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
Next-generation wireless communications systems are becoming increasingly sophisticated with higher speeds, wider bandwidths, and multiple modulation methods in which the signal changes dynamically with time. Frequency bands are shifting above 3 GHz to ensure sufficient bandwidth for new and emerging services and applications. As a result, to permit analysis without impact to transient changes, measuring instruments require excellent measurement accuracy and wideband analysis performance at frequency bands above 3 GHz.

Unlike other instruments with a basic band limited to 3 GHz, the MS2690A/MS2691A/MS2692A signal analyzer uses leading-edge architecture offering a basic band that goes to 6 GHz. The MS2690A/MS2691A/MS2692A supports world-class absolute amplitude accuracy, modulation precision and wideband analysis across a frequency range from 50 Hz to 6 GHz.

The MS2690A/MS2691A/MS2692A has a built-in vector signal analysis function that performs FFT analysis over a 125 MHz bandwidth and a digitizing function that accurately captures signal waveforms with no signal dropout.

These advanced functions are ideal for the R&D arena where increasingly complex next-generation communication systems are being developed.

In addition, these analyzers are fast. Adding the optional vector signal generator (covering frequencies up to 6 GHz) creates a one-box tester that increases work efficiency in R&D applications, reduces tact times in manufacturing, and supports quick configuration of test systems.
**MS2690A/MS2691A/MS2692A Signal Analyzer**

- **Frequency Range**
  - MS2690A: 50 Hz to 6.0 GHz
  - MS2691A: 50 Hz to 13.5 GHz
  - MS2692A: 50 Hz to 26.5 GHz
- **Windows XP Professional OS**

**Spectrum Analyzer**
- **World-class Dynamic Range and Total Level Accuracy**
  - Display Average Noise Level: -155 dBm/Hz, TOI: ≥ +22 dBm
  - Total Level Accuracy: ±0.5 dB (50 Hz to 6 GHz)

**Vector Signal Analysis (VSA) Function**
- **Wideband FFT Analysis up to 125 MHz Included** (Standard: 31.25 MHz)
- **World-class Dynamic Range, Total Level Accuracy, and Measurement Speed**
  - Display Average Noise Level: -152.5 dBm/Hz, TOI: ≥ +22 dBm
  - Total Level Accuracy: ±0.5 dB (50 Hz to 6 GHz)

**Digitize Function**
- **High Accuracy Waveform Capture Based on High-performance RF**
- **Large 128 Msample Memory Built-in as Standard**

- **Advanced Architecture Provides top-of-the-line RF Performance**
- **Leading Vector Signal Analysis Function Combines Speed and Reliable RF Performance**
- **High Accuracy Digitize Function Captures RF Signal without Loss**

**General Purpose**
- **RF Device (Amp, Filter, ..)**
- **Next-Generation Communication System**
- **Public Radio System, Satellite Communication System, Radar, ..**

**Customize the instruments for each communication technology**

**+Analysis Software (WIMAX, W-CDMA ..)**

**+Analysis Software**

**+Dedicated Hardware** (available later)

**Convenient Dedicated Solution**
Top Class RF Performance Based on Advanced Architecture

Excellent Level Accuracy up to 6 GHz

The MS2690A/MS2691A/MS2692A integrates Anritsu's high-frequency technology and an advanced architecture that includes two built-in calibration oscillators. External power meters and single-frequency calibrations are obsolete, as the built-in calibration oscillators perform calibration across the entire band and enable the MS2690A/MS2691A/MS2692A to demonstrate a total level accuracy of ±0.5 dB from 50 Hz to 6 GHz.

The built-in phase calibration oscillator compensates for IF Filter frequencies and allows the analyzer to achieve the superior modulation accuracy required for WiMAX, 3G LTE, and other wideband technologies.

Coupling calibration across the entire frequency band with a low noise floor ensures that low level spurious signals can be seen and accurately measured.

