frequency.




## Phase vs. Time

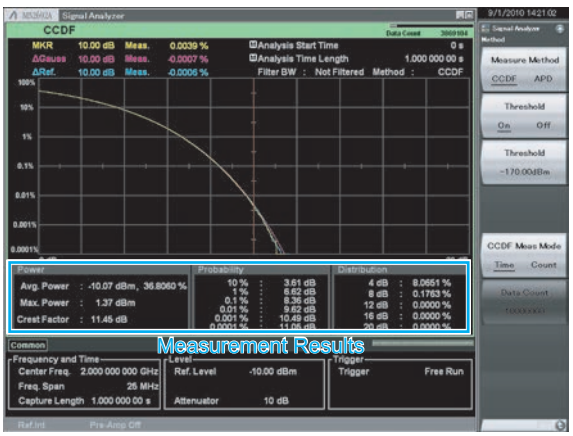
The Phase vs. Time trace displays a graph with phase on the y-axis and time on the x-axis to confirm time variation of the measured signal phase.




## CCDF*1/APD*2

The CCDF trace displays the power variation probability on the y-axis and power variation on the y-axis to confirm the CCDF and APD of measured signals.

∗1: CCDF (Complementary Cumulative Distribution Function)
∗2: APD (Amplitude Probability Density)



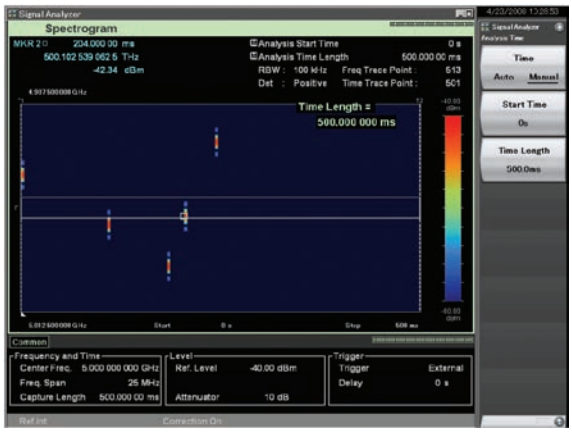

**Measurement Results**

- CCDF: The CCDF display indicates the cumulative distribution of transient power variations compared to average power.
- APD: The APD display indicates the probability distribution of transient power fluctuations compared to average power.

# Signal Analyzer: Trace

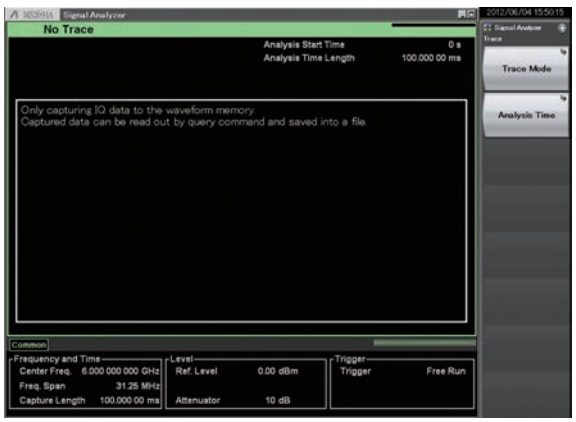
## Spectrogram

The Spectrogram trace displays the level as color with frequency on the y-axis and time on the x-axis. The captured IQ data is FFT processed to confirm time variations in the continuous spectrum. It is useful for monitoring frequency hopping and transient signals.




## No Trace

No Trace mode does not execute signal analysis. Therefore, “IQ data output” and “IQ data readout using remote commands” can be executed quickly without the need to wait for completion of analysis.

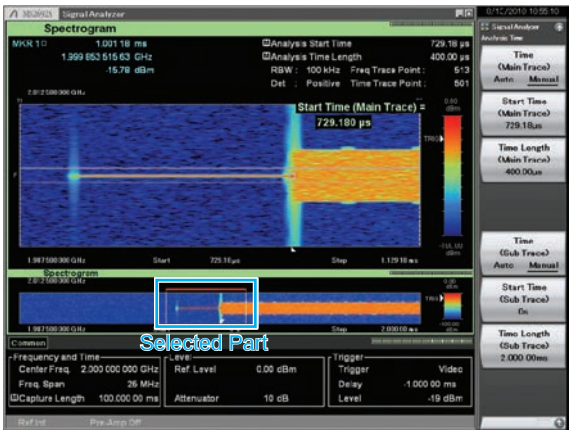



## Measurement with Sub-trace Display

This function splits the screen into top and bottom halves; simultaneous display of the sub-trace supports easy monitoring of fault locations and transient phenomena.

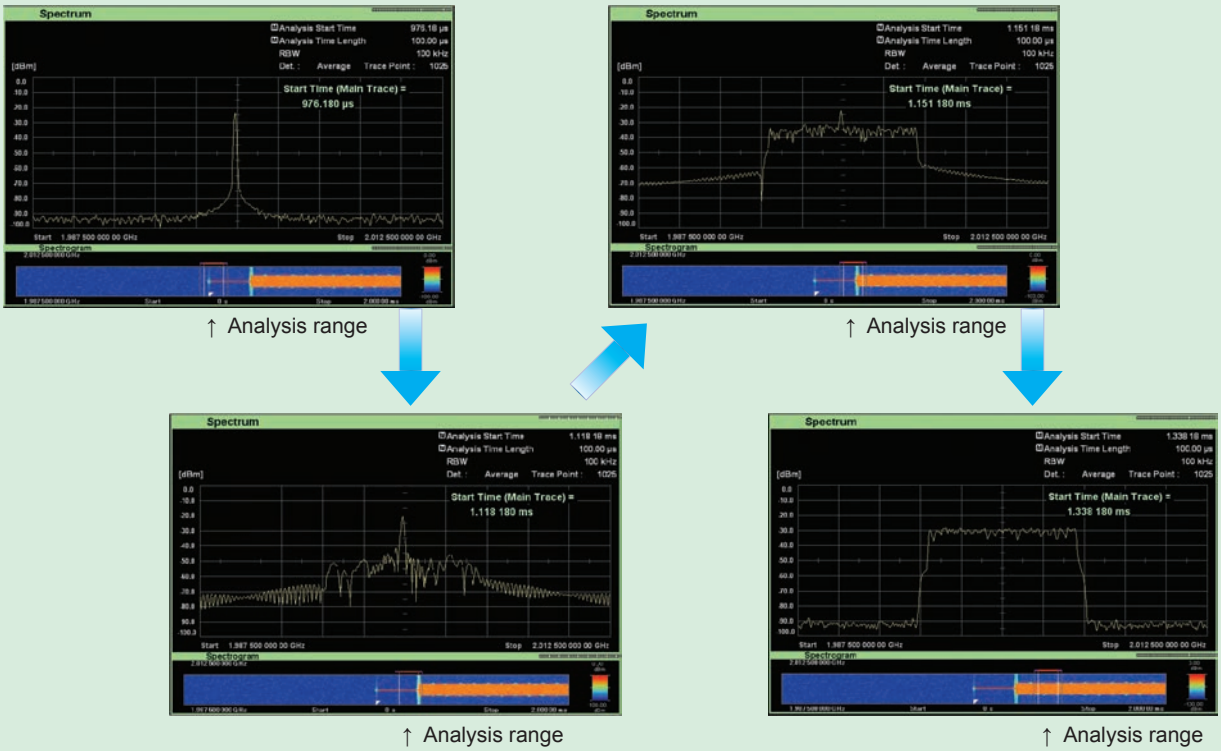
Main: Spectrum, Frequency vs. Time, Power vs. Time, Phase vs. Time, CCDF/APD, Spectrogram
Sub: Power vs. Time, Spectrogram

The part of a previously captured long-term signal to be monitored can be selected (Blue part) on the sub-trace to display the problem part only on the main trace.



# Signal Analyzer: Trace

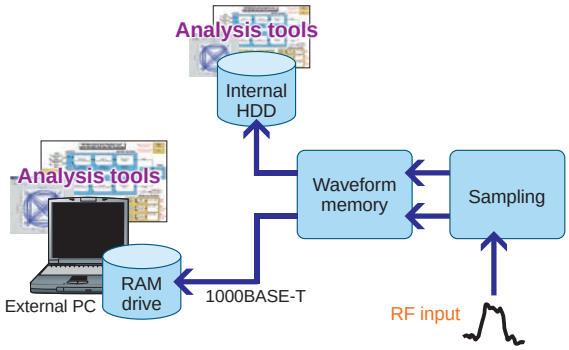
**Example: Sub-trace Display**
Confirm analysis range in sub-trace, and target signal status on main trace.



# Signal Analyzer: Applications

## Analyze Captured Waveforms using Third-Party Tools

The MS269xA utilizes proprietary calibration technologies, enabling digitized baseband data to be used directly in third-party analysis tools without the need for correction.




## *Capture & Playback* Real-World Signals

The MS269xA provides *Capture & Playback* functionality that enables laboratory-grade testing of transceiver systems using real world signals. Using the optional integrated Vector Signal Analyzer and Vector Signal Generator of the MS269xA, *Capture & Playback* allows users to conveniently capture up to 100 MHz of spectrum and play it back at any designated frequency and amplitude, making it easy to determine device performance margins.

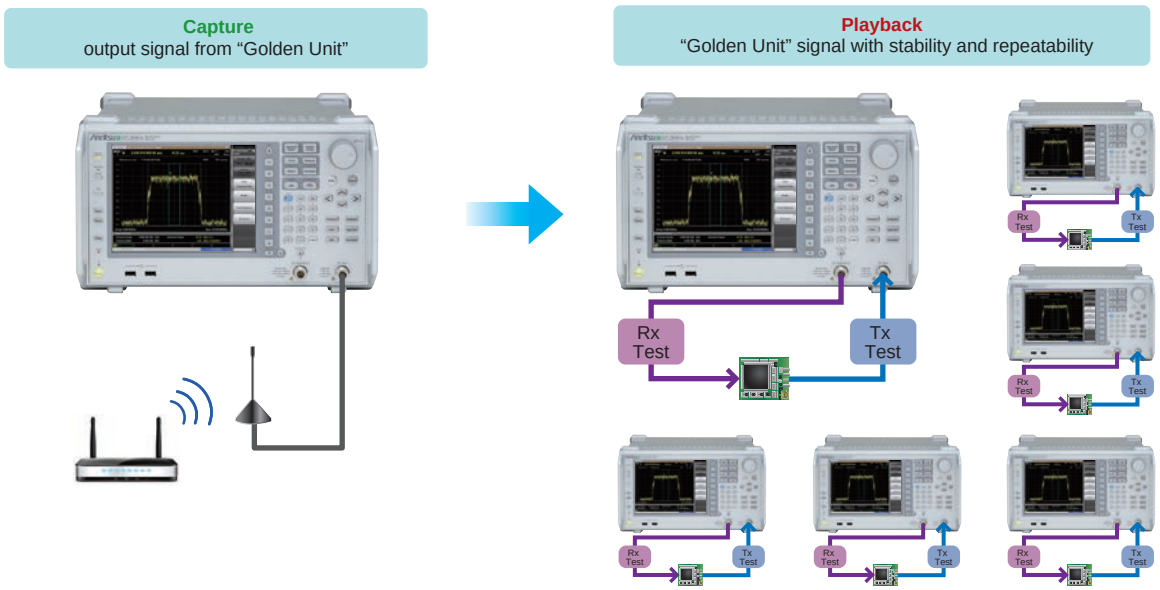
### Applications for *Capture & Playback*

**Validation/Production Test**
Captured signals can be used to initiate a communications link and perform receiver sensitivity testing with a device under test (DUT) using signals captured from a Golden Unit.

**Device Characterization**
Actual baseband signals captured from an RFIC can be used as simulation for characterizing amplifiers and other downstream devices or modules.

**Electromagnetic Compatibility Test**
Problematic RF environments or discrete signals – such as cellular or Wi-Fi – can be captured and used to evaluate a device's susceptibility to RF interference, debug any problems found and validate the solution


**Repeatably Test Device Performance using "Real-World" RF Environments**

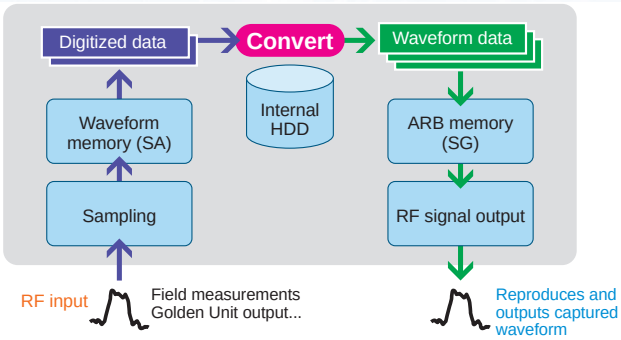



**Use "Golden Unit" Signal for Manufacturing Test and Calibration**

# Signal Analyzer: Applications

## *Capture & Playback* Highlights

- Bandwidth and Time Limits
  Minimum 10 kHz Bandwidth (2000 s maximum duration)*
  Maximum 100 MHz Bandwidth (500 ms maximum duration)*
  *: Maximum bandwidth depends upon vector signal analyzer options installed (Standard analysis bandwidth or MS269xA-077/078).
- Captured signal may be freely tuned to any output frequency and amplitude supported by the vector signal generator.
- Any section of the captured waveform record may be selected and played back.
  - ✓ Enables user to isolate and reproduce specific signal bursts
  - ✓ Enables user to change duty cycle of pulsed waveforms



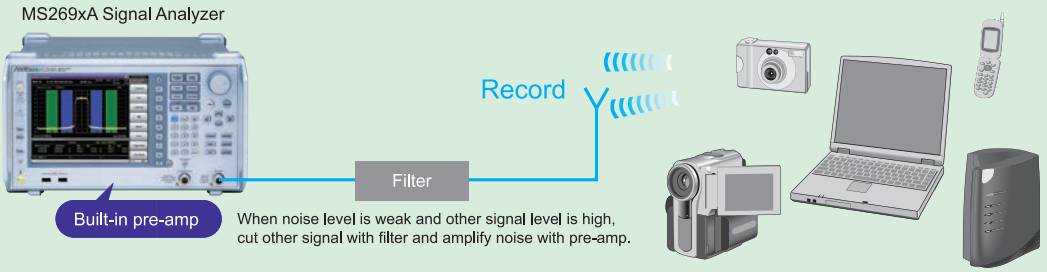

**Playback Block Diagram**


**Playback any Desired Section of Captured Waveform**

**Example: Noise Analysis and Record and Replay**

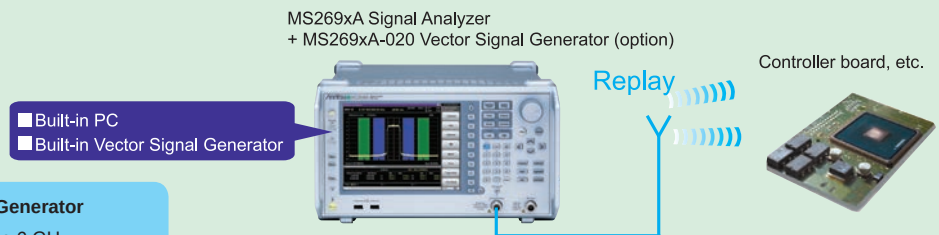
**Signal Analyzer Capture Function Records Noise**

- Save frequency span × Capture time as data file in memory
- Re-sample saved data and output as file to internal or external hard disk
- Recall data saved in internal or external hard disk and analyze as many times as necessary
- Perform multi-domain analysis, such as frequency axis, time axis, spectrogram, etc.




**Replay Captured Noise from Vector Signal Generator**

- Vector Signal Generator generates waveform pattern using built-in PC based on data captured by Signal Analyzer
- Outputs generated waveform at arbitrary level and frequency → Replay noise
- Simple Capture & Playback function key operations support easy capture through to noise regeneration




**MS269xA-020 Vector Signal Generator**

- Frequency Range: 125 MHz to 6 GHz
- Output Level: –140 to 0 dBm
- Baseband Generator Clock: 20 kHz to 160 MHz
- Arbitrary Waveform Memory: 1 GB

# Versatile Built-in Functions

## Useful for Tx Characteristics Evaluation

The MS269xA is fully loaded with all the functions required for evaluating Tx characteristics. Tests can be performed simply and in accordance with standards using functions tailored to measurement contents.

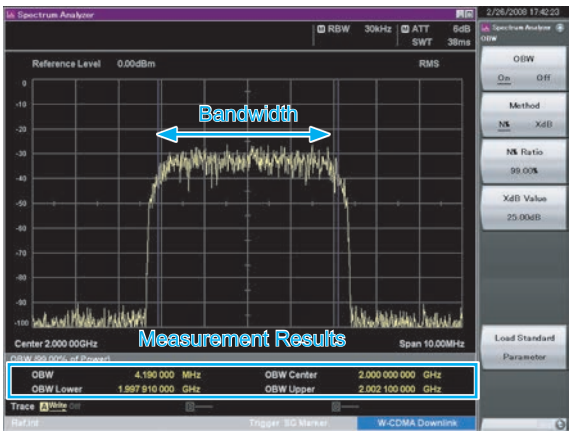
| Measure Function | SPA*1 | VSA*2 |
|---|---|---|
| Channel Power | ✓ | ✓ |
| Occupied Bandwidth | ✓ | ✓ |
| Adjacent Channel Leakage Power | ✓ | ✓ |
| Spectrum Emission Mask | ✓ | |
| Burst Average Power | ✓ | ✓ |
| Spurious Emission | ✓ | |
| AM Depth | | ✓ |
| FM Deviation | | ✓ |
| Multi-marker & Marker List | ✓ | ✓ |
| Highest 10 Markers | ✓ | ✓ |
| Limit Line | ✓ | |
| Frequency Counter | ✓ | |
| 2-tone 3rd-order Intermodulation Distortion | ✓ | |
| Annotation Display (On/Off) | ✓ | |
| Phase Noise | Independent function | |
| Power Meter | Independent function*3 | |
| Noise Figure | MS269xA-017*4 | |

∗1: SPA (Spectrum Analyzer)
∗2: VSA (Vector Signal Analyzer)
∗3: Use USB Power Sensors
∗4: Use Noise Sources (Noisecom, NC346 series)

## Occupied Bandwidth

SPA VSA

Occupied bandwidth is measured by selecting either the N% or X-dB mode.
Pre-installed templates for each standard support easy parameter setting.