MS2690A/MS2691A/MS2692A Block Diagram

Pre-selector

The MS2690A/MS2691A/MS2692A has a basic band that goes to 6 GHz without a pre-selector. Standard spectrum analyzers may use a pre-selector in the high band to clean-up images but it is extremely difficult to stabilize the amplitude and frequency characteristics of the pre-selector. This instability is the main cause of degraded level accuracy and modulation precision in measuring instruments.

Additionally, the pre-selector passband frequency can cause limitations at analysis bandwidths. No pre-selector means greater measurement accuracy.
Wide Dynamic Range for True Value Measurements

By using a front end that controls the noise figure and digital IF technology capable of advanced 16-bit ADC, this model achieves a superior display average noise level (DANL) of –155 dBm/Hz and a third-order intercept (TOI) ≥+22 dBm. Measurement performance does not degrade over this range, allowing measurement of true values across the entire dynamic range. The Category B spurious test standard established by 3GPP, which requires a wide dynamic range in measuring instruments, can be measured without using correction devices, such as filters and amplifiers. The true values of devices and base stations are measured easily and spurious tests can be performed with less test equipment. This analyzer really shows its worth when configuring simple test systems by reducing the calibration burden and external equipment costs.

World-class Measurement Speed

Taking full advantage of advanced software and high-speed CPUs, these analyzers use the full power of FFT (Fast Fourier Transform) technology to achieve world-class measurement speeds for modulation analysis measurements over span of 125 MHz.

The speed of the analysis software has been stepped up, supporting speeds 20 times faster than previous instruments. A variety of interfaces, such as high-speed 1000BASE-T LAN and USB 2.0, are built-in as standard.

Overall, these analyzers raise efficiency for R&D development while cutting production-line tact times.
Leading Vector Signal Analysis Function
Combining Speed and Reliable RF Performance

High-speed, High-performance FFT Analysis over Range up to 125 MHz
The built-in VSA function of the MS2690A/MS2691A/MS2692A utilizes a superior RF front end combined with a 16-bit ADC, high-speed CPU, and other functions to make full use of the strengths of FFT technologies. This combination allows the signal analyzer to achieve world-class measurement speeds over a span up to 31.25 MHz and ensures the high-performance reliability needed for demanding RF function tests. Additionally, installing the MS2690A/MS2691A/MS2692A-004 Wideband Analysis Hardware option supports analysis up to 125 MHz max.

Powerful Digitizing Function Accurately Captures Waveforms up to 125 MHz
Due to the superior level accuracy and high-performance RF analysis over the wide dynamic range, the MS2690A/MS2691A/MS2692A can accurately capture waveforms over an uninterrupted range up to 125 MHz.

Built-in Large-capacity 128 Msample Waveform Memory
A large-capacity 128 Msample waveform memory is built-in as standard, permitting waveform capture over long periods. The maximum capture time varies according to the frequency span as shown in Table 1.

<table>
<thead>
<tr>
<th>Frequency Span</th>
<th>Sampling Rate</th>
<th>Max. Capture Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 kHz</td>
<td>2 kHz</td>
<td>2000 s</td>
</tr>
<tr>
<td>2.5 kHz</td>
<td>5 kHz</td>
<td>2000 s</td>
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<tr>
<td>5 kHz</td>
<td>10 kHz</td>
<td>2000 s</td>
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<td>200 MHz</td>
<td>500 ms</td>
</tr>
<tr>
<td>125 MHz</td>
<td>200 MHz</td>
<td>500 ms</td>
</tr>
</tbody>
</table>

Table 1
Diverse Analysis of Captured Waveforms using VSA Function

**Frequency versus Time**
This function monitors frequency changes over time up to a maximum span of 6 MHz. The frequency variations of FSK and GMSK modulation waves as well as the VCO frequency switching times can be measured.

**CCDF/APD**
The CCDF analysis can be performed over bandwidths up to 125 MHz. Moreover, the characteristics of power amplifiers for wideband-modulation communications systems can be evaluated.