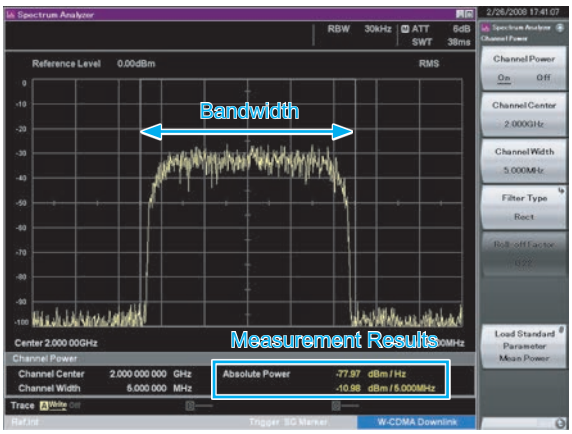



**Measurement Results**
■ Bandwidth for specified conditions

## Channel Power

SPA VSA

This function measures channel bandwidth power. Three types of filters (Rect, Nyquist, Root Nyquist) can be selected.
Pre-installed templates for each standard support easy parameter setting.




**Measurement Results**
■ Absolute power per Hz in channel band
■ Total power in channel band

## Adjacent Channel Leakage Power

SPA VSA

This function measures carrier adjacent channel (offset) power (In-Band).
1 to 12 carriers can be set and switched instantaneously on-screen.
True ACLR performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result.
Pre-installed templates for each standard support easy parameter setting.

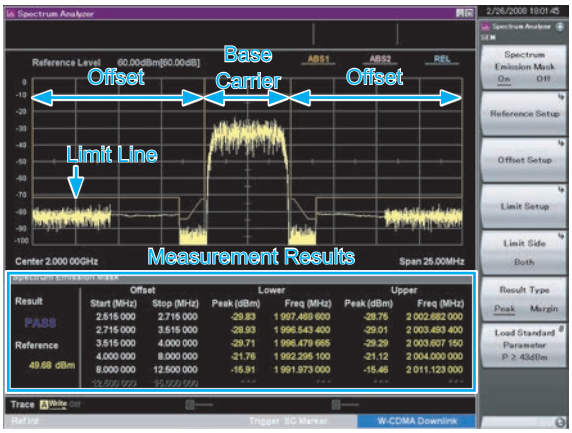

**Measurement Results**
■ Absolute power of Offset channel
■ Relative values in relation to reference power selected in ACP reference

# Versatile Built-in Functions

## Spectrum Emission Mask

SPA

This function splits the offset part into up to 12 segments; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. Pre-installed templates for each standard support easy parameter setting.



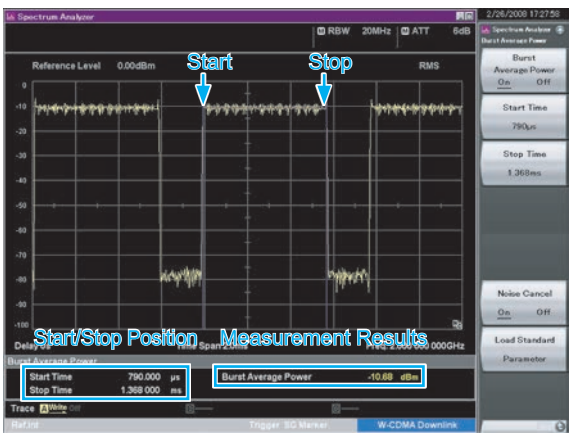

**Measurement Results**

- Peak power (or margin) at offset
- Each peak frequency

## Burst Average Power

SPA VSA

The average power for the range specified by two markers is displayed in the time domain. Measurement only requires setting the measurement start and stop positions on the screen. True performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result. Pre-installed templates for each standard support easy parameter setting.



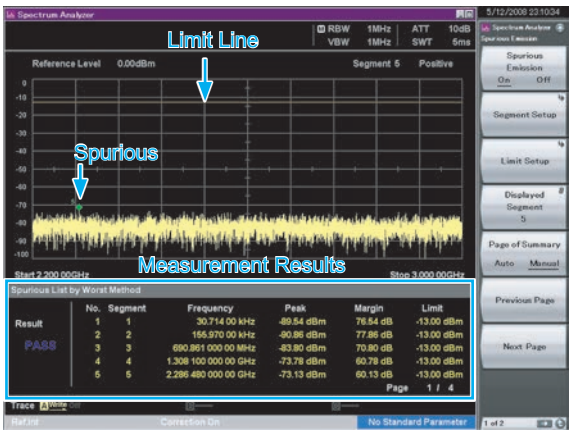

**Measurement Results**

- Average power of specified range

## Spurious Emission

SPA

This function splits the frequency range into up to 20 segments for sweeping; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. In particular, all tests can be completed up to the final stage without an external PC because the zero-span capture function described in the technology compliance test is built-in.



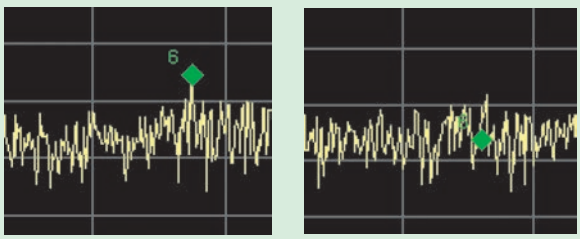

**Measurement Results**

- Each segment peak power and margin
- Each peak frequency

### Example: Spurious Emission

The Japanese Radio Law governing measurement of spurious specifies searching for the peak level in the swept frequency segment using different parameter settings and then performing zero-span measurement of the found peak point. The MS269xA spurious measurement function not only performs the sweep search but also performs the zero-span measurement automatically as well, and displays the results of both. Using zero-span measurement, the search screen is displayed as is while zero-span measurement runs in the background and the result markers are plotted on the search screen. Time wasted by screen switching is reduced and the correlation with the search results can be seen at a glance.

**Measurement Example**



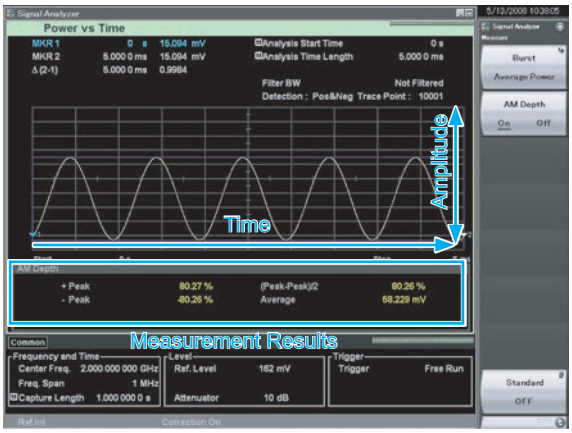
Search only | Search + Measurement

# Versatile Built-in Functions

## AM Depth

VSA

The Power vs. Time trace measurement function is used to confirm AM depth.
It measures the measured signal AM based on trace data at the displayed marker. When marker is Off, the whole range is measured.



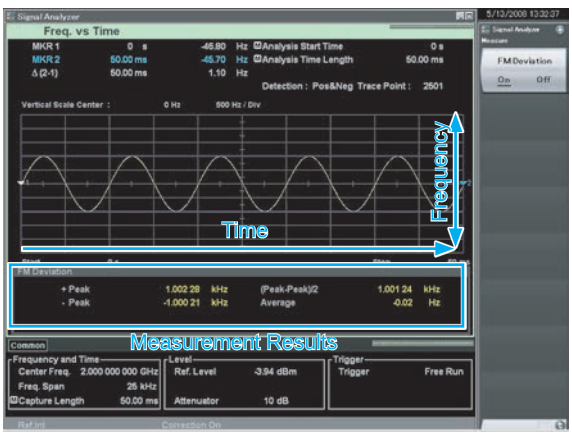

**Measurement Results**

- +Peak, –Peak, (Peak-Peak)/2, Average

## FM Deviation

VSA

The Frequency vs. Time trace measurement is used to confirm the FM deviation. It measures the maximum and minimum frequencies from trace data in the marker range. When marker is Off, the whole range is measured.



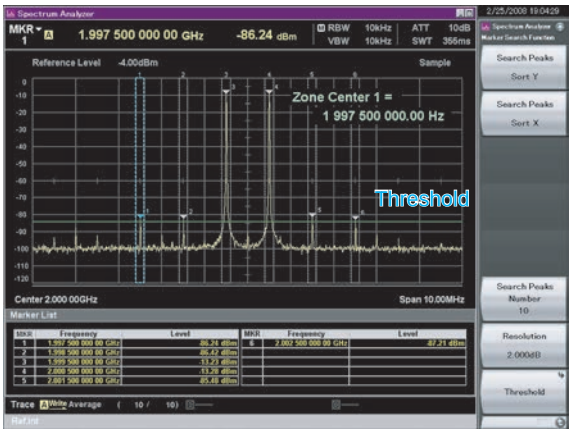

**Measurement Results**

- +Peak, –Peak, (Peak-Peak)/2, Average

## Multi-marker & Marker List

SPA VSA

Up to 10 markers can be set for this function. Markers may be either a spot or a zone. Using a zone marker, the peak of a signal with an unstable variable frequency can be tracked and measured. Not only can the 10 markers be listed below the trace but the differences between markers can be calculated and displayed using the delta setting.



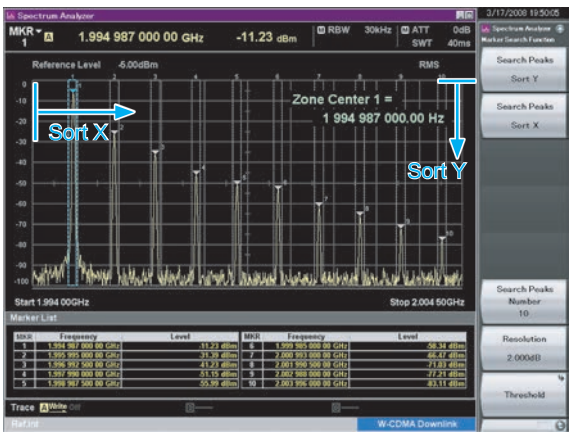

**Measurement Results**

- Marker point frequency
- Marker point power
- Absolute power per Hz in marker bandwidth
- Total power in marker bandwidth
- Difference between any markers

## Highest 10 Markers

SPA VSA

This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.




**Measurement Results**

- Peak Search Y:
  Sets up to 10 markers in order of peak level
- Peak Search X:
  Sets up to 10 markers in order of frequency (time) level

# Versatile Built-in Functions

## Limit Lines

SPA

### Setting Limit Lines

Up to six types of Limit line can be set on the spectrum display (frequency domain).
In addition to setting the frequency and level of crossover points manually in sequence from the low frequency, after creating the right half of a line, the left half can be created by reversing and copying the right half, to set a symmetric limit line. Additionally, a Limit line that traces the measured waveform can be created using the Limit Envelope function. A margin can be set on the Limit line in the amplitude direction.

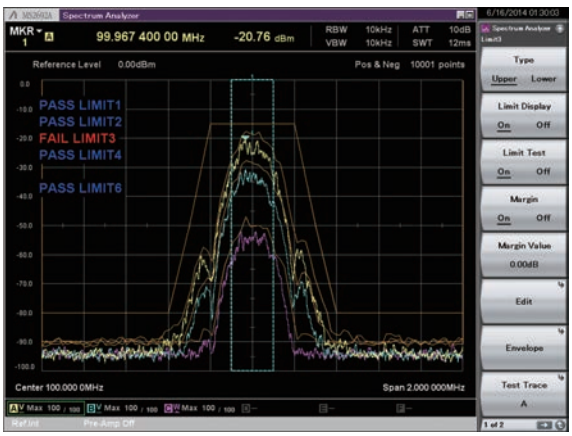
### Evaluating using Limit Line Setting (Limit Test Function)

When the waveform is above or below the Limit line, it is evaluated automatically as PASS or FAIL. Evaluation is also possible with an added margin. The target evaluation line can be chosen from any of six types.

### Auto-saving Waveform Data using Limit Line Setting (Save on Event Function)

When the waveform matches the evaluation conditions (Event), it can be saved automaticaly as a csv format file. Any one of the following five Event types can be selected.

(1) Limit Fail: Saves waveform file when evaluation result is Fail
(2) Limit Pass: Saves waveform file when evaluation result is Pass
(3) Margin Fail: Saves waveform file when evaluation result including margin is Fail
(4) Margin Pass: Saves waveform file when evaluation result including margin is Pass
(5) Sweep Complete: Saves waveform file at every measurement regardless of evaluation result




**Example:**

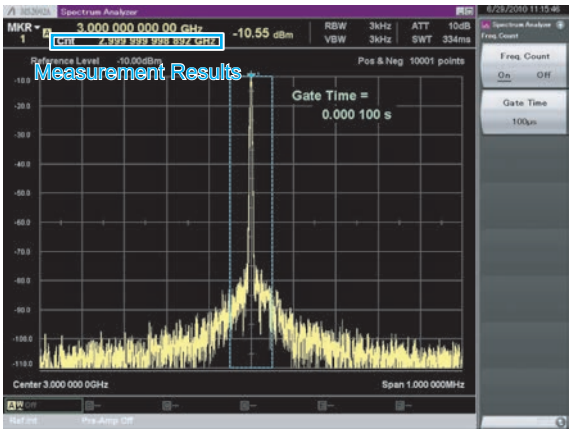
PASS/FAIL evaluation is performed by changing the input signal level.
The evaluation results for the five line types can be displayed simultaneously on one screen.

Line: Limit 1, Limit 2, Limit 3, Limit 4, Limit 5, Limit 6
Evaluation Type: Upper Limit, Lower Limit
Crossover (Point): 1 to 100
Margin: Set Margin line for each Limit 1, 2, 3, 4, 5, 6
Evaluation Result: PASS, FAIL
Result Save: Auto-save as csv format file

## Frequency Counter

SPA

This function of the marker functions is used to measure CW frequencies.
Gate Time sets the measurement target time.




**Measurement Results**

■ Marker point frequency

## 2-tone 3rd-order Intermodulation Distortion

SPA

By inputting two different frequency CW signals (desired waves), two-tone third-order intermodulation distortion is generated close to the desired waves according to non-linear characteristics of Device Under Test (DUT). Then, Third Order Intercept (TOI) is calculated from the two-tone third-order intermodulation distortion.


**Measurement Results**

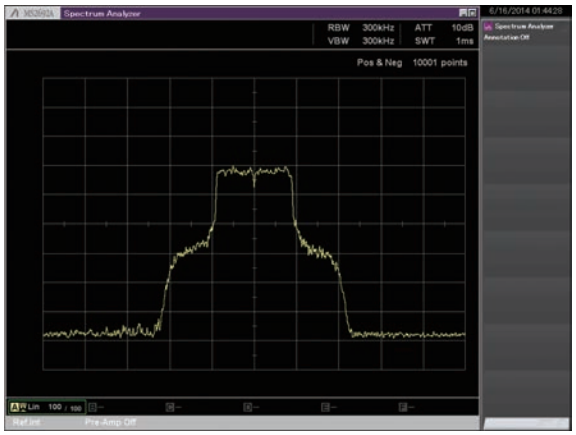
■ TOI: [dBm]
■ Amplitude: [dBc]

# Versatile Built-in Functions

## Annotation Display

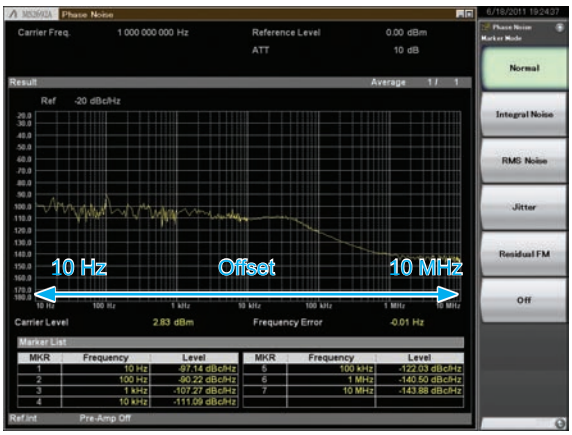
SPA

Screen annotations can be set to On or Off. Annotations about frequency, level, etc., are not displayed at the Off setting.




## Phase Noise

This function measures phase noise in the 10 Hz to 10 MHz frequency offset range.

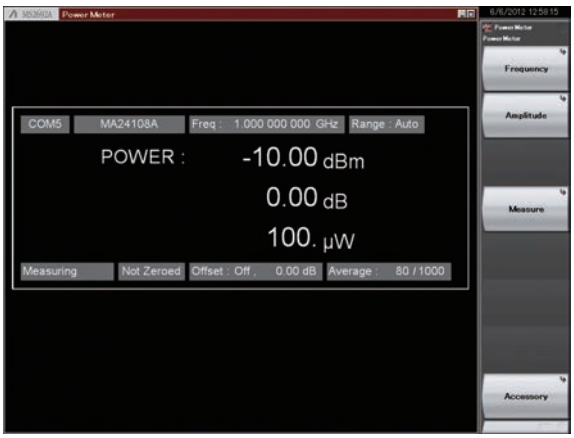



**Measurement Results**

- Carrier level
- Error between set frequency and carrier frequency
- Marker point phase noise level

## Power Meter

Power meter function can connect a USB power sensor to the MS2830A and read the measurement values.




**Measurement Results**

- Power: [dBm], [W]
- Relative power: [dB]

**Compatible USB power sensors.**

| Model | Frequency Range | Resolution | Dynamic Range |
|---|---|---|---|
| MA24104A* | 600 MHz to 4 GHz | 1 kHz | +3 to +51.76 dBm |
| MA24105A | 350 MHz to 4 GHz | 100 kHz | +3 to +51.76 dBm |
| MA24106A | 50 MHz to 6 GHz | 1 kHz | –40 to +23 dBm |
| MA24108A | 10 MHz to 8 GHz | 100 kHz | –40 to +20 dBm |
| MA24118A | 10 MHz to 18 GHz | 100 kHz | –40 to +20 dBm |
| MA24126A | 10 MHz to 26 GHz | 100 kHz | –40 to +20 dBm |

*: MA24104A has been discontinued.

## Noise Figure Measurement (MS269xA-017)

Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source.