**Spectrum**
This function captures waveforms without interruption across a span of up to 125 MHz using FFT and displays them in real time. Measurements such as ACP, Channel Power, and OBW functions are built-in as standard.

**Power versus Time**
This function measures the changes in power over time. The in-burst average power and burst spurious are measured accurately and at high speed.

Captured Waveforms Analysis using Commercial Analysis Tools
Other digitizers may exhibit severe degradation of the RF channel during capture, requiring troublesome calibration of the captured data when using analysis tools. The MS2690A/MS2691A/MS2692A uses high-performance RF and two built-in calibration oscillators to minimize the degradation and eliminate the need for calibration before using analysis tools. The waveform data are saved to the internal hard disk and can be output to an external PC via a high-speed interface, such as the 1000BASE-T LAN port.

Captured Waveform Output from Vector Signal Generator Option
Waves captured using the digitizing function can be regenerated by using with the optional MS2690A/MS2691A/MS2692A-020 Vector Signal Generator. Signals captured in the field can be returned to the lab for analysis by replaying the signal using the Signal Generator. Signals captured from known good devices can provide a stable reference to increase debugging efficiency and test reliability.
High-Performance Vector Signal Generator Option

Save Valuable Bench Space by Adding an Optional Signal Generator to the Analyzer

The MS2690A/MS2691A/MS2692A-020 Vector Signal Generator option covers a frequency range from 125 MHz to 6 GHz. It is a high-performance waveform generator with a 120 MHz wideband vector modulation band and built-in 256 Msample waveform memory. Boasting superior ACLR functions and level accuracy that compares favorably with stand-alone signal generators, the addition of the signal generator option creates a versatile one-box tester capable of multiple applications including component and base station testing.

- Frequency: 125 MHz to 6 GHz
- 120 MHz wide vector modulation band
- 256 Msample large-capacity waveform memory
- Absolute level accuracy: ±0.5 dB, Linearity: ±0.2 dB (typ.)
- Excellent ACLR performance
  - ≤–64 dBc (5 MHz offset)
  - ≤–67 dBc (10 MHz offset)
- BER Measurement and AWGN addition functions*:
  *: The AWGN bandwidth is the value of the sampling clock for the required waveform.

Versatile Multiple Waveform Generation

Any type of waveform can be generated using the MS2690A/MS2691A/MS2692A-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 MS2690A/MS2691A/MS2692A main frame.

- HSDPA/HSUPA IQproducer
- TDMA IQproducer
- Multi-carrier IQproducer
- Mobile WiMAX IQproducer
- LTE IQproducer

Creating Any Waveform

IQ Data created using the MS2690A/MS2691A/MS2692A digitize function or by simulation tools or in C can be converted to a waveform pattern using the SG option and output.
Useful IQproducer Waveform Generation Software

IQproducer is application software for a PC for editing, creating and transferring waveform patterns using the MS2690A/MS2691A/MS2692A 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 MS2690A/MS2691A/MS2692A-20

Parameter Setting Screen (HSDPA/HSUPA IQproducer)

Simulation Screen (CCDF)

Convert Screen

Application

**Simplified Tx Test Setup**

**Easy AMP Test**
Future-proof Platform

The MS2690A/MS2691A/MS2692A design adopts a modular multi-slot structure for excellent future-proof expandability. The analyzer is customized for its target measurements by installing options in these slots.

Options

Hardware Options

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

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

**MS2690A/MS2691A/MS2692A-004**
Wideband Analysis Hardware
This option expands the maximum analysis bandwidth to 125 MHz.

**MS2690A/MS2691A/MS2692A-008**
6 GHz Preamplifier
This option increases the level sensitivity up to 6 GHz.

**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-030**
W-CDMA RNC Simulator (ATM 1.5M/2M)
This option simulates a Radio Network Controller (RNC) to control the W-CDMA base-station Tx/Rx conditions via the ATM E1/T1 interface. BER/BLER measurements are also supported.

*: Please consult us first about the connection between this option and the base station.

**IQproducer License for MS2690A/MS2691A/MS2692A-20 VSG**

Waveforms generated by IQproducer can be downloaded to the MS2690A/MS2691A/MS2692A main frame in which the MS2690A/MS2691A/MS2692A-020 Vector Signal Generator is installed, but the following licenses (option) are required to output the signal.

*: No license is required to generate or edit the signal.

- **MX269901A** HSDPA IQproducer
- **MX269902A** TDMA IQproducer
- **MX269904A** Multi-Carrier IQproducer
- **MX269905A** Mobile WiMAX IQproducer
- **MX269908A** LTE IQproducer
MX269010A
Mobile WiMAX Measurement Software

The MX269010A Mobile WiMAX Measurement Software supports analysis of Mobile WiMAX signals. Downlink signal analysis can be automated because allocation settings are read from DL-MAP. Analysis is accomplished with simple one-touch operations.

Measurement Functions
Downlink:
  - Constellation
  - Frequency Offset, EVM, CINR, Timing Error
  - Power Spectrum versus Subcarrier
  - Power versus Time
  - I/Q Data versus Subcarrier
  - Map Information
  - Error Vector versus Subcarrier
  - Error Vector versus Symbol
  - Spectral Flatness

Uplink:
  - Constellation
  - Frequency Offset, EVM, Timing Error
  - Power Spectrum versus Subcarrier
  - Power versus Time
  - Spectral Flatness

Measurement Performance
Residual Vector Error: <0.6% (rms)
Spectrum Flatness Accuracy: ±0.3 dB
Amplitude Measurement Accuracy: ±0.6 dB

Easy One-Touch Analysis

MX269030A
W-CDMA BS Measurement Software

The MX269030A W-CDMA BS Measurement Software supports analysis of W-CDMA/HSDPA-compliant DL signals. Modulation analysis including frequency deviation, EVM, PCDE, CDP, and channel power plus ACLR, OBW, and SEM, can be measured in 100 ms, greatly reducing tact times on production lines for W-CDMA/HSDPA equipment.

Measurement Functions
Base Station Output Power
CPICH Power Accuracy
Carrier Frequency Error
EVM
Peak Code Domain Error
Occupied Bandwidth
ACLR
Spectrum Emission Mask

Measurement Performance
Residual Vector Error: ≤1.0% (rms)
Code Domain Power Accuracy: ±0.02 dB
Tx Power Measurement Accuracy: ±0.6 dB
ACLR: –65 dBc (5 MHz offset)
–66 dBc (10 MHz offset)
SEM: –78 dBc/30 kHz (≥2.515 MHz offset)

Graph Display Function
  - Constellation, Code Domain Power

Refer to the relevant catalog for details about the following measurement software:
- MX269012A W-CDMA/HSPA Uplink Measurement Software
- MX269015A TD-SCDMA Measurement Software
- MX269020A LTE Downlink Measurement Software
- MX269021A LTE Uplink Measurement Software
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 MS2690A/MS2691A/MS2692A is in the operating mode.
2. Hard disk access lamp: Lights up when the MS2690A/MS2691A/MS2692A internal hard disk is being accessed.
3. Copy key: Press to capture a screen image from the display and save it to a 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 MS2690A/MS2691A/MS2692A 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 MS2690A/MS2691A/MS2692A. Executable functions vary depending on the application currently selected.
12. Main function keys 2: Used to set or execute main functions of the MS2690A/MS2691A/MS2692A. 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 MS2690A/MS2691A/MS2692A Option 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 (if MS2690A/MS2691A/MS2692A-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 MS2690A/MS2691A/MS2692A.
Ref Input connector (reference frequency signal input connector): Inputs an external reference frequency signal (10 MHz). It is used for inputting reference frequency signals with accuracy higher than that of those inside the MS2690A/MS2691A/MS2692A, or for synchronizing the frequency of the MS2690A/MS2691A/MS2692A to that of another device.