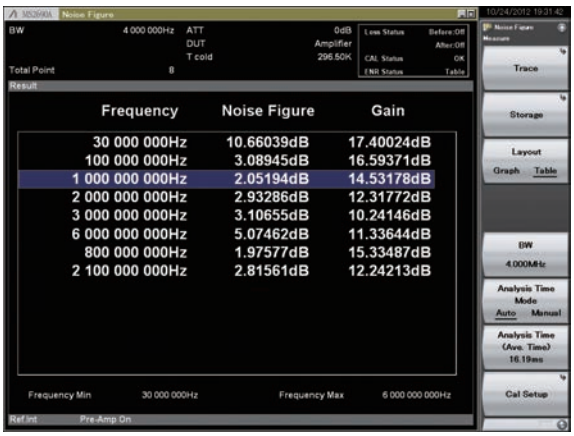
Frequency Mode: Fixed/List/Sweep
DUT Mode: Amplifier
Screen Layout: Graph/Table

**Measurement Results Display**

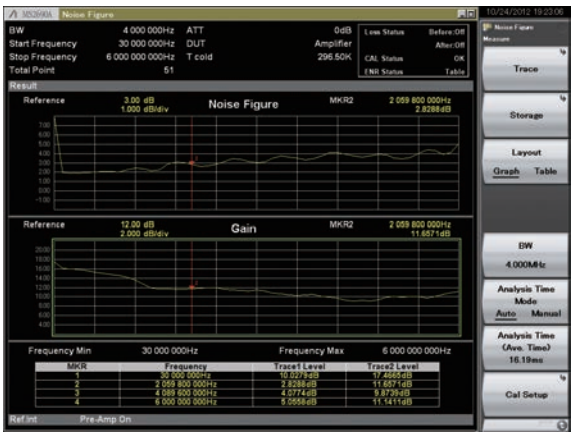
■ Graph/List/Spot

Displays measurement results for each trace (Trace1/Trace2).

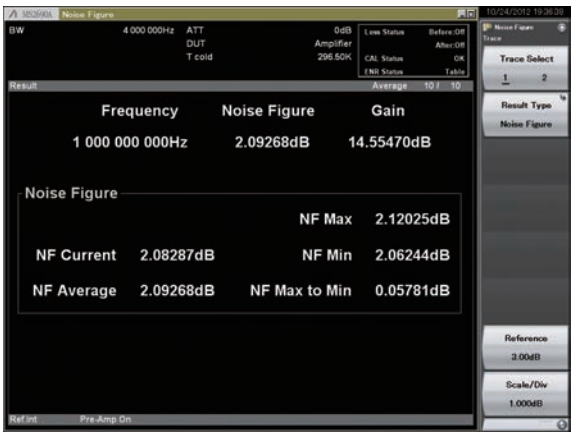
- Noise Figure (NF) [dB]
- Noise Factor (F) [Linear]
- Gain
- Y-Factor: Power ratio when Noise Source is turned ON/OFF
- T effective: Effective noise temperature
- P Hot: Power measured when Noise Source is On.
- P Cold: Power measured when Noise Source is Off.




**Measurement Result: Example of List display (Frequency Mode: List, Screen Layout: List)**




**Measurement Result: Example of Graph display (Frequency Mode: Sweep, Screen Layout: Graph)**




**Measurement Result: Example of Spot display (Frequency Mode: Fixed)**

# Versatile Built-in Functions

**Noise Source**

Supports noise sources from Noisecom NC346 series. NC346 series models and summary specifications are listed below.
See the NC346 series catalog and datasheet for detailed specifications.

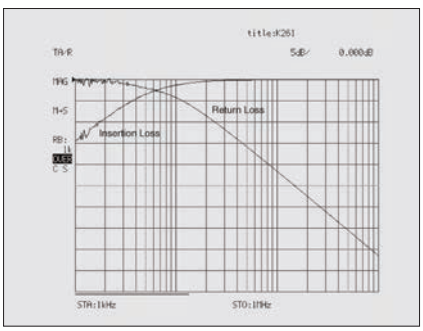
**NC346 series summary specifications**

| Model | RF Connector | Frequency [GHz] | Output ENR [dB] | VSWR (maximum @ on/off) [GHz] | | | | DC Offset | DC Block |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.01 to 5 | 5 to 18 | 18 to 26.5 | 26.5 to 40 | | |
| NC346A | SMA (M) | 0.01 to 18.0 | 5 to 7 | 1.15:1 | 1.25:1 | — | — | No | Not required |
| NC346A Precision | APC3.5 (M) | 0.01 to 18.0 | 5 to 7 | 1.15:1 | 1.25:1 | — | — | No | Not required |
| NC346A Option 1 | N (M) | 0.01 to 18.0 | 5 to 7 | 1.15:1 | 1.25:1 | — | — | No | Not required |
| NC346A Option 2 | APC7 | 0.01 to 18.0 | 5 to 7 | 1.15:1 | 1.25:1 | — | — | No | Not required |
| NC346A Option 4 | N (F) | 0.01 to 18.0 | 5 to 7 | 1.15:1 | 1.25:1 | — | — | No | Not required |
| NC346B | SMA (M) | 0.01 to 18.0 | 14 to 16 | 1.15:1 | 1.25:1 | — | — | No | Not required |
| NC346B Precision | APC3.5 (M) | 0.01 to 18.0 | 14 to 16 | 1.15:1 | 1.25:1 | — | — | No | Not required |
| NC346B Option 1 | N (M) | 0.01 to 18.0 | 14 to 16 | 1.15:1 | 1.35:1 | — | — | No | Not required |
| NC346B Option 2 | APC7 | 0.01 to 18.0 | 14 to 16 | 1.15:1 | 1.25:1 | — | — | No | Not required |
| NC346B Option 4 | N (F) | 0.01 to 18.0 | 14 to 16 | 1.15:1 | 1.35:1 | — | — | No | Not required |
| NC346D | SMA (M) | 0.01 to 18.0 | 19 to 25*1 | 1.50:1 | 1.50:1 | — | — | No | Not required |
| NC346D Precision | APC3.5 (M) | 0.01 to 18.0 | 19 to 25*1 | 1.50:1 | 1.50:1 | — | — | No | Not required |
| NC346D Option 1 | N (M) | 0.01 to 18.0 | 19 to 25*1 | 1.50:1 | 1.75:1 | — | — | No | Not required |
| NC346D Option 2 | APC7 | 0.01 to 18.0 | 19 to 25*1 | 1.50:1 | 1.50:1 | — | — | No | Not required |
| NC346D Option 3 | N (F) | 0.01 to 18.0 | 19 to 25*1 | 1.50:1 | 1.75:1 | — | — | No | Not required |
| NC346C | APC3.5 (M) | 0.01 to 26.5 | 13 to 17 | 1.15:1 | 1.25:1 | 1.35:1 | — | Yes*3 | **Required***3 |
| NC346E | APC3.5 (M) | 0.01 to 26.5 | 19 to 25*1 | 1.50:1 | 1.50:1 | 1.50:1 | — | Yes*3 | **Required***3 |
| NC346Ka | K (M)*2 | 0.10 to 40.0 | 10 to 17 | 1.25:1 | 1.30:1 | 1.40:1 | 1.50:1 | Yes*3 | **Required***3 |

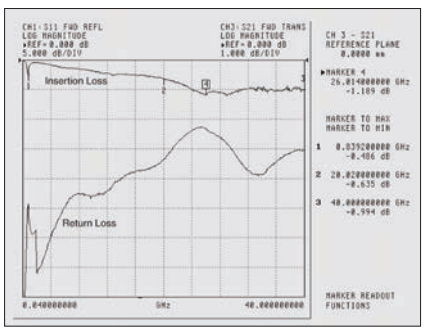
∗1: Flatness better than ±2 dB
∗2: Compatible with SMA and APC3.5
**∗3: When using noise sources output by DC, always use in combination with a DC block.**

**Specifications outlines of recommended DC Blocks and Adapters**

| | Ordering | | RF Connector | Frequency Range | VSWR |
|---|---|---|---|---|---|
| | Model | Name | | | |
| DC Block | J0805 | DC Block, N type (MODEL 7003) | N (M)-N (F) | 10 kHz to 18 GHz | 1.35 (max.) |
| | J1555A | DC Block, SMA type (MODEL 7006-1) | SMA (M)-SMA (F) | 9 kHz to 20 GHz | 1.50 (9 kHz to 10 kHz)<br>1.50 (11 kHz to 20 kHz)<br>1.30 (20 kHz to 20 GHz) |
| | J1554A | DC Block, SMA type (MODEL 7006) | SMA (M)-SMA (F) | 9 kHz to 26.5 GHz | 1.50 (9 kHz to 20 kHz)<br>1.35 (20 kHz to 20 GHz)<br>1.70 (20 GHz to 26.5 GHz) |
| | K261 | DC Block | K (M)-K (F) | 10 kHz to 40 GHz | See figure (return loss) below |
| Adapter | J0004 | Coaxial Adapter | N (M)-SMA (F) | DC to 12.4 GHz | ≤1.08 (DC to 3 GHz)<br>≤1.11 (3 GHz to 6 GHz)<br>≤1.18 (6 GHz to 12.4 GHz) |
| | J1398A | N-SMA Adapter | N (M)-SMA (F) | DC to 26.5 GHz | ≤1.05 (DC to 3 GHz)<br>≤1.07 (3 GHz to 6 GHz)<br>≤1.2 (6 GHz to 13.5 GHz)<br>≤1.3 (13.5 GHz to 20 GHz)<br>≤1.45 (20 GHz to 26.5 GHz) |




Typical Low Frequency Insertion Loss measured on K261 over the range of 1 kHz to 1 MHz.




Insertion Loss and Return Loss measured on K261 over the range of 40 MHz to 40 GHz.

**K261 DC Block Return Loss**

**Recommended DC blocks / Adaptor combinations for MS269xA/MS2830A series signal analyzer**

| | Model | Frequency Range | RF connector | Recommended DC Block Order Name | Recommended Adapter Order Name |
|---|---|---|---|---|---|
| MS269xA series | MS2690A | 50 Hz to 6 GHz | N (F) | J1555A | J0004 |
| | MS2691A | 50 Hz to 13.5 GHz | N (F) | J1555A | J1398A |
| | MS2692A | 50 Hz to 26.5 GHz | N (F) | J1554A | J1398A |
| MS2830A series | MS2830A-040 | 9 kHz to 3.6 GHz | N (F) | Not required | Not required |
| | MS2830A-041 | 9 kHz to 6 GHz | N (F) | Not required | Not required |
| | MS2830A-043 | 9 kHz to 13.5 GHz | N (F) | Not required | Not required |
| | MS2830A-044 | 9 kHz to 26.5 GHz | N (F) | J1554A | J1398A |
| | MS2830A-045 | 9 kHz to 43 GHz | K (F) | K261 | Not required |

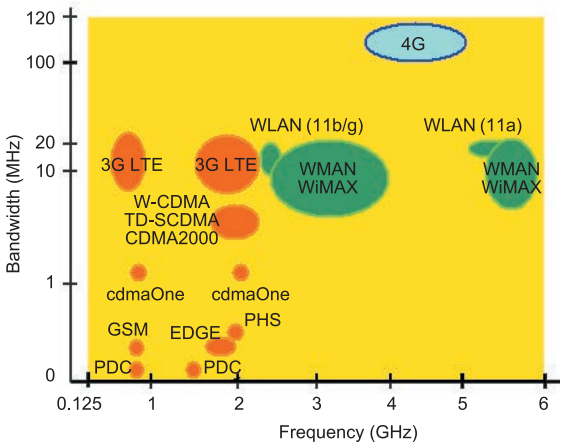
# Vector Signal Generator (MS269xA-020): Basic Performance

The MS269xA-020 Vector Signal Generator option covers the frequency range from 125 MHz to 6 GHz; it has a wide vector modulation bandwidth of 120 MHz as well as a large built-in memory for storing 256 Msamples. Its level accuracy is at least as good as a dedicated signal generator and the ACLR performance is ideal for Tx tests of devices such as amplifiers and Rx tests of base stations. The all-in-one analyzer and signal generator supports simple configuration of space-saving measurement systems as well as easy signal analysis matching the output timing from the signal generator option.

## Frequency Range

**Frequency Range: 125 MHz to 6 GHz**
**Resolution: 0.01 Hz step**

The Vector Signal Generator (MS269xA-020) frequency range is 125 MHz to 6 GHz, covering the key wireless communication range.

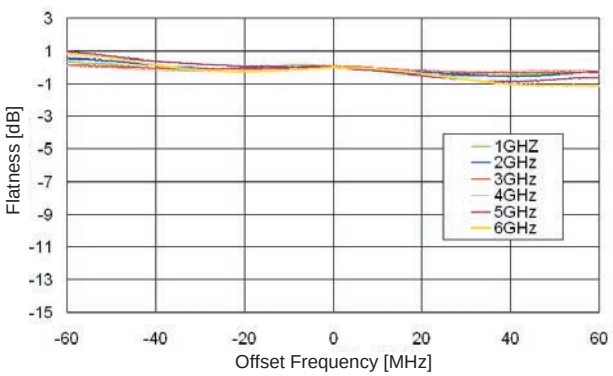



## Internal Baseband Generator

**Vector Modulation Bandwidth: 120 MHz**
**Sampling Clock: 20 kHz to 160 MHz**

The wideband 120-MHz vector modulation bandwidth is achieved using the MS269xA-020 baseband signal generator.
The sampling clock supports up to 160 MHz.

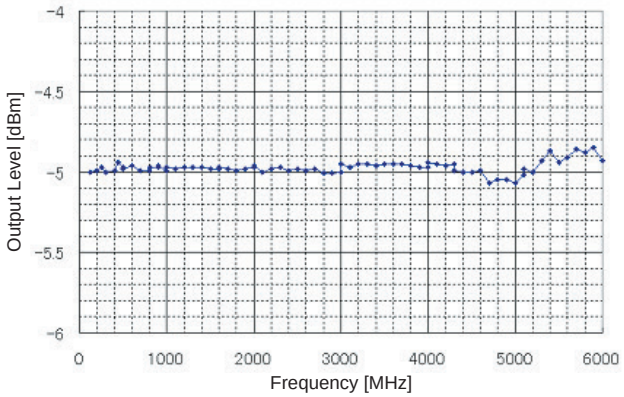
**Example: Vector Modulation Bandwidth**



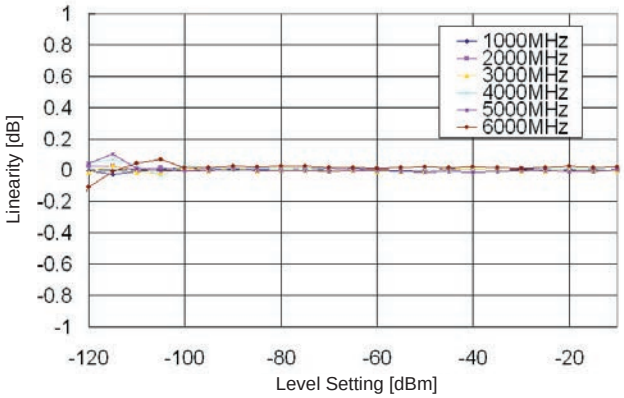

## Level Accuracy ±0.5 dB

**Output Level Accuracy (CW):**
**±0.5 dB (–120 dBm ≤ Level ≤ +5 dBm, Frequency ≤3 GHz)**
**±0.8 dB (–110 dBm ≤ Level ≤ +5 dBm, Frequency >3 GHz)**

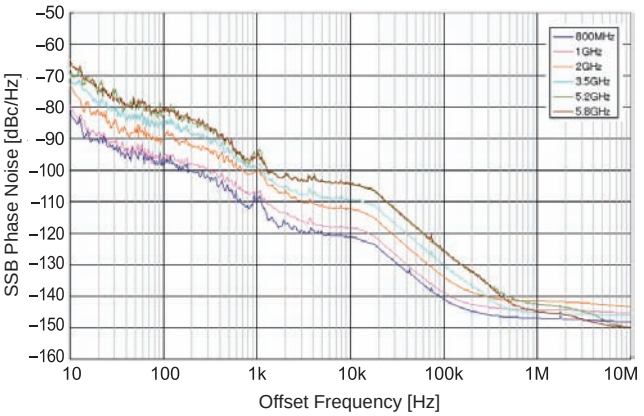
**Example: Frequency Characteristics (Referenced to –5 dBm)**




**Example: Linearity (Referenced to –5 dBm)**




**Example: SSB Phase Noise**



# Vector Signal Generator (MS269xA-020): Basic Performance

## Large-capacity Memory

**1GB = 256 Msamples/channel**

The MS269xA-020 arbitrary waveform memory can save 256 Msamples/channel as well as multiple waveform patterns at the same time. Waveform patterns in memory can be output instantaneously by switching without need to recall from hard disk.

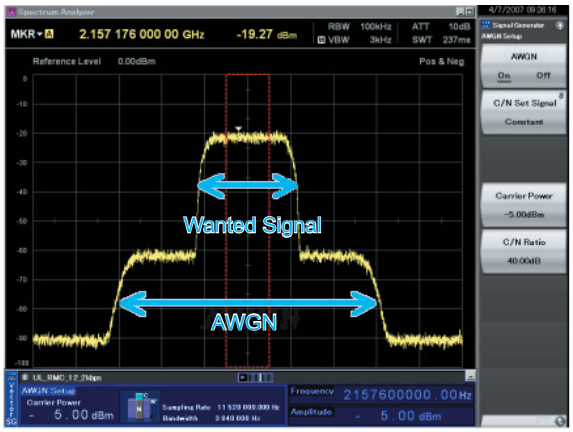
## Internal AWGN Generator

**Absolute CN Ratio: ≤40 dB**

This functions adds AWGN (Additive White Gaussian Noise) to the wanted waveform in memory. It is ideal for Tx dynamic range tests.

AWGN band set automatically to sampling clock of wanted signal.