Buffer Out connector (reference frequency signal output connector): Outputs the reference frequency signal (10 MHz) generated inside the MS2690A/MS2691A/MS2692A. It is used for synchronizing the frequencies between other devices and the MS2690A/MS2691A/MS2692A based on the reference frequency signal output from this connector.

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.

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

IF Out connector: Outputs an IF signal. 874.878 MHz is specified as the center frequency during spectrum analyzer operations, and 875 MHz is specified during signal analyzer operations. The IF signal is output without band limitation by RBW during both spectrum analyzer and signal analyzer operations.

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.

GPIB connector: Used when controlling the MS2690A/MS2691A/MS2692A externally via GPIB.

USB connector (type B): Used when controlling the MS2690A/MS2691A/MS2692A externally via USB.

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

USB connectors (type A): Used to connect a USB keyboard or mouse or the USB memory supplied with the MS2690A/MS2691A/MS2692A.

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

AC inlet: Used for supplying power.
### Specifications

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

- **MS2690A/MS2691A/MS2692A Signal Analyzer**

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

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>50 Hz to 6.0 GHz (MS2690A), 50 Hz to 13.5 GHz (MS2691A), 50 Hz to 26.5 GHz (MS2692A)</th>
</tr>
</thead>
</table>
| **Frequency Bands** | 50 Hz to 6.0 GHz (Band 0)  
3.0 to 6.0 GHz (Band 1 – L) (when MS2691A-003/MS2692A-003 installed, MS2691A/MS2692A)  
5.9 to 8.0 GHz (Band 1–) (MS2691A/MS2692A)  
7.9 to 13.5 GHz (Band 1+) (MS2691A/MS2692A)  
13.4 to 20.0 GHz (Band 2–) (MS2692A)  
19.9 to 26.5 GHz (Band 2+) (MS2692A) |
| **Pre-Selector Range** | 5.9 to 13.5 GHz (Frequency band mode: Normal) (MS2691A)  
5.9 to 26.5 GHz (Frequency band mode: Normal) (MS2692A)  
3.0 to 13.5 GHz (Frequency band mode: Spurious, Settable only when MS2691A-003 installed)  
3.0 to 26.5 GHz (Frequency band mode: Spurious, Settable only when MS2692A-003 installed) |
| **Frequency Setting** | Setting range: 0 Hz to 6.0 GHz (MS2690A), 0 Hz to 13.5 GHz (MS2691A), 0 Hz to 26.5 GHz (MS2692A)  
Setting resolution: 1 Hz |
| **Internal Reference Oscillator** | Start-up characteristics (At 23˚C, referenced to frequency at 24 h after power-on):  
±5 x 10^{-7} (2 minutes after power-on), ±5 x 10^{-6} (5 minutes after power-on)  
Aging rate: ±1 x 10^{-7}/year  
Temperature characteristics: ±2 x 10^{-8} (+5˚ to +45˚C)  
When Option 001 Rubidium Reference Oscillator installed  
Start-up characteristics (At 23˚C, referenced to frequency at 24 h after power-on):  
±1 x 10^{-9} (7 minutes after power-on)  
Aging rate: ±1 x 10^{-10}/month  
Temperature characteristics: ±1 x 10^{-9} (+5˚ to +45˚C) |
| **Single Sideband Noise** | At +18˚ to +28˚C, 2 GHz  
| Frequency Offset | Max. |
| 100 kHz | −116 dBc/Hz |
| 1 MHz | −137 dBc/Hz |
| **Measurement Range** | Average noise level to +30 dBm |
| **Max. Input Level** | CW Average power: +30 dBm (Input attenuator ≥10 dB)  
DC Voltage: 0 Vdc |
| **Input Attenuator** | 0 to 60 dB, 2 dB steps |
| **Input Attenuator Switching Error