Example: When wanted signal conditions are:
- W-CDMA
- Bandwidth = 3.84 MHz
- Over sampling = × 4



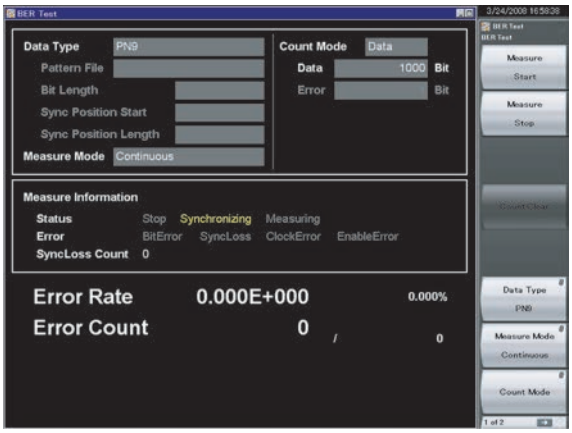

**Wanted Signal + AWGN Signal output from one unit**

## Internal BER Measurement Function

**Input Bit Rate: 100 bps to 10 Mbps**
**Input Level: TTL Level**
**Input Signal: Data, Clock, Enable**
**Connector: Rear panel, Aux connector***

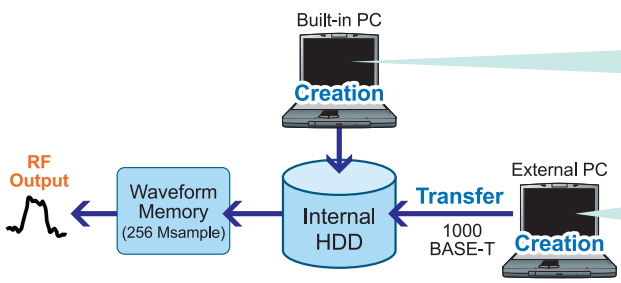
*: Requires J1373A AUX Conversion Adapter (sold separately)

Adding the MS269xA-020 Vector Signal Generator option includes a built-in BER tester for measurements up to 10 Mbps. It supports Rx sensitivity tests by inputting the receiver-demodulated Data/Clock/Enable to the back of the MS269xA.




## Versatile Multiple Waveform Generation

Any type of waveform can be generated using the MS269xA-020 Signal Generator option. In addition to using C and simulation tools, Anritsu's IQproducer can be run on a PC to edit waveform parameters and output waveforms.




### Creating Waveform Using IQproducer

IQproducer is PC software that is used to edit parameters and create any waveform pattern. It can be installed either on an external PC or in the MS269xA main frame.

- HSDPA/HSUPA IQproducer
- TDMA IQproducer
- Multi-carrier IQproducer
- Mobile WiMAX IQproducer
- LTE IQproducer
- LTE TDD IQproducer
- WLAN IQproducer
- TD-SCDMA IQproducer

### Creating Any Waveform

IQ Data created using the MS269xA digitize function or by simulation tools or in C can be converted to a waveform pattern using the SG option and output.

# Vector Signal Generator (MS269xA-020): Basic Performance

## Useful IQproducer Waveform Generation Software

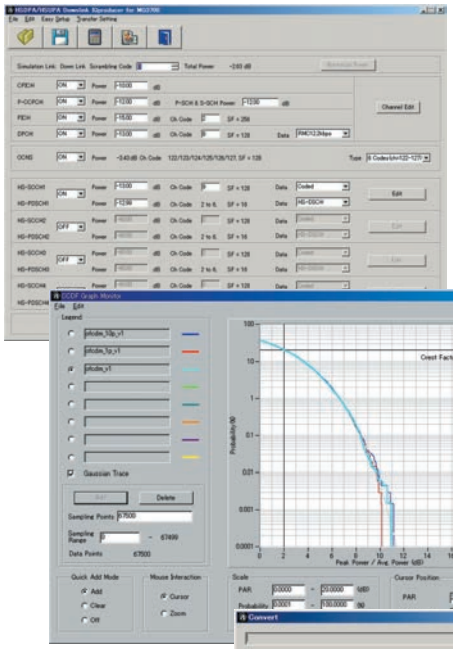
IQproducer is application software for a PC for editing, creating and transferring waveform patterns using the MS269xA-020 arbitrary waveform generation option.
It has the following three main functions.

**Parameter Editing:**
Function for easily editing parameters matching each communication method

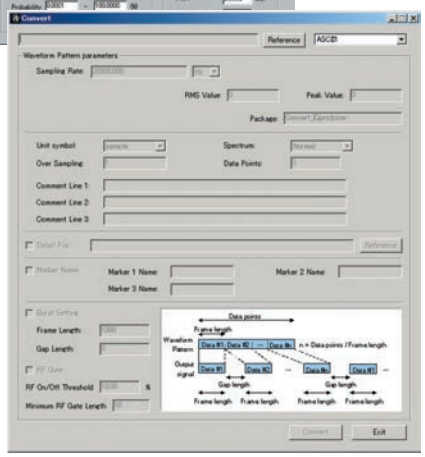
**Simulation:**
Function for checking generated waveform pattern before transfer to CCDF and FFT graphs

**Conversion:**
Function for converting ASCII format waveform patterns created by simulation software, files captured using digitizing function, and MG3700A waveform patterns, into files that can be used by MS269xA-020

**Parameter Setting Screen (HSDPA/HSUPA IQproducer)**



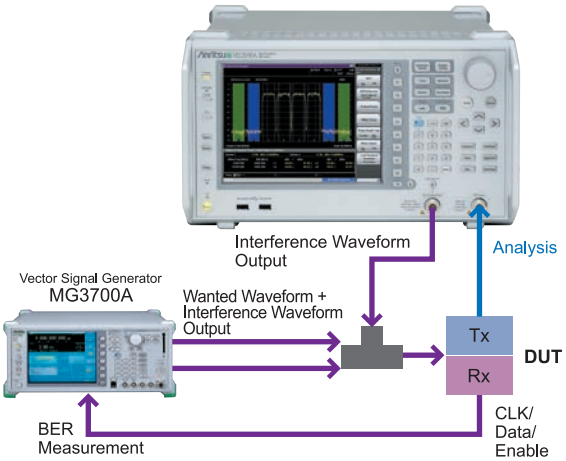
**Simulation Screen (CCDF)**



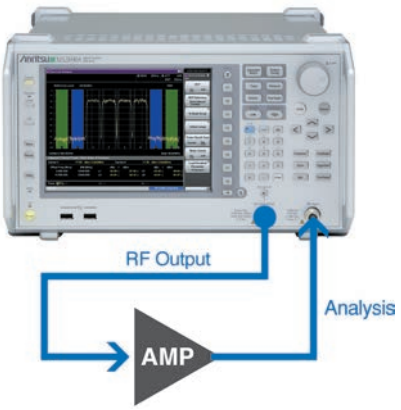
**Convert Screen**

## Application

**Simplified Tx/Rx Test Setup**




**Easy AMP Test**



# Excellent Expandability Platform (Hardware)

The versatility of the MS269xA series is tailored easily to the application by installing modules in expansion slots.

## Basic Function and Performance Upgrades

**MS2690A/MS2691A/MS2692A-001**
**Rubidium Reference Oscillator**
This option is a 10 MHz reference crystal oscillator with excellent frequency stability startup characteristics of ±1 × $10^{-9}$ at 7 minutes after power-on.

Aging Rate: ±1 × $10^{-10}$/month
Start-up Characteristics: ±1 × $10^{-9}$ (7 minutes after power-on)

**MS2691A/MS2692A-003**
**Preselector Extended Lower Limit (3 GHz)**
This option extends the lower limit of the preselector from 5.9 GHz to 3 GHz. It can only be installed in the MS2691A/MS2692A.

**MS2690A/MS2691A/MS2692A-008**
**6 GHz Preamplifier**
This option increases the sensitivity of the spectrum/signal analyzer functions and is used for examining low-level signals such as interference waveforms.

Frequency Range: 100 kHz to 6 GHz
Gain: 14 dB (≤3 GHz)
13 dB (3 GHz < Frequency ≤ 4 GHz)
11 dB (4 GHz < Frequency ≤ 5 GHz)
10 dB (5 GHz < Frequency ≤ 6 GHz)

**MS2692A-067 Microwave Preselector Bypass**
Bypassing the preselector used for the microwave band improves RF frequency characteristics and in-band frequency characteristics.

∗: Cannot be installed simultaneously with MS2692A-003/008

## Signal Analyzer Function and Performance Upgrade

**MS2690A/MS2691A/MS2692A-077**
**Analysis Bandwidth Extension to 62.5 MHz**
This option expands the analysis bandwidth to 62.5 MHz.

**MS2690A/MS2691A/MS2692A-078**[*1, *2]
**Analysis Bandwidth Extension to 125 MHz**
This option expands the analysis bandwidth to 125 MHz.

∗1: Requires MS269xA-077
∗2: Combining with MX269028A-002 wireless LAN IEEE 802.11ac (160 MHz) measurement software (only for MS269xA) supports modulation analysis up to 160-MHz bandwidth signals of the IEEE 802.11ac.
See measurement software catalog for more details

**Usage Example: Record Noise and Replay**

When the Vector Signal Generator (MS269xA-020) generates a signal based on the data captured by the signal analyzer, a signal that mimics the captured signal can be output[*1]. The Capture & Playback function can also be used for capture and replay using a simple procedure.
For example, a variety of noise sources can be captured and edited using one MS269xA to evaluate the noise tolerance of a product. In some cases, it is not possible to capture minute level fluctuations with a resolution of 20 ns[*2], depending on the noise components. In these circumstances, a signal very close to the actual noise can be captured and replayed by setting the resolution to 5 ns[*3].
(At signal generation, the setting range of the pattern sampling rate must be within the 160 MHz upper limit of the vector signal generator sampling rate.)

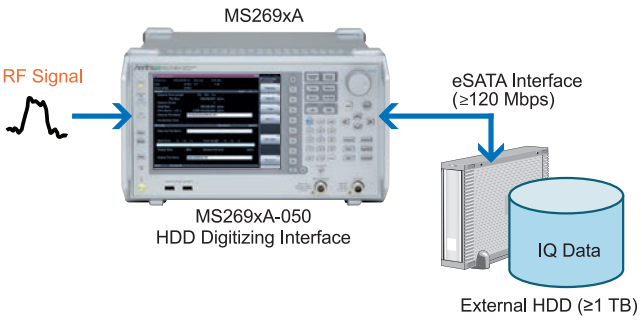
∗1: Capture time depends on memory capacity.
∗2: Sampling rate of 50 MHz at 31.25 MHz FFT band
∗3: Sampling rate of 200 MHz at 125 MHz FFT band

## Expansion Functions

**MS2690A/MS2691A/MS2692A-017**
**Noise Figure Measurement Function**
Adds noise figure measurement function.
Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source.

**MS2690A/MS2691A/MS2692A-020**
**Vector Signal Generator**
This option is a high-performance waveform generator covering a frequency range of 125 MHz to 6 GHz with a 120 MHz wideband vector modulation band and built-in 256 Msample waveform memory.

**MS2690A/MS2691A/MS2692A-050**
**HDD Digitizing Interface**
Installing the MS269xA-050 HDD Digitizing Interface option captures up to 4 hours of 20 MHz wideband RF signals. It is convenient for troubleshooting uncommon faults.



# Future-proof Platform (Software*)

*: See each software catalog for more details.

Adding measurement software options to the signal analyzer assures that the modulation analysis and other functions will support all common current and future communications systems.

## Measurement Software

| Communications Systems | Model | Name |
|---|---|---|
| Mobile WiMAX | MX269010A | Mobile WiMAX Measurement Software |
| W-CDMA/ HSPA/HSPA Evolution | MX269011A | W-CDMA/HSPA Downlink Measurement Software |
| | MX269012A | W-CDMA/HSPA Uplink Measurement Software |
| W-CDMA/HSPA | MX269030A | W-CDMA BS Measurement Software |
| GSM/EDGE | MX269013A | GSM/EDGE Measurement Software |
| EDGE Evolution | MX269013A-001 | EDGE Evolution Measurement Software |
| ETC/DSRC | MX269014A | ETC/DSRC Measurement Software |
| TD-SCDMA | MX269015A | TD-SCDMA Measurement Software |
| Multi-TDMA systems | MX269017A | Vector Modulation Analysis Software |
| LTE/ LTE-Advanced (FDD) | MX269020A | LTE Downlink Measurement Software |
| | MX269020A-001 | LTE-Advanced FDD Downlink Measurement Software |
| | MX269021A | LTE Uplink Measurement Software |
| | MX269021A-001 | LTE-Advanced FDD Uplink Measurement Software |
| LTE/ LTE-Advanced (TDD) | MX269022A | LTE TDD Downlink Measurement Software |
| | MX269022A-001 | LTE-Advanced TDD Downlink Measurement Software |
| | MX269023A | LTE TDD Uplink Measurement Software |
| | MX269023A-001 | LTE-Advanced TDD Uplink Measurement Software |
| CDMA2000 | MX269024A | CDMA2000 Forward Link Measurement Software |
| | MX269024A-001 | All Measure Function |
| 1xEV-DO | MX269026A | EV-DO Forward Link Measurement Software |
| | MX269026A-001 | All Measure Function |
| WLAN | MX269028A | WLAN (802.11) Measurement Software (Supports IEEE 802.11n/11a/11b/ 11g/11j/11p) |
| | MX269028A-002* | 802.11ac (160 MHz) Measurement Software (for MS269xA) |

*: Only for MS269xA.
Combining with the MS269xA-078 Analysis Bandwidth Extension to 125 MHz supports modulation analysis up to 160-MHz bandwidth signals of the IEEE 802.11ac.

## Measurement Software for Smart Meter

This software is for PC. This software supports automatic measurement of the PHY layer and protocol analysis of the PHY/ MAC layer of smart utility network wireless communications (Wi-SUN).

- MX705010A Wi-SUN PHY Measurement Software*1
- MX705110A Wi-SUN Protocol Monitor*2

The MX705010A*1 supports automatic measurement of Wi-SUN Alliance PHY Conformance test cases. The MS269xA is controlled by remote commands from this software

*1: Cannot be installed in MS269xA.
Requires the latest firmware of MS269xA.
Requires MX269017A, MS269xA-020 and MX269902A.

MX705110A*2 is possible to check the details of a Wi-SUN protocol. The wireless signals*3 between communicating wireless equipments are captured as I/Q data using the MS269xA digitize function and data analysis is performed by this software. Data analysis displays the PHY/MAC frame format, Tx timing, etc.

*2: Cannot be installed in MS269xA.
Requires the latest firmware of MS269xA.
*3: IEEE 802.15.4g/e (GFSK)

# Future-proof Platform (Software*)

Adding a license for the IQproducer waveform generation software to the vector signal generator option supports easy generation of test patterns for all common communications systems worldwide.

## IQproducer License for MS269xA-020 VSG

Waveforms generated by IQproducer can be downloaded to the MS269xA main frame in which the MS269xA-020 Vector Signal Generator is installed, but the following licenses (option) are required to output the signal.

- MX269901A HSDPA/HSUPA IQproducer
- MX269902A TDMA IQproducer
- MX269904A Multi-Carrier IQproducer
- MX269905A Mobile WiMAX IQproducer
- MX269908A LTE IQproducer
- MX269908A-001*1 LTE-Advanced FDD Option
- MX269910A LTE TDD IQproducer
- MX269910A-001*2 LTE-Advanced TDD Option
- MX269911A WLAN IQproducer
- MX269911A-001*3 802.11ac (80 MHz) Option
- MX269912A TD-SCDMA IQproducer

∗1: Requires MX269908A.
∗2: Requires MX269910A.
∗3: Requires MX269911A.

## Waveform Patterns for MS269xA-020 VSG

Various waveforms with preset parameters matching each communication method are provided. The MS269xA-020 Vector Signal Generator option outputs RF signals.
Pre-installed reference waveforms are saved on the MS269xA hard disk for free use.

- **Pre-installed Patterns**
  - W-CDMA
  - HSDPA (Test Model5)
  - CDMA2000 1xEV-DO
  - CDMA2000
  - GSM/EDGE
  - Digital Broadcasting (ISDB-T/CS/BS/CATV)
  - WLAN (IEEE 802.11a/b/g)
  - *Bluetooth*

- **Option Patterns**
  - MX269970A 1xEV-DO Reverse Receiver Test Waveform Pattern

# Specifications

The specification is the value after a 30-minute warm-up at a constant ambient temperature.
Typical values are only for reference and are not guaranteed specifications.

## ■ Vector Signal Analysis Function/Spectrum Analyzer Function Common

### Frequency

| | |
|---|---|
| Frequency Range | 50 Hz to 6.0 GHz (MS2690A)<br>50 Hz to 13.5 GHz (MS2691A)<br>50 Hz to 26.5 GHz (MS2692A) |
| Frequency Bands | Frequency / Band / Mixer harmonic order (N)<br>50 Hz ≤ Frequency ≤ 6.0 GHz / 0 / 1<br>3.0 GHz ≤ Frequency ≤ 6.0 GHz / 1 – L / 1 (with MS2691A-003/MS2692A-003, MS2691A/MS2692A)<br>5.9 GHz ≤ Frequency ≤ 8.0 GHz / 1– / 1 (MS2691A/MS2692A)<br>7.9 GHz ≤ Frequency ≤ 13.5 GHz / 1+ / 1 (MS2691A/MS2692A)<br>13.4 GHz ≤ Frequency ≤ 20.0 GHz / 2– / 2 (MS2692A)<br>19.9 GHz ≤ Frequency ≤ 26.5 GHz / 2+ / 2 (MS2692A) |
| Preselector Range | 5.9 GHz to 13.5 GHz (Frequency band mode: Normal) (MS2691A)<br>5.9 GHz to 26.5 GHz (Frequency band mode: Normal) (MS2692A)<br>3.0 GHz to 13.5 GHz (Frequency band mode: Spurious) (MS2691A)<br>3.0 GHz to 26.5 GHz (Frequency band mode: Spurious) (MS2692A) |
| Frequency Setting Range | 0 Hz to 6.0 GHz (MS2690A)<br>0 Hz to 13.5 GHz (MS2691A)<br>0 Hz to 26.5 GHz (MS2692A)<br>Setting resolution: 1 Hz |
| Internal Reference Oscillator | Start-up characteristics (23˚C, referenced to frequency at 24 h after power-on):<br>±5 × $10^{-7}$ (2 minutes after power-on), ±5 × $10^{-8}$ (5 minutes after power-on)<br>Aging rate: ±1 × $10^{-7}$/year, ±1 × $10^{-8}$/day<br>Temperature characteristics: ±2 × $10^{-8}$ (5˚ to 45˚C)<br>with MS269xA-001 Rubidium Reference Oscillator<br>Start-up characteristics (23˚C, referenced to frequency at 24 h after power-on): ±1 × $10^{-9}$ (7 minutes after power-on)<br>Aging rate: ±1 × $10^{-10}$/month<br>Temperature characteristics: ±1 × $10^{-9}$ (5˚ to 45˚C) |
| SSB Phase Noise | 18˚ to 28˚C, 2 GHz<br>Frequency Offset / Max.<br>100 kHz / –116 dBc/Hz<br>1 MHz / –137 dBc/Hz |

### Amplitude

| | |
|---|---|
| Measurement Range | without MS269xA-008, or Preamp: Off<br>DANL to +30 dBm<br>with MS269xA-008, Preamp: On<br>DANL to +10 dBm |
| Max. Input Level | without MS269xA-008, or Preamp: Off<br>CW Average power: +30 dBm (Input attenuator: ≥10 dB)<br>DC Voltage: 0 Vdc<br>with MS269xA-008, Preamp: On<br>CW Average power: +10 dBm (Input attenuator: 0 dB)<br>DC Voltage: 0 Vdc |
| Input Attenuator | 0 to 60 dB, 2 dB steps |
| Input Attenuator Switching Error | Referenced to 10 dB input attenuator<br>without MS269xA-008, or Preamp: Off<br>Frequency band mode: Normal<br>±0.2 dB (≤6.0 GHz, 10 to 60 dB)<br>±0.75 dB (>6.0 GHz, 10 to 60 dB)<br>Frequency band mode: Spurious<br>±0.2 dB (<3.0 GHz, 10 to 60 dB)<br>±0.75 dB (≥3.0 GHz, 10 to 60 dB)<br>with MS269xA-008, Preamp: On<br>Frequency band mode: Normal<br>±0.65 dB (≤6.0 GHz, 10 to 60 dB) |

## ■ Vector Signal Analysis Function/Spectrum Analyzer Function Common (Continuation)

### Reference Level

| | |
|---|---|
| Setting Range | Log scale: –120 to +50 dBm, or Equivalent level<br>Linear scale: 22.4 µV to 70.7 V, or Equivalent level<br>Setting resolution: 0.01 dB, or Equivalent level |
| Units | Log scale: dBm, dBµV, dBmV, dBµV (emf), dBµV/m, V, W<br>Linear scale: V |
| Linearity Error | Excluding the noise floor effect<br>without MS269xA-008, or Preamp: Off<br>±0.07 dB (Mixer input level: ≤–20 dBm)<br>±0.10 dB (Mixer input level: ≤–10 dBm)<br>Frequency band mode: Normal, Mixer input level: ≤0 dBm<br>±0.15 dB (≤6.0 GHz)<br>±0.50 dB (>6.0 GHz) (MS2691A)<br>±0.60 dB (>6.0 GHz) (MS2692A)<br>Frequency band mode: Spurious, Mixer input level: ≤0 dBm<br>±0.15 dB (<3.0 GHz)<br>±0.50 dB (≥3.0 GHz) (MS2691A)<br>±0.60 dB (≥3.0 GHz) (MS2692A)<br>with MS269xA-008, Preamp: On<br>±0.07 dB (Preamp input level: ≤–40 dBm)<br>±0.10 dB (Preamp input level: ≤–30 dBm)<br>Frequency band mode: Normal<br>±0.50 dB (Preamp input level: ≤–20 dBm, ≤6.0 GHz) |
| RF Frequency Characteristics | 18˚ to 28˚C, after CAL, Input attenuator: 10 dB<br>without MS269xA-008, or Preamp: Off<br>±0.35 dB (9 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)<br>(9 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)<br>without MS2692A-067, or Microwave Preselector Bypass: Off, after Preselector tuning<br>±1.50 dB (6.0 GHz < Frequency ≤ 13.5 GHz, Frequency band mode: Normal)<br>(3.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Spurious)<br>±2.50 dB (13.5 GHz < Frequency ≤ 26.5 GHz)<br>with MS269xA-008, Preamp: On<br>±0.65 dB (100 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)<br>(100 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious) |
| 1 dB Gain Compression | without MS269xA-008, or Preamp: Off, Mixer input level<br>≥+3 dBm (100 MHz ≤ Frequency < 400 MHz)<br>≥+7 dBm (400 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)<br>(400 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)<br>≥+3 dBm (3.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Spurious) (MS2691A)<br>(6.0 GHz < Frequency ≤ 13.5 GHz) (MS2691A)<br>≥0 dBm (3.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Spurious) (MS2692A)<br>(6.0 GHz < Frequency ≤ 26.5 GHz) (MS2692A)<br>with MS269xA-008, Preamp: On, Preamp input level<br>≥–20 dBm (100 MHz ≤ Frequency < 400 MHz)<br>≥–15 dBm (400 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)<br>(400 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious) |

### Spurious Response

| | |
|---|---|
| 2nd Harmonic Distortion | without MS269xA-008, or Preamp: Off, Mixer input level: –30 dBm<br>Harmonic (dBc) ≤–60, SHI (dBm) ≥+30 (10 Hz ≤ Frequency ≤ 400 MHz)<br>Harmonic (dBc) ≤–75, SHI (dBm) ≥+45 (400 MHz < Frequency ≤ 3.0 GHz)<br>without MS2692A-067, Mixer input level: –10 dBm<br>Harmonic (dBc) ≤–90, SHI (dBm) ≥+80 (>3.0 GHz, Frequency band mode: Normal)<br>Harmonic (dBc) ≤–90, SHI (dBm) ≥+80 (≥1.5 GHz, Frequency band mode: Spurious)<br>with MS2692A-067, Microwave Preselector Bypass: Off, Mixer input level: –10 dBm<br>Harmonic (dBc) ≤–70, SHI (dBm) ≥+60 (3 GHz < Frequency ≤ 13.25 GHz)<br>with MS269xA-008, Preamp: On, Preamp input level: –45 dBm<br>Harmonic (dBc) ≤–50, SHI (dBm) ≥+5 (10 Hz ≤ Frequency ≤ 400 MHz)<br>Harmonic (dBc) ≤–55, SHI (dBm) ≥+10 (400 MHz < Frequency ≤ 3.0 GHz) |
| Residual Response | Frequency: ≥1 MHz, Input attenuator: 0 dB, 50Ω terminated<br>Signal Analyzer: with MS269xA-077/078, Except bandwidth setting: >31.25 MHz<br>≤–100 dBm |

## ■ Vector Signal Analysis Function/Spectrum Analyzer Function Common (Continuation)

### Connector

| | |
|---|---|
| RF Input | Front panel, N-J, 50Ω (nominal)<br>18˚ to 28˚C, Input attenuator: ≥10 dB<br>VSWR: ≤1.2 (nominal, 40 MHz ≤ Frequency ≤ 3.0 GHz)<br>≤1.5 (nominal, 3.0 GHz < Frequency ≤ 6.0 GHz)<br>≤2.0 (nominal, 6.0 GHz < Frequency ≤ 26.5 GHz) |
| IF Output | Rear panel, BNC-J, 50Ω (nominal)<br>Frequency: 875 MHz (Signal Analyzer, without MS269xA-077/078, or Bandwidth: ≤31.25 MHz)<br>900 MHz (Signal Analyzer, with MS269xA-077/078, Bandwidth: >31.25 MHz)<br>874.988 MHz (Spectrum Analyzer)<br>Gain: 0 dB (nominal) (Referenced to RF input level, RF frequency: 1 GHz, Input attenuator: 0 dB)<br>IF Bandwidth: 120 MHz (nominal) |
| External Reference Input | Rear panel, BNC-J, 50Ω (nominal)<br>Frequency: 10 MHz,13 MHz<br>Operation range: ±1 ppm<br>Input level: –15 dBm ≤ Level ≤ +20 dBm, 50Ω (AC coupling) |
| Reference Signal Output | Rear panel, BNC-J, 50Ω (nominal)<br>Frequency: 10 MHz<br>Output level: ≥0 dBm (AC coupling) |
| Sweep Status Output | Rear panel, BNC-J<br>Output level: TTL Level (High level at sweeping or waveform capture) |
| Trigger Input | Rear panel, BNC-J<br>Input level: TTL Level |
| Noise Source Drive | This is available when the MS269xA-017/117 is installed.<br>Supply(+28 V) of the Noise Source Drive.<br>Rear Panel, BNC-J<br>Output Voltage: 28 ±0.5 V, Pulsed |
| External Reference | Control from external controller (Excluding power-on)<br>Ethernet 10/100/1000BASE-T, Rear panel, RJ-45<br>GPIB: IEEE 488.2, Rear panel, IEEE 488 bus connector<br>Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2<br>USB (B): USB2.0, Rear panel, USB-B connector |
| USB | USB2.0 Supporting waveform hard copy to external device, and saving main frame settings<br>USB-A connector (Front panel: 2 ports, Rear panel: 2 ports) |
| Monitor Output | Rear panel, VGA compatible, mini D-Sub 15 pin |
| Aux | When using MS269xA-020 trigger input/output<br>Rear panel, 68 pins (DX10BM-68S equivalent) |
| Display | XGA-color LCD (1024 × 768 resolution), 8.4 inch (213 mm) |

### General Specifications

| | |
|---|---|
| Dimensions and Mass | 340 (W) × 200 (H) × 350 (D) mm (Excluding projections), ≤13.5 kg (Excluding options) |
| Power Supply | 100 V(ac) to 120 V(ac), 200 V(ac) to 240 V(ac) (–15/+10%, 250 V max.), 50 Hz/60 Hz (±5%)<br>≤260 VA (Excluding options), ≤440 VA (Including all options, max.) |
| Temperature Range | Operating: +5˚ to +45˚C, Storage: –20˚ to +60˚C |
| EMC | EN61326-1, EN61000-3-2 |
| LVD | EN61010-1 |

## ■ Spectrum Analyzer Function

### Frequency

| | |
|---|---|
| Span | Range: 0 Hz, 300 Hz to 6.0 GHz (MS2690A)<br>0 Hz, 300 Hz to 13.5 GHz (MS2691A)<br>0 Hz, 300 Hz to 26.5 GHz (MS2692A)<br>Resolution: 2 Hz<br>Accuracy: ±0.2% (Number of Trace points: 10001) |
| Display Frequency Accuracy | ± [Display frequency × Reference oscillator accuracy + Span frequency × Span accuracy + RBW × 0.05 + 2 × N<br>+ Span frequency/(Number of trace points – 1) ] Hz<br>N: Mixer harmonic order |
| Resolution Bandwidth (RBW) | Setting range: 30 Hz to 3 MHz (1-3 sequence), 50 kHz, 5, 10, 20, 31.25 MHz<br>∗31.25 MHz: Can be set when Span: 0 Hz only<br>Selectivity (–60 dB/–3 dB): 4.5:1 (Nominal, 30 Hz to 10 MHz) |
| Video Bandwidth (VBW) | Setting range: 1 Hz to 10 MHz (1-3 sequence), 5 kHz, Off<br>VBW mode: Video Average, Power Average |

### Amplitude

Displayed Average Noise Level (DANL)

18˚ to 28˚C, Detector: Sample, VBW: 1 Hz (Video Average), Input attenuator: 0 dB

without MS269xA-008, 6.0 GHz ≤ Frequency ≤ 26.5 GHz: without MS2692A-067

| Frequency | Max. | Frequency band mode |
|---|---|---|
| 100 kHz | –135.0 [dBm/Hz] | |
| 1 MHz | –145.0 [dBm/Hz] | |
| 30 MHz ≤ Frequency < 2.4 GHz | –155.0 [dBm/Hz] | |
| 2.4 GHz ≤ Frequency < 3.0 GHz | –153.0 [dBm/Hz] | |
| 3.0 GHz ≤ Frequency < 4.0 GHz | –153.0 [dBm/Hz] | Normal |
| 4.0 GHz ≤ Frequency < 6.0 GHz | –152.0 [dBm/Hz] | Normal |
| 6.0 GHz ≤ Frequency < 10.0 GHz | –151.0 [dBm/Hz] | Normal |
| 10.0 GHz ≤ Frequency ≤ 13.5 GHz | –150.0 [dBm/Hz] | Normal |
| 13.5 GHz < Frequency ≤ 20.0 GHz | –147.0 [dBm/Hz] | Normal |
| 20.0 GHz < Frequency ≤ 26.5 GHz | –143.0 [dBm/Hz] | Normal |

with MS269xA-008, Preamp: On

| Frequency | Max. | Frequency band mode |
|---|---|---|
| 100 kHz | –150.0 [dBm/Hz] | |
| 1 MHz | –159.0 [dBm/Hz] | |
| 30 MHz ≤ Frequency < 2.4 GHz | –166.0 [dBm/Hz] | |
| 2.4 GHz ≤ Frequency < 3.0 GHz | –165.0 [dBm/Hz] | |
| 3.0 GHz ≤ Frequency < 4.0 GHz | –164.0 [dBm/Hz] | Normal |
| 4.0 GHz ≤ Frequency < 5.0 GHz | –161.0 [dBm/Hz] | Normal |
| 5.0 GHz ≤ Frequency ≤ 6.0 GHz | –159.0 [dBm/Hz] | Normal |

with MS269xA-008, Preamp: Off

| Frequency | Max. | Frequency band mode |
|---|---|---|
| 100 kHz | –135.0 [dBm/Hz] | |
| 1 MHz | –145.0 [dBm/Hz] | |
| 30 MHz ≤ Frequency < 2.4 GHz | –153.0 [dBm/Hz] | |
| 2.4 GHz ≤ Frequency < 3.0 GHz | –152.0 [dBm/Hz] | |
| 3.0 GHz ≤ Frequency < 4.0 GHz | –151.0 [dBm/Hz] | Normal |
| 4.0 GHz ≤ Frequency < 5.0 GHz | –150.0 [dBm/Hz] | Normal |
| 5.0 GHz ≤ Frequency < 6.0 GHz | –149.0 [dBm/Hz] | Normal |

Total Level Accuracy*

∗: The Total level accuracy is found from root sum of squares (RSS) of RF characteristics, linearity error, and input attenuator switching error.

18˚ to 28˚C, after CAL, Input attenuator: ≥10 dB, Auto Sweep Time Select: Normal, RBW: ≤1 MHz,
Detection: Positive, CW, Excluding the noise floor effect

without MS269xA-008, Preamp: Off
Mixer input level: ≤0 dBm,
±0.5 dB (50 Hz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
(50 Hz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)
after Preselector tuning
±1.8 dB (6.0 GHz < Frequency ≤ 13.5 GHz, Frequency band mode: Normal)
(3.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Spurious)
±3.0 dB (13.5 GHz < Frequency ≤ 26.5 GHz)

with MS269xA-008, Preamp: On
Preamp input level: ≤–20 dBm
±1.0 dB (100 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
(100 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)

## ■ Spectrum Analyzer Function (Continuation)

### Spurious Response

| | |
|---|---|
| 2-tone 3rd-order Intermodulation Distortion | 18˚ to 28˚C, ≥300 kHz separation<br>without MS269xA-008, or Preamp: Off<br>with MS2692A-067, Microwave Preselector Bypass: Off<br>Mixer input level: –15 dBm (per waveform)<br>≤–60 dBc (TOI: +15 dBm) (30 MHz ≤ Frequency < 400 MHz)<br>≤–66 dBc (TOI: +18 dBm) (400 MHz ≤ Frequency < 700 MHz)<br>≤–74 dBc (TOI: +22 dBm) (700 MHz ≤ Frequency < 4.0 GHz, Frequency band mode: Normal)<br>(700 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)<br>≤–66 dBc (TOI: +18 dBm) (4.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)<br>≤–45 dBc (TOI: +7.5 dBm) (6.0 GHz < Frequency ≤ 26.5 GHz, Frequency band mode: Normal)<br>(3.0 GHz ≤ Frequency ≤ 26.5 GHz, Frequency band mode: Spurious)<br>with MS269xA-008, Preamp: On<br>Preamp input level: –45 dBm (per waveform)<br>≤–73 dBc (TOI: –8.5 dBm) (30 MHz ≤ Frequency < 400 MHz)<br>≤–78 dBc (TOI: –6 dBm) (400 MHz ≤ Frequency < 700 MHz)<br>≤–81 dBc (TOI: –4.5 dBm) (700 MHz ≤ Frequency < 4.0 GHz, Frequency band mode: Normal)<br>(700 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)<br>≤–78 dBc (TOI: –6 dBm) (4.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) |
| Image Response | without MS2692A-067<br>≤–70 dBc (Frequency ≤ 13.5 GHz)<br>≤–65 dBc (13.5 GHz < Frequency ≤ 26.5 GHz) |

### Sweep

| | |
|---|---|
| Sweep Mode | Single, Continuous |
| Sweep Time | Setting range: 2 ms to 1000 s (Span: ≥300 Hz), 1 µs to 1000 s (Span: 0 Hz) |

### Waveform Display

| | |
|---|---|
| Detector | Pos&Neg, Positive Peak, Sample, Negative Peak, RMS |
| Number of Trace Points | 1001, 2001, 5001, 10001 (Span: >500 MHz)<br>101, 201, 251, 401, 501, 1001, 2001, 5001, 10001 (100 MHz < Span ≤ 500 MHz)<br>(300 Hz ≤ Span ≤ 100 MHz, Sweep time: >10 s)<br>11, 21, 41, 51, 101, 201, 251, 401, 501, 1001, 2001, 5001, 10001 (300 Hz ≤ Span ≤ 100 MHz, Sweep time: ≤10 s)<br>(Span: 0 Hz, Sweep time: ≤10 s)<br>101, 201, 251, 401, 501, 1001, 2001, 5001, 10001 (Span: 0 Hz, Sweep time: >10 s) |
| Scale | Log display: 10 div/12 div, 0.1 to 20 dB/div (1-2-5 sequence)<br>Lin display: 10 div, 1 to 10%/div (1-2-5 sequence) |
| Trigger Function | Trigger mode: Free Run (Trig Off), Video, Wide IF, External (TTL)<br>SG Marker (with MS269xA-020), BBIF (with MS269xA-040) |
| Gate Function | Gate mode: Off, Wide IF, External<br>SG Marker (with MS269xA-020), BBIF (with MS269xA-040) |

### Measurement Functions

| | | |
|---|---|---|
| Adjacent Channel Leakage Power (ACP) | | Reference: Span Total, Carrier Total, Both side of Carrier, Carrier Select<br>Adjacent channel specification: 3 channels × 2 (Normal Mode), 8 channels × 2 (Advanced Mode) |
| Burst Average Power | | In time domain, displays average power in specified time |
| Channel Power | | Absolute value measurement: dBm, dBm/Hz |
| Occupied Bandwidth (OBW) | | N% of Power, X-dB Down |
| Spectrum Emission Mask | | Pass/Fail evaluation at Peak/Margin measurement |
| Spurious Emission | | Pass/Fail evaluation at Worst/Peaks measurement |
| Frequency Counter | Accuracy | Span: ≤1 MHz, RBW: 1 kHz, S/N: ≥50 dB, Gate time: ≥100 ms,<br>± (Marker frequency × Frequency reference accuracy + (0.01 × N/Gate Time[s]) Hz)<br>N: Mixer harmonic order |
| | Gate Time Range | 100 µs to 1 s |
| 2-tone 3rd-order Intermodulation Distortion | | Measures IM3 and TOI from two-tone signal. |

## Vector Signal Analysis Function

### Common

| | |
|---|---|
| Trace Mode | Spectrum, Power vs. Time, Frequency vs. Time, Phase vs. Time, CCDF, Spectrogram, No Trace |
| Bandwidth | without MS269xA-077/078<br>Specified analysis bandwidth from center frequency<br>1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz<br>with MS269xA-077<br>Adds the 50 MHz, 62.5 MHz bandwidths to the standard analysis bandwidths.<br>with MS269xA-077/078<br>Adds the 50, 62.5, 100, and 125 MHz bandwidths to the standard analysis bandwidths. |
| Sampling Rate | Auto-setting depending on RBW<br>without MS269xA-077/078, or Bandwidth: ≤31.25 MHz<br>2 kHz to 50 MHz (1-2-5 sequence)<br>with MS269xA-077, Bandwidth: >31.25 MHz<br>100 MHz<br>with MS269xA-077/078, Bandwidth: >31.25 MHz<br>100 MHz, 200 MHz |
| Capture Time | Set length of capture time<br>without MS269xA-077/078, or Bandwidth: ≤31.25 MHz<br>Min. capture time length: 2 µs to 50 ms (determined depending on analysis bandwidth)<br>Max. capture time length: 2 to 2000 s (determined depending on analysis bandwidth)<br>Setting mode: Auto, Manual<br>with MS269xA-077, Bandwidth: >31.25 MHz<br>Min. capture time length: 1 µs (determined depending on analysis bandwidth)<br>Max. capture time length: 500 ms<br>with MS269xA-077/078, Bandwidth: >31.25 MHz<br>Min. capture time length: 500 ns to 1 µs (determined depending on analysis bandwidth)<br>Max. capture time length: 500 ms |
| Trigger | Trigger mode: Free Run (Trig Off), Video, Wide IF Video, External (TTL)<br>SG Marker (with MS269xA-020), BBIF (with MS269xA-040) |
| ADC Resolution | 16 bits |

### Spectrum Display Function

| | |
|---|---|
| Function Outline | Displays any time length in captured waveform data and spectrum in frequency range |
| Analysis Time Range | Analysis start time: Set analysis start time point from waveform data header<br>Analysis time length: Set analysis time length<br>Setting mode: Auto, Manual |
| Frequency | Set center frequency and Span in frequency range of waveform data |
| Frequency Setting Range | without MS269xA-077/078, or Bandwidth: ≤31.25 MHz<br>0 Hz to 6.0 GHz (MS2690A), 0 Hz to 13.5 GHz (MS2691A), 0 Hz to 26.5 GHz (MS2692A)<br>with MS269xA-077, or with MS269xA-077/078, without MS2692A-067, Bandwidth: >31.25 MHz<br>100 MHz to 6.0 GHz<br>with MS269xA-077, or with MS269xA-077/078, with MS2692A-067, Bandwidth: >31.25 MHz<br>100 MHz to 26.5 GHz |
| Resolution Bandwidth (RBW) | without MS269xA-077/078, or Bandwidth: ≤31.25 MHz<br>Setting range: 1 Hz to 1 MHz (1-3 sequence)<br>Selectivity (–60 dB/–3 dB): 4.5:1 (nominal)<br>with MS269xA-077, Bandwidth: >31.25 MHz<br>Setting range: 3 kHz to 3 MHz (1-3 sequence)<br>Selectivity (–60 dB/–3 dB): 4.5:1 (nominal)<br>with MS269xA-077/078, Bandwidth: >31.25 MHz<br>Setting range: 3 kHz to 10 MHz (1-3 sequence)<br>Selectivity (–60 dB/–3 dB): 4.5:1 (nominal) |

## ■ Vector Signal Analysis Function (Continuation)

### Spectrum Display Function (Continuation)

<table>
<tr><td>Total Level Accuracy*<br><br>*: The Total level accuracy is found from root sum of squares (RSS) of RF characteristics, linearity error, and input attenuator switching error.</td><td>18˚ to 28˚C, after CAL, Input attenuator: ≥10 dB, Center frequency, CW, RBW: Auto, Time Detection: Average, Marker Result: Integration or Peak (Accuracy), Excluding the noise floor effect<br><br>Mixer input level: ≤0 dBm<br>without MS269xA-077/078, or Bandwidth: ≤31.25 MHz<br>without MS269xA-008, or Preamp: Off<br>±0.5 dB (50 Hz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)<br>(50 Hz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)<br><br>after Preselector tuning<br>±1.8 dB (6.0 GHz < Frequency ≤ 13.5 GHz, Frequency band mode: Normal)<br>(3.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Spurious)<br>±3.0 dB (13.5 GHz ≤ Frequency ≤ 26.5 GHz)<br><br>with MS269xA-077, or with MS269xA-077/078, Bandwidth: >31.25 MHz<br>without MS269xA-008, or Preamp: Off<br>±0.5 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)<br><br>with MS269xA-077, or with MS269xA-077/078<br>with MS2692A-067, Microwave Preselector Bypass: On, Bandwidth: >31.25 MHz<br>±1.8 dB (6.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Normal)<br>±3.0 dB (13.5 GHz ≤ Frequency ≤ 26.5 GHz)<br><br>Preamp input level: ≤–20 dBm<br>without MS269xA-077/078, or Bandwidth: ≤31.25 MHz<br>with MS269xA-008, Preamp: On<br>±1.0 dB (100 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)<br>(100 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)<br><br>with MS269xA-077, or with MS269xA-077/078, Bandwidth: >31.25 MHz<br>with MS269xA-008, Preamp: On<br>±1.0 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>Displayed Average Noise Level (DANL)</td><td>18˚ to 28˚C, Input attenuator: 0 dB<br><br>without MS269xA-008, 6.0 GHz ≤ Frequency ≤ 26.5 GHz: without MS2692A-067
<table>
<tr><th>Frequency</th><th>Max.</th><th>Frequency band mode</th></tr>
<tr><td>100 kHz</td><td>–132.5 [dBm/Hz]</td><td></td></tr>
<tr><td>1 MHz</td><td>–142.5 [dBm/Hz]</td><td></td></tr>
<tr><td>30 MHz ≤ Frequency < 2.4 GHz</td><td>–152.5 [dBm/Hz]</td><td></td></tr>
<tr><td>2.4 GHz ≤ Frequency < 3.0 GHz</td><td>–150.5 [dBm/Hz]</td><td></td></tr>
<tr><td>3.0 GHz ≤ Frequency < 4.0 GHz</td><td>–150.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>4.0 GHz ≤ Frequency < 6.0 GHz</td><td>–149.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>6.0 GHz ≤ Frequency < 10.0 GHz</td><td>–148.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>10.0 GHz ≤ Frequency ≤ 13.5 GHz</td><td>–147.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>13.5 GHz < Frequency ≤ 20.0 GHz</td><td>–144.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>20.0 GHz < Frequency ≤ 26.5 GHz</td><td>–140.5 [dBm/Hz]</td><td>Normal</td></tr>
</table>
with MS269xA-008, Preamp: On
<table>
<tr><th>Frequency</th><th>Max.</th><th>Frequency band mode</th></tr>
<tr><td>100 kHz</td><td>–147.5 [dBm/Hz]</td><td></td></tr>
<tr><td>1 MHz</td><td>–156.5 [dBm/Hz]</td><td></td></tr>
<tr><td>30 MHz ≤ Frequency < 2.4 GHz</td><td>–163.5 [dBm/Hz]</td><td></td></tr>
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</table>
with MS269xA-008, Preamp: Off
<table>
<tr><th>Frequency</th><th>Max.</th><th>Frequency band mode</th></tr>
<tr><td>100 kHz</td><td>–132.5 [dBm/Hz]</td><td></td></tr>
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</table></td></tr>
<tr><td>Adjacent Channel Leakage Power Measurement (ACP)</td><td>Reference: Span Total, Carrier Total, Both Sides of Carriers, Carrier Select<br>Adjacent channel specification: 3 channels × 2</td></tr>
<tr><td>Channel Power</td><td>Absolute value measurement: dBm, dBm/Hz</td></tr>
<tr><td>Occupied Bandwidth (OBW)</td><td>N% of Power, × dB Down</td></tr>
</table>

## ■ Vector Signal Analysis Function (Continuation)

### Power vs. Time Display Function

| | |
|---|---|
| Function Outline | Displays variation in power of captured waveform with time |
| Analysis Time Range | Analysis start time: Sets analysis start time point from waveform data header<br>Analysis time length: Sets analysis time length<br>Setting mode: Auto, Manual |
| Resolution Bandwidth | Filter type: Rect, Gaussian, Nyquist, Root Nyquist, Off, (Default: Off)<br>Roll-off ratio: 0.01 to 1 (Set for Nyquist, Root Nyquist)<br>Filter frequency offset: Set center frequency of filter in wavelength data frequency band |
| AM Depth<br>(Peak to Peak Measurement) | Measures with AM depth or marker function<br>+Peak, –Peak, (P-P)/2, Average |
| Burst Average Power | Measures average power of burst signal |

### Frequency vs. Time Display Function

| | |
|---|---|
| Function Outline | Displays variation in frequency of input signal with time from captured waveform data |
| Analysis Time Range | Analysis start time: Sets analysis start time point from waveform data header<br>Analysis time length: Sets analysis time length<br>Setting mode: Auto, Manual |
| Operation Level Range | –17 to +30 dBm (Input attenuator: ≥10 dB) |
| Frequency (Vertical axis) | Sets center frequency and Span in waveform data frequency range<br>Display frequency range: 1/25, 1/10, 1/5, 1/2 of RBW<br>Input frequency range: 10 MHz to 6 GHz |
| Display Frequency Accuracy | Input level: –17 to +30 dBm (Span: ≤31.25 MHz, Scale: Span/25)<br>CW input: ± (Reference oscillator accuracy × Center frequency + Display frequency range × 0.01) Hz |
| FM Deviation<br>(Peak to Peak Measurement) | Measures with FM deviation or marker function<br>+Peak, –Peak, (P-P)/2, Average |

### Phase vs. Time Display Function

| | |
|---|---|
| Function Outline | Displays phase time fluctuation of input signal from captured waveform data |
| Analysis Time Range | Analysis start time: Sets analysis start time point from waveform data header<br>Analysis time length: Sets analysis time length<br>Setting mode: Auto, Manual |
| Phase (Vertical axis) | Display mode: Wrap, Unwrap<br>Display phase range: 0.01 deg./div to 200 Gdeg./div<br>Offset: –100 deg. to +100 Mdeg. |

### CCDF/APD Display Function

| | |
|---|---|
| Function Outline | Displays CCDF and APD of waveform data captures for fixed time |
| Analysis Time Range | Analysis start time: Sets analysis start time point from waveform data header<br>Analysis time length: Sets analysis time length<br>Setting mode: Auto, Manual |
| Display | Displays CCDF or APD as graph<br>Histogram resolution: 0.01 dB<br>Numeric display: Average Power, Max Power, Crest Factor |
| Resolution Bandwidth<br>(RBW) | Filter type: Rectangle, Off, (Default: Off)<br>Filter frequency offset: Sets filter center frequency in waveform data frequency band |

### Spectrogram Display Function

| | |
|---|---|
| Function Outline | Displays spectrogram for time period in captured waveform data |
| Analysis Time Range | Analysis start time: Sets position of analysis start after waveform data header<br>Analysis time length: Sets analysis time length<br>Setting mode: Auto, Manual |
| Frequency | Settable as center frequency and span frequency of waveform data |
| Resolution Bandwidth<br>(RBW) | Setting range: 1 Hz to 1 MHz (1-3 sequence)<br>Selection (–60/–3 dB): 4.5: 1 (nominal) |

### Digitize Function

| | |
|---|---|
| Function Outline | Outputs captured waveform data to internal hard disk or external device |
| Waveform Data | Format: I, Q (32 bit Float Binary format)<br>Level: Sets 0 dBm input to $\sqrt{(I^2 + Q^2)} = 1$<br>Level accuracy: Same as Total level accuracy of Signal Analyzer |
| External Output | Output to external PC via Ethernet |

## ■ Vector Signal Analysis Function (Continuation)

### Replay Function

| Function Outline | Captured waveforms can be replayed again by using the VSA function to read saved digitize data |
|---|---|
| Measurable Waveform Data Condition | Format: I, Q (Binary format)<br>Combination of Span, Sampling rate, and Minimum Capture Sample: |

| Span | Sampling Rate | Minimum Capture Sample |
|---|---|---|
| 1 kHz | 2 kHz | 74000 (37 s) |
| 2.5 kHz | 5 kHz | 160000 (32 s) |
| 5 kHz | 10 kHz | 310000 (31 s) |
| 10 kHz | 20 kHz | 610000 (30.5 s) |
| 25 kHz | 50 kHz | 730000 (14.6 s) |
| 50 kHz | 100 kHz | 730000 (7.3 s) |
| 100 kHz | 200 kHz | 730000 (3.65 s) |
| 250 kHz | 500 kHz | 730000 (1.46 s) |
| 500 kHz | 1 MHz | 730000 (730 ms) |
| 1 MHz | 2 MHz | 730000 (365 ms) |
| 2.5 MHz | 5 MHz | 730000 (146 ms) |
| 5 MHz | 10 MHz | 730000 (73 ms) |
| 10 MHz | 20 MHz | 730000 (36.5 ms) |
| 18.6 MHz | 20 MHz | 730000 (36.5 ms) |
| 20 MHz | 25 MHz | 730000 (29.2 ms) |
| 25 MHz | 50 MHz | 730000 (14.6 ms) |
| 31.25 MHz | 50 MHz | 730000 (14.6 ms) |
| 50 MHz | 100 MHz | 730000 (7.3 ms) |
| 62.5 MHz | 100 MHz | 730000 (7.3 ms) |
| 100 MHz | 200 MHz | 730000 (3.65 ms) |
| 125 MHz | 200 MHz | 730000 (3.65 ms) |

## ■ Hardware Option

### MS2690A/MS2691A/MS2692A-001 Rubidium Reference Oscillator

| | |
|---|---|
| Function Outline | Generates 10 MHz reference signal with higher frequency stability |

### MS2691A/MS2692A-003 Extension of Preselector Lower Limit to 3 GHz

Cannot be installed simultaneously MS2692A-003 and MS2692A-067.

| | |
|---|---|
| Function Outline | Extends lower limit of preselector to 3 GHz |

### MS2690A/MS2691A/MS2692A-008 6 GHz Preamplifier

Cannot be installed simultaneously MS2692A-008 and MS2692A-067.

#### Frequency

| | |
|---|---|
| Range | 100 kHz to 6 GHz |

#### Amplitude

| | |
|---|---|
| Measurement Range | Displayed average noise level to +10 dBm |
| Max. Input Level | CW Average power: +10 dBm (Input attenuator: 0 dB)<br>DC Voltage: 0 Vdc |
| Gain | 14 dB (Frequency ≤ 3.0 GHz), 13 dB (3.0 GHz < Frequency ≤ 4.0 GHz), 11 dB (4.0 GHz < Frequency ≤ 5.0 GHz),<br>10 dB (5.0 GHz < Frequency ≤ 6.0 GHz) |
| Noise Factor | 7.0 dB (Frequency ≤ 3.0 GHz), 8.5 dB (3.0 GHz < Frequency ≤ 4.0 GHz), 9.5 dB (4.0 GHz < Frequency ≤ 6.0 GHz) |
| Displayed Average Noise Level (DANL) | Spectrum analyzer function: 18˚ to 28˚C, Input attenuator: 0 dB, Detector: sample, VBW: 1 Hz (Video average)<br>Vector signal analysis function: 18˚ to 28˚C, Input attenuator: 0 dB<br>Preamp: On |

| Frequency | Max. (Spectrum analyzer function) | Max. (Vector signal analysis function) | Frequency band mode |
|---|---|---|---|
| 100 kHz | –150.0 [dBm/Hz] | –147.5 [dBm/Hz] | |
| 1 MHz | –159.0 [dBm/Hz] | –156.5 [dBm/Hz] | |
| 30 MHz ≤ Frequency < 2.4 GHz | –166.0 [dBm/Hz] | –163.5 [dBm/Hz] | |
| 2.4 GHz ≤ Frequency < 3.0 GHz | –165.0 [dBm/Hz] | –162.5 [dBm/Hz] | |
| 3.0 GHz ≤ Frequency < 4.0 GHz | –164.0 [dBm/Hz] | –161.5 [dBm/Hz] | Normal |
| 4.0 GHz ≤ Frequency < 5.0 GHz | –161.0 [dBm/Hz] | –158.5 [dBm/Hz] | Normal |
| 5.0 GHz ≤ Frequency ≤ 6.0 GHz | –159.0 [dBm/Hz] | –156.5 [dBm/Hz] | Normal |

Preamp: Off

| Frequency | Max. (Spectrum analyzer function) | Max. (Vector signal analysis function) | Frequency band mode |
|---|---|---|---|
| 100 kHz | –135.0 [dBm/Hz] | –132.5 [dBm/Hz] | |
| 1 MHz | –145.0 [dBm/Hz] | –142.5 [dBm/Hz] | |
| 30 MHz ≤ Frequency < 2.4 GHz | –153.0 [dBm/Hz] | –150.5 [dBm/Hz] | |
| 2.4 GHz ≤ Frequency < 3.0 GHz | –152.0 [dBm/Hz] | –149.5 [dBm/Hz] | |
| 3.0 GHz ≤ Frequency < 4.0 GHz | –151.0 [dBm/Hz] | –148.5 [dBm/Hz] | Normal |
| 4.0 GHz ≤ Frequency < 5.0 GHz | –150.0 [dBm/Hz] | –147.5 [dBm/Hz] | Normal |
| 5.0 GHz ≤ Frequency < 6.0 GHz | –149.0 [dBm/Hz] | –146.5 [dBm/Hz] | Normal |

| | |
|---|---|
| Input Attenuator Switching Error | Frequency band mode: Normal<br>±0.65 dB (≤6.0 GHz, 10 to 60 dB) |

#### Reference Level

| | |
|---|---|
| RF Frequency Characteristics | 18˚ to 28˚C, After CAL, Input attenuator: 10 dB<br>±0.65 dB (100 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)<br>(100 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious) |
| Linearity Error | Excluding the noise floor effect<br>±0.07 dB (Preamp input level*: ≤–40 dBm)<br>±0.10 dB (Preamp input level*: ≤–30 dBm)<br>Frequency band mode: Normal<br>±0.5 dB (Preamp input level*: ≤–20 dBm, frequency: ≤6.0 GHz) |
| 1 dB Gain Compression | Preamp input level*<br>≥–20 dBm (100 MHz ≤ Frequency < 400 MHz)<br>≥–15 dBm (400 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)<br>(400 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious) |

## ■ Hardware Option (Continuation)

### Spurious Response

| | |
|---|---|
| 2nd Harmonic Distortion | Preamp input level*: –45 dBm<br>Harmonic SHI<br>≤–50 dBc ≥+5 dBm (10 Hz ≤ Frequency ≤ 400 MHz)<br>≤–55 dBc ≥+10 dBm (400 MHz < Frequency ≤ 3.0 GHz) |
| 2-tone 3rd-order Intermodulation Distortion | 18° to 28°C, Preamp input level*: –45 dBm (per waveform), ≥300 kHz separation<br>≤–73 dBc (TOI: –8.5 dBm) (30 MHz ≤ Frequency < 400 MHz)<br>≤–78 dBc (TOI: –6 dBm) (400 MHz ≤ Frequency < 700 MHz)<br>≤–81 dBc (TOI: –4.5 dBm) (700 MHz ≤ Frequency < 4.0 GHz, Frequency band mode: Normal)<br>(700 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)<br>≤–78 dBc (TOI: –6 dBm) (4.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) |

*: Preamp input level = RF input level – Input attenuator setting value

## MS2690A/MS2691A/MS2692A-017 Noise Figure Measurement Function*

### Frequency

| | |
|---|---|
| Frequency range | MS2690A: 30 MHz to 6 GHz<br>MS2691A: 30 MHz to 6 GHz<br>MS2692A: 30 MHz to 6 GHz |
| Frequency setting range | MS2690A: 10 MHz to 6 GHz<br>MS2691A: 10 MHz to 13.5 GHz<br>MS2692A: 10 MHz to 26.5 GHz |

### NF Measurement

| | |
|---|---|
| Measurement range | Within the frequency range<br>(Attenuator = 0 dB, Pre-Amp = On)<br>– 20 to +40 dB |
| Instrument Uncertainty | Within the measurement range<br>ENR: 4 to 7 dB ±0.02 dB<br>ENR: 12 to 17 dB ±0.025 dB<br>ENR: 20 to 22 dB ±0.03 dB |

### GAIN Measurement

| | |
|---|---|
| Measurement range | Within the frequency range<br>–20 to +40 dB |
| Instrument Uncertainty | Within the measurement range<br>≤0.07 |

### Resolution Bandwidth

| | |
|---|---|
| Setting Range | 100 kHz to 8 MHz |

### Connector

| | |
|---|---|
| Noise Source | Connector: Rear Panel, BNC-J<br>Output Voltage: 28 ±0.5 V, Pulsed |

*: Recommending the NC346 Series noise sources by Noisecom company

## ■ Hardware Option (Continuation)

# MS2690A/MS2691A/MS2692A-020 Vector Signal Generator

### Frequency

| | |
|---|---|
| Range | 125 MHz to 6 GHz |
| Resolution | 0.01 Hz steps |

### Output Level

| | |
|---|---|
| Setting range | –140 to +10 dBm (CW), –140 to 0 dBm (Modulation) |
| Units | dBm, dBμV (Terminated, Open) |
| Resolution | 0.01 dB |
| Level Accuracy | 18˚ to 28˚C, CW<br>Output level: p<br>–120 ≤ p ≤ +5 dBm ±0.5 dB (≤3.0 GHz)<br>–110 ≤ p ≤ +5 dBm ±0.8 dB (>3.0 GHz)<br>–127 ≤ p < –120 dBm ±0.7 dB (≤3.0 GHz)<br>–127 ≤ p ≤ –110 dBm ±2.5 dB (typ.) (>3.0 GHz)<br>–136 ≤ p < –127 dBm ±1.5 dB (typ.) (≤3.0 GHz) |
| Linearity | 18˚ to 28˚C, CW, Referenced to –5 dBm output<br>Output level: p<br>–120 ≤ p ≤ –5 dBm ±0.2 dB (typ.) (≤3.0 GHz)<br>–110 ≤ p ≤ –5 dBm ±0.3 dB (typ.) (>3.0 GHz) |
| Connector | N-J connector, 50Ω [Front panel, SG Output (MS269xA-020) ] |
| VSWR | CW: ≤–5 dBm, Modulation: ≤–15 dBm<br>1.3 (≤3.0 GHz)<br>1.9 (>3.0 GHz) |
| Max. Reverse Input | 1 W peak (≥300 MHz), 0.25 W peak (<300 MHz) |

### Signal Purity

| | |
|---|---|
| Harmonic Spurious | Output level: ≤+5 dBm, CW, Output frequency: ≥300 MHz<br>≤–30 dBc |
| Non-harmonic Spurious | Output level: ≤+5 dBm, CW, Offset: ≥15 kHz (from Output frequency)<br><–68 dBc (125 MHz ≤ Frequency ≤ 500 MHz)<br><–62 dBc (500 MHz < Frequency ≤ 1.0 GHz)<br><–56 dBc (1.0 GHz < Frequency ≤ 2.0 GHz)<br><–50 dBc (2.0 GHz < Frequency ≤ 6.0 GHz) |

### Vector Modulation

18˚ to 28˚C, SG Level Auto CAL: On

| | |
|---|---|
| Vector Accuracy | W-CDMA (DL1code)<br>Output level: ≤–5 dBm, Output frequency: 800 MHz to 2700 MHz<br>≤2% (rms) |
| Carrier Leak | Output frequency: ≥300 MHz<br>≤–40 dBc |
| Image Rejection | Output frequency: ≥300 MHz, Using 10 MHz max. sine wave<br>≤–40 dBc |
| ACLR | Output level: ≤–5 dBm,<br>Using W-CDMA (Test Model 1 64DPCH) signal, 300 MHz ≤ Output frequency ≤ 2.4 GHz<br>≤–64 dBc/3.84 MHz (5 MHz offset), ≤–67 dBc/3.84 MHz (10 MHz offset) |
| CW and Level Error at Vector Modulation | AWGN signal with bandwidth of 5 MHz, Output frequency: ≥300 MHz<br>±0.2 dB (Output level: ≤–15 dBm)<br>±0.4 dB (typ., –15 dBm < Output level: ≤–5 dBm) |
| Spectrum Inversion | Supported |

### Pulse Modulation

| | |
|---|---|
| On/Off ratio | ≥60 dB |
| Rising/Falling Edge Time | ≤90 ns (10 to 90%) |
| Pulse Repetition Frequency | DC to 1 MHz (Duty 50%) |
| External Panel Modulation Signal Input | AUX connector (Rear panel), 600Ω, 0 to 5 V, Threshold value: approx. 1 V |

## ■ Hardware Option (Continuation)

### Arbitrary Waveform Generator

| | |
|---|---|
| Waveform Resolution | 14 bits |
| Marker Output | Three signals (three signals in waveform pattern, or real-time three signals generation), TTL, polarity inversion function |
| Internal Baseband Reference Clock | Range: 20 kHz to 160 MHz<br>Resolution: 0.001 Hz |
| External Baseband Reference Clock | Range: 20 kHz to 40 MHz<br>Division, Multiplier function: 1, 2, 4, 8, 16, 1/2, 1/4, 1/8, 1/16 of input signal<br>Input connector: AUX connector (Rear panel), 0.7 Vp-p min. (AC/50Ω), or TTL |
| Waveform Memory | Memory: 256 Msamples |
| AWGN Addition Function | CN Ratio absolute value: ≤40 dB |

### BER Measurement

| | |
|---|---|
| Connector | AUX connector (Rear panel) |
| Input Level | TTL Level |
| Input Signal | Data, Clock, Enable |
| Input Bit Rate | 100 bps to 10 Mbps |
| Measured Patterns | PN9, PN11, PN15, PN20, PN23, ALL0, ALL1, 01 Repeat<br>PN9Fix, PN11Fix, PN15Fix, PN20Fix, PN23Fix, User Define |
| Synchronization Establishing Condition | PN Signal: PN stage × 2 bit error free<br>At PNFix Signal: 0 PN stage × 2 bit error free, PN signal and sync establishment, establish sync with PNFix signal at PN stage error free from PNFix signal header bit<br>ALL0, ALL1, 01 Repeat: 10 bit error free<br>User Define: 8 to 1024 bits (variable) error free, Select header bit used at sync detection |
| Re-synchronization Judgment Condition | x/y<br>y = Measured bit count: Select from 500, 5000, 50000<br>x = y bit error bit count: Setting range 1 to y/2 |
| Measured Bit Count | ≤$2^{32}$ – 1 bits |
| Measured Error Bit Count | ≤$2^{31}$ – 1 bits |
| Measurement End Conditions | Measured bit count, Measured error bit count |
| Auto Re-synchronization Function | On/Off |
| Operation at Resync. | Select from Count Clear, and Count Keep |
| Measurement Mode | Single, Endless, Continuous |
| Display | Status, Error, Error Rate, Error Count, Sync Loss Count, Measured bit count |
| Polarity Inversion Function | Data, Clock, Enable polarity inversion |
| Clear Measurement Function | Clear measured value saved at sync during BER measurement, and select measurement from 0 |

## MS2690A/MS2691A/MS2692A-050 HDD Digitizing Interface

| | |
|---|---|
| Bandwidth, Sampling Rate, Recorded Data Format | <table><tr><th>Bandwidth</th><th>Sampling Rate</th><th>Recorded Data Format</th></tr><tr><td>100, 250, 500 kHz, 1, 2.5, 5 MHz</td><td>200, 500 kHz, 1, 2, 5, 10 MHz</td><td>Floating Decimal Format</td></tr><tr><td>10 MHz, 18.6 MHz</td><td>20 MHz</td><td rowspan="2">Fixed Decimal Format (16 bits)</td></tr><tr><td>20 MHz</td><td>25 MHz</td></tr></table> |
| Recording Time | 5 seconds to 4 hours |
| Number of Recorded File | 1000 files max. |
| Resample Function | Convert by resampling at data retrieval, Setting range: Sampling rate/2 to Sampling rate |
| Trigger Function | Video, Wide IF Video, External, SG Marker |
| Count Mode | Capturing times: 1 to 20 times |
| Interface | Connector: External Serial ATA Connector<br>Data rate: 1.5 Gbps<br>Hot Plug: Not supported (The main frame and external HDD must be off when connecting/disconnecting connectors.) |

## ■ Hardware Option (Continuation)

### MS2692A-067 Microwave Preselector Bypass

Bypasses the preselector to improve the RF frequency characteristics and the in-band frequency characteristics.
When the preselector option is set to On, the image response elimination filter is bypassed.
Therefore, this function is not appropriate for spurious measurement to receive the image response.
Microwave Preselector Bypass: On (with MS2692A-067), Microwave Preselector Bypass: Off (with special directions)

Cannot install simultaneously with MS2692A-003, MS2692A-008.

#### Frequency

| | |
|---|---|
| Frequency Range | 6.0 GHz to 26.5 GHz |

#### Amplitude

| | |
|---|---|
| RF Frequency Characteristics | 18° to 28°C, after CAL, Input attenuator: 10 dB, Microwave Preselector Bypass: On<br>±1.0 dB (6.0 GHz ≤ Frequency ≤ 13.5 GHz)<br>±1.5 dB (13.5 GHz < Frequency ≤ 26.5 GHz)<br>∗ with MS2692A-067, Microwave Preselector Bypass: Off, see Signal Analyzer/Spectrum Analyzer (RF Frequency Characteristics) |
| Displayed Average Noise Level (DANL) | 18° to 28°C, Detector: Sample, VBW: 1 Hz (Video average), Input attenuator: 0 dB<br>Microwave Preselector Bypass: On or Off<br>–146 dBm/Hz (6.0 GHz ≤ Frequency < 10.0 GHz)<br>–145 dBm/Hz (10.0 GHz ≤ Frequency ≤ 13.5 GHz)<br>–142 dBm/Hz (13.5 GHz < Frequency ≤ 20.0 GHz)<br>–138 dBm/Hz (20.0 GHz < Frequency ≤ 26.5 GHz) |
| Image Responses | Microwave Preselector Bypass: Off<br>≤–60 dBc (6.0 GHz ≤ Frequency ≤ 26.5 GHz) |

### MS2690A/MS2691A/MS2692A-077 Analysis Bandwidth Extension to 62.5 MHz
### MS2690A/MS2691A/MS2692A-078 Analysis Bandwidth Extension to 125 MHz (Requires MS269xA-077)

#### Common

| | |
|---|---|
| Bandwidth | with MS269xA-077<br>Adds the 50 MHz, 62.5 MHz bandwidths to the standard analysis bandwidths.<br>with MS269xA-077/078<br>Adds the 50, 62.5, 100, and 125 MHz bandwidths to the standard analysis bandwidths. |
| Sampling Rate | Auto-setting depending on RBW<br>with MS269xA-077, Bandwidth: >31.25 MHz<br>100 MHz<br>with MS269xA-077/078, Bandwidth: >31.25 MHz<br>100 MHz, 200 MHz |
| Capture Time | Set length of capture time<br>with MS269xA-077, Bandwidth: >31.25 MHz<br>Min. capture time length: 1 µs (determined depending on analysis bandwidth)<br>Max. capture time length: 500 ms<br>with MS269xA-077/078, Bandwidth: >31.25 MHz<br>Min. capture time length: 500 ns to 1 µs (determined depending on analysis bandwidth)<br>Max. capture time length: 500 ms |
| Resolution Bandwidth (RBW) | with MS269xA-077, Bandwidth: >31.25 MHz<br>Setting range: 3 kHz to 3 MHz (1-3 sequence)<br>Selectivity (–60 dB/–3 dB): 4.5:1 (nominal)<br>with MS269xA-077/078, Bandwidth: >31.25 MHz<br>Setting range: 3 kHz to 10 MHz (1-3 sequence)<br>Selectivity (–60 dB/–3 dB): 4.5:1 (nominal) |
| ADC Resolution | with MS269xA-077/078, Bandwidth: >31.25 MHz<br>14 bits |
| Frequency | without MS2692A-067, Bandwidth: >31.25 MHz<br>100 MHz to 6.0 GHz<br>with MS2692A-067, Bandwidth: >31.25 MHz<br>100 MHz to 26.5 GHz |

## ■ Hardware Option (Continuation)

### Amplitude

**Displayed Average Noise Level (DANL)**

18° to 28°C, Input attenuator: 0 dB

without MS269xA-008, or Preamp: Off, Frequency band mode: Normal

| Frequency | Max. |
|---|---|
| 100 MHz ≤ Frequency < 2.2 GHz | –147.0 [dBm/Hz] |
| 2.2 GHz ≤ Frequency < 4.0 GHz | –145.0 [dBm/Hz] |
| 4.0 GHz ≤ Frequency ≤ 6.0 GHz | –143.0 [dBm/Hz] |

with MS269xA-008, Preamp: On, Frequency band mode: Normal

| Frequency | Max. |
|---|---|
| 100 MHz ≤ Frequency < 2.2 GHz | –160.0 [dBm/Hz] |
| 2.2 GHz ≤ Frequency < 4.0 GHz | –158.0 [dBm/Hz] |
| 4.0 GHz ≤ Frequency ≤ 6.0 GHz | –154.0 [dBm/Hz] |

with MS2692A-067, Microwave Preselector Bypass: On

| Frequency | Max. |
|---|---|
| 6.0 GHz < Frequency < 10.0 GHz | –140.0 [dBm/Hz] |
| 10.0 GHz ≤ Frequency ≤ 13.5 GHz | –136.0 [dBm/Hz] |
| 13.5 GHz < Frequency ≤ 20.0 GHz | –133.0 [dBm/Hz] |
| 20.0 GHz < Frequency ≤ 26.5 GHz | –129.0 [dBm/Hz] |

**Total Level Accuracy***

*: The Total level accuracy is found from root sum of squares (RSS) of RF characteristics, linearity error, and input attenuator switching error.

18° to 28°C, after CAL, Input attenuator: ≥10 dB, Center frequency, CW, RBW: Auto, Time Detection: Average, Marker Result: Integration or Peak (Accuracy), Excluding the noise floor effect

without MS269xA-008, or Preamp: Off, Mixer input level: ≤0 dBm, Bandwidth: >31.25 MHz
±0.5 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)

with MS269xA-008, Preamp: On, Preamp input level: ≤–20 dBm, Bandwidth: >31.25 MHz
±1.0 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)

with MS269xA-077, or MS269xA-077/078, Bandwidth: >31.25 MHz
with MS2692A-067, Microwave Preselector Bypass: On
±1.8 dB (6.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Normal)
±3.0 dB (13.5 GHz ≤ Frequency ≤ 26.5 GHz)

**Linearity Error**

Excluding the noise floor effect

without MS269xA-008, or Preamp: Off, Frequency band mode: Normal
±0.07 dB (Mixer input level: ≤–20 dBm)
±0.10 dB (Mixer input level: ≤–10 dBm)
±0.30 dB (Mixer input level: ≤0 dBm, Frequency: ≤6.0 GHz)

with MS269xA-008, Preamp: On, Frequency band mode: Normal
±0.07 dB (Mixer input level: ≤–40 dBm)
±0.10 dB (Mixer input level: ≤–30 dBm)
±0.50 dB (Mixer input level: ≤–20 dBm)

with MS2692A-067, Microwave Preselector Bypass: On
±0.60 dB (Mixer input level: ≤0 dBm, Frequency: > 6.0 GHz)

**RF Frequency Characteristics**

18° to 28°C, After CAL, Input attenuator: 10 dB

without MS269xA-008, or Preamp: Off
±0.35 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)

with MS269xA-008, Preamp: On
±0.65 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)

with MS2692A-067, Microwave Preselector Bypass: On
±1.0 dB (6.0 GHz < Frequency ≤ 13.5 GHz)
±1.5 dB (13.5 GHz < Frequency ≤ 26.5 GHz)

Note: Amplitude errors may occur in digitized IQ data at a probability of 0.0001 ppm or less. (AD converter maker nominal specifications) when the Analysis Bandwidth Extension 62.5 MHz/125 MHz option operates at the 50 MHz/62.5 MHz/100 MHz/125 MHz bandwidth setting.

**Typical (typ.):**
Performance not warranted. Must products meet typical performance.
**Nominal (nom.):**
Values not warranted. Included to facilitate application of product.
**Example:**
Performance not warranted. Data actually measured by randomly selected measuring instruments.

# Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

| Model/Order No. | Name |
|---|---|
| | **- Main Frame -** |
| MS2690A | Signal Analyzer (50 Hz to 6.0 GHz) |
| MS2691A | Signal Analyzer (50 Hz to 13.5 GHz) |
| MS2692A | Signal Analyzer (50 Hz to 26.5 GHz) |
| | **- Standard Accessories -** |
| | Power Cord :1 pc |
| P0031A | USB Memory (>1 GB USB2.0 Flash Driver) :1 pc |
| Z0541A | USB Mouse :1 pc |
| | Install CD-ROM |
| | (Application software, instruction manual CD-ROM) :1 pc |
| | **- Options -** |
| MS2690A-001 | Rubidium Reference Oscillator (Aging rate ±1 × $10^{-10}$/month) |
| MS2690A-008 | 6 GHz Preamplifier (100 kHz to 6 GHz) |
| MS2690A-017 | Noise Figure Measurement Function |
| MS2690A-020 | Vector Signal Generator (125 MHz to 6 GHz) |
| MS2690A-050 | HDD Digitizing Interface |
| MS2690A-077 | Analysis Bandwidth Extension to 62.5 MHz |
| MS2690A-078*2 | Analysis Bandwidth Extension to 125 MHz (Requires MS2690A-077) |
| MS2691A-001 | Rubidium Reference Oscillator (Aging rate ±1 × $10^{-10}$/month) |
| MS2691A-003 | Extension of Preselector Lower Limit to 3 GHz (Extends lower limit of preselector to 3 GHz) |
| MS2691A-008 | 6 GHz Preamplifier (100 kHz to 6 GHz) |
| MS2691A-017 | Noise Figure Measurement Function |
| MS2691A-020 | Vector Signal Generator (125 MHz to 6 GHz) |
| MS2691A-050 | HDD Digitizing Interface |
| MS2691A-077 | Analysis Bandwidth Extension to 62.5 MHz |
| MS2691A-078*2 | Analysis Bandwidth Extension to 125 MHz (Requires MS2691A-077) |
| MS2692A-001 | Rubidium Reference Oscillator (Aging rate ±1 × $10^{-10}$/month) |
| MS2692A-003 | Extension of Preselector Lower Limit to 3 GHz (Extends lower limit of preselector to 3 GHz) |
| MS2692A-008 | 6 GHz Preamplifier (100 kHz to 6 GHz) |
| MS2692A-017 | Noise Figure Measurement Function |
| MS2692A-020 | Vector Signal Generator (125 MHz to 6 GHz) |
| MS2692A-050 | HDD Digitizing Interface |
| MS2692A-067*3 | Microwave Preselector Bypass |
| MS2692A-077 | Analysis Bandwidth Extension to 62.5 MHz |
| MS2692A-078*2 | Analysis Bandwidth Extension to 125 MHz (Requires MS2692A-077) |
| | **- Retrofit Options -** |
| MS2690A-101 | Rubidium Reference Oscillator Retrofit (Aging rate ±1 × $10^{-10}$/month) |
| MS2690A-108 | 6 GHz Preamplifier Retrofit (100 kHz to 6 GHz) |
| MS2690A-117 | Noise Figure Measurement Function Retrofit |
| MS2690A-120 | Vector Signal Generator Retrofit (125 MHz to 6 GHz) |
| MS2690A-150 | HDD Digitizing Interface Retrofit |
| MS2690A-177*1 | Analysis Bandwidth Extension to 62.5 MHz Retrofit |
| MS2690A-178*1, *2 | Analysis Bandwidth Extension to 125 MHz Retrofit (Requires MS2690A-077/177) |
| MS2690A-180*4 | CPU/Windows7 Upgrade Retrofit |
| MS2691A-101 | Rubidium Reference Oscillator Retrofit (Aging rate ±1 × $10^{-10}$/month) |
| MS2691A-103 | Extension of Preselector Lower Limit to 3 GHz Retrofit (Extends lower limit of pre-selector to 3 GHz) |
| MS2691A-108 | 6 GHz Preamplifier Retrofit (100 kHz to 6 GHz) |
| MS2691A-117 | Noise Figure Measurement Function Retrofit |
| MS2691A-120 | Vector Signal Generator Retrofit (125 MHz to 6 GHz) |
| MS2691A-150 | HDD Digitizing Interface Retrofit |
| MS2691A-177*1 | Analysis Bandwidth Extension to 62.5 MHz Retrofit |
| MS2691A-178*1, *2 | Analysis Bandwidth Extension to 125 MHz Retrofit (Requires MS2691A-077/177) |
| MS2691A-180*4 | CPU/Windows7 Upgrade Retrofit |

∗1: The MS269xA-177/178 cannot be retrofitted to the MS269xA already fitted with the MS269xA-004/104 option (discontinued).
∗2: Combining the MS269xA-078 Analysis Bandwidth Extension to 125 MHz and MX269028A-002 wireless LAN IEEE 802.11ac (160 MHz) measurement software (only for MS269xA) supports modulation analysis up to 160-MHz bandwidth signals of the IEEE 802.11ac.
See measurement software catalog for more details.
∗3: Cannot be installed simultaneously with MS2692A-003/103/008/108 and MS2692A-004/104 option (discontinued).
∗4: Contact our sales representative for more details.

| Model/Order No. | Name |
|---|---|
| MS2692A-101 | Rubidium Reference Oscillator Retrofit (Aging rate ±1 × $10^{-10}$/month) |
| MS2692A-103 | Extension of Preselector Lower Limit to 3 GHz Retrofit (Extends lower limit of pre-selector to 3 GHz) |
| MS2692A-108 | 6 GHz Preamplifier Retrofit (100 kHz to 6 GHz) |
| MS2692A-117 | Noise Figure Measurement Function Retrofit |
| MS2692A-120 | Vector Signal Generator Retrofit (125 MHz to 6 GHz) |
| MS2692A-150 | HDD Digitizing Interface Retrofit |
| MS2692A-167*3 | Microwave Preselector Bypass Retrofit |
| MS2692A-177*1 | Analysis Bandwidth Extension to 62.5 MHz Retrofit |
| MS2692A-178*1, *2 | Analysis Bandwidth Extension to 125 MHz Retrofit (Requires MS2692A-077/177) |
| MS2692A-180*4 | CPU/Windows7 Upgrade Retrofit |
| | **- Software Options -** |
| | CD-ROM with License and Operation manuals |
| MX269010A | Mobile WiMAX Measurement Software |
| MX269011A | W-CDMA/HSPA Downlink Measurement Software |
| MX269012A | W-CDMA/HSPA Uplink Measurement Software |
| MX269013A | GSM/EDGE Measurement Software |
| MX269013A-001 | EDGE Evolution Measurement Software (Requires MX269013A) |
| MX269014A | ETC/DSRC Measurement Software |
| MX269015A | TD-SCDMA Measurement Software |
| MX269017A | Vector Modulation Analysis Software |
| MX269020A | LTE Downlink Measurement Software |
| MX269020A-001 | LTE-Advanced FDD Downlink Measurement Software (Requires MX269020A) |
| MX269021A | LTE Uplink Measurement Software |
| MX269021A-001 | LTE-Advanced FDD Uplink Measurement Software (Requires MX269021A) |
| MX269022A | LTE TDD Downlink Measurement Software |
| MX269022A-001 | LTE-Advanced TDD Downlink Measurement Software (Requires MX269022A) |
| MX269023A | LTE TDD Uplink Measurement Software |
| MX269023A-001 | LTE-Advanced TDD Uplink Measurement Software (Requires MX269023A) |
| MX269024A | CDMA2000 Forward Link Measurement Software |
| MX269024A-001 | All Measure Function (Requires MX269024A) |
| MX269026A | EV-DO Forward Link Measurement Software |
| MX269026A-001 | All Measure Function (Requires MX269026A) |
| MX269028A | WLAN (802.11) Measurement Software |
| MX269028A-002*2 | 802.11ac (160 MHz) Measurement Software (For MS269xA. Requires MX269028A) |
| MX269030A | W-CDMA BS Measurement Software |
| MX269901A | HSDPA/HSUPA IQproducer |
| MX269902A | TDMA IQproducer |
| MX269904A | Multi-Carrier IQproducer |
| MX269905A | Mobile WiMAX IQproducer |
| MX269908A | LTE IQproducer |
| MX269908A-001 | LTE-Advanced FDD Option (Requires MX269908A) |
| MX269910A | LTE TDD IQproducer |
| MX269910A-001 | LTE-Advanced TDD Option (Requires MX269910A) |
| MX269911A | WLAN IQproducer |
| MX269911A-001 | 802.11ac (80 MHz) Option (Requires MX269911A) |
| MX269912A | TD-SCDMA IQproducer |
| MX269970A | 1xEV-DO Reverse Receiver Test Waveform Pattern |
| | **- Other Software Options -** |
| | These software are for PC. |
| MX705010A | Wi-SUN PHY Measurement Software |
| MX705110A | Wi-SUN Protocol Monitor |
| | **- Warranty Service -** |
| MS2690A-ES210 | 2 Years Extended Warranty Service |
| MS2690A-ES310 | 3 Years Extended Warranty Service |
| MS2690A-ES510 | 5 Years Extended Warranty Service |
| MS2691A-ES210 | 2 Years Extended Warranty Service |
| MS2691A-ES310 | 3 Years Extended Warranty Service |
| MS2691A-ES510 | 5 Years Extended Warranty Service |
| MS2692A-ES210 | 2 Years Extended Warranty Service |
| MS2692A-ES310 | 3 Years Extended Warranty Service |
| MS2692A-ES510 | 5 Years Extended Warranty Service |

| Model/Order No. | Name |
|---|---|
| | **- Application Parts -** |
| | Following operation manuals provided as hard copy |
| W2850AE | MS2690A/MS2691A/MS2692A Operation Manual (Main frame Operation) |
| W2851AE | MS2690A/MS2691A/MS2692A Operation Manual (Main frame Remote Control) |
| W2852AE | MS2690A/MS2691A/MS2692A Operation Manual (Signal Analyzer Function Operation) |
| W2853AE | MS2690A/MS2691A/MS2692A Operation Manual (Signal Analyzer Function Remote Control) |
| W2854AE | MS2690A/MS2691A/MS2692A Operation Manual (Spectrum Analyzer Function Operation) |
| W2855AE | MS2690A/MS2691A/MS2692A Operation Manual (Spectrum Analyzer Function Remote Control) |
| W2856AE | MS2690A/MS2691A/MS2692A-020 Operation Manual (Operation) |
| W2857AE | MS2690A/MS2691A/MS2692A-020 Operation Manual (Remote Control) |
| W2914AE | MS2690A/MS2691A/MS2692A-020 Operation Manual (IQproducer) |
| W2929AE | MS2690A/MS2691A/MS2692A-020 Operation Manual (Standard Waveform Pattern) |
| W3130AE | MS2690A/MS2691A/MS2692A-040 Operation Manual (Operation) |
| W3117AE | Phase Noise Measurement Function Operation Manual (Operation) |
| W3118AE | Phase Noise Measurement Function Operation Manual (Remote control) |
| W3655AE | MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Noise Figure Measurement Function Operation) |
| W3656AE | MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Noise Figure Measurement Function Remote control) |
| W2919AE | MX269010A Operation Manual (Operation) |
| W2954AE | MX269010A Operation Manual (Remote Control) |
| W3098AE | MX269011A Operation Manual (Operation) |
| W3099AE | MX269011A Operation Manual (Remote control) |
| W3060AE | MX269012A Operation Manual (Operation) |
| W3061AE | MX269012A Operation Manual (Remote control) |
| W3100AE | MX269013A Operation Manual (Operation) |
| W3101AE | MX269013A Operation Manual (Remote control) |
| W3031AE | MX269014A Operation Manual (Operation) |
| W3032AE | MX269014A Operation Manual (Remote control) |
| W3044AE | MX269015A Operation Manual (Operation) |
| W3045AE | MX269015A Operation Manual (Remote control) |
| W3305AE | MX269017A Operation Manual (Operation) |
| W3306AE | MX269017A Operation Manual (Remote control) |
| W3014AE | MX269020A Operation Manual (Operation) |
| W3064AE | MX269020A Operation Manual (Remote control) |
| W3015AE | MX269021A Operation Manual (Operation) |
| W3065AE | MX269021A Operation Manual (Remote control) |
| W3209AE | MX269022A Operation Manual (Operation) |
| W3210AE | MX269022A Operation Manual (Remote control) |
| W3521AE | MX269023A Operation Manual (Operation) |
| W3522AE | MX269023A Operation Manual (Remote Control) |
| W3201AE | MX269024A Operation Manual (Operation) |
| W3202AE | MX269024A Operation Manual (Remote control) |
| W3203AE | MX269026A Operation Manual (Operation) |
| W3204AE | MX269026A Operation Manual (Remote control) |
| W3528AE | MX269028A Operation Manual (Operation) |
| W3529AE | MX269028A Operation Manual (Remote Control) |
| W2860AE | MX269030A Operation Manual (Operation) |
| W2861AE | MX269030A Operation Manual (Remote control) |
| W3108AE | MX269050A Operation Manual (Operation) |
| W3109AE | MX269050A Operation Manual (Remote control) |
| W2915AE | MX269901A Operation Manual |
| W2916AE | MX269902A Operation Manual |
| W2917AE | MX269904A Operation Manual |
| W2918AE | MX269905A Operation Manual |
| W3023AE | MX269908A Operation Manual |
| W3221AE | MX269910A Operation Manual |
| W3488AE | MX269911A Operation Manual |
| W3582AE | MX269912A Operation Manual |
| W3675AE | MX269970A Operation Manual |

| Model/Order No. | Name |
|---|---|
| K240B | Power Divider (K connector, DC to 26.5 GHz, 50Ω, K-J, 1 W max) |
| MA1612A | Four-Port Junction Pad (5 MHz to 3 GHz, N-J) |
| MP752A | Termination (DC to 12.4 GHz, 50Ω, N-P) |
| MA2512A | Band Pass Filter (for W-CDMA, 1.92 to 2.17 GHz) |
| J0576B | Coaxial Cord (N-P · 5D-2W · N-P), 1 m |
| J0576D | Coaxial Cord (N-P · 5D-2W · N-P), 2 m |
| J0127A | Coaxial Cord (BNC-P · RG58A/U · BNC-P), 1 m |
| J0127B | Coaxial Cord (BNC-P · RG58A/U · BNC-P), 2 m |
| J0127C | Coaxial Cord (BNC-P · RG58A/U · BNC-P), 0.5 m |
| J0322A | Coaxial Cord (SMA-P · 50Ω SUCOFLEX104 · SMA-P), 0.5 m (DC to 18 GHz) |
| J0322B | Coaxial Cord (SMA-P · 50Ω SUCOFLEX104 · SMA-P), 1 m (DC to 18 GHz) |
| J0322C | Coaxial Cord (SMA-P · 50Ω SUCOFLEX104 · SMA-P), 1.5 m (DC to 18 GHz) |
| J0322D | Coaxial Cord (SMA-P · 50Ω SUCOFLEX104 · SMA-P), 2 m (DC to 18 GHz) |
| J0805 | DC Block, N type (MODEL 7003) (10 kHz to 18 GHz, N-P · N-J) |
| J1554A | DC Block, SMA type (MODEL 7006) (9 kHz to 26.5 GHz, SMA-P · SMA-J) |
| J1555A | DC Block, SMA type (MODEL 7006-1) (9 kHz to 20 GHz, SMA-P · SMA-J) |
| K261 | DC Block (10 kHz to 40 GHz, K-P · K-J) |
| J0004 | Coaxial Adapter (DC to 12.4 GHz, 50Ω, N-P · SMA-J) |
| J1398A | N-SMA Adapter (DC to 26.5 GHz, 50Ω, N-P · SMA-J) |
| J0911 | Coaxial Cord, 1.0 M (for 40 GHz) (DC to 40 GHz, approx. 1 m) (SF102A, 11K254/K254/1.0M) |
| J0912 | Coaxial Cord, 0.5 M (for 40 GHz) (DC to 40 GHz, approx. 0.5 m) (SF102A, 11K254/K254/0.5M) |
| 41KC-3 | Fixed Attenuator, 3 dB (DC to 40 GHz, 3 dB) |
| J1261A | Ethernet Cable (Shield type, straight), 1 m |
| J1261B | Ethernet Cable (Shield type, straight), 3 m |
| J1261C | Ethernet Cable (Shield type, cross), 1 m |
| J1261D | Ethernet Cable (Shield type, cross), 3 m |
| J0008 | GPIB Connection Cable, 2.0 m |
| J1373A* | AUX Conversion Adapter (AUX → BNC, for vector signal generator option) |
| B0597A | Rack Mount Kit (EIA) |
| B0589A | Carrying Case (Hard type, with casters) |
| B0633A | Carrying Case (Soft type) |
| Z1082A | 10/13 MHz Reference Signal Input |
| MA24105A | Inline Peak Power Sensor (350 MHz to 4 GHz, with USB A to mini B cable) |
| MA24106A | USB Power Sensor (50 MHz to 6 GHz, with USB A to mini B cable) |
| MA24108A | Microwave USB Power Sensor (10 MHz to 8 GHz, with USB A to Micro-B cable) |
| MA24118A | Microwave USB Power Sensor (10 MHz to 18 GHz, with USB A to Micro-B cable) |
| MA24126A | Microwave USB Power Sensor (10 MHz to 26 GHz, with USB A to Micro-B cable) |
| Z1037A | Installation Kit (required when retrofitting options or installing software) |

*: The J1373A AUX Conversion Adapter is not a standard accessory for the MS269xA-020/120 Vector Signal Generator Option.

**J1373A**
**AUX Conversion Adapter**

**MA24106A**
**USB Power Sensor**

**B0589A**
**Carrying Case (Hard type)**

**B0633A**
**Carrying Case (Soft type)**



Anritsu

Specifications are subject to change without notice.

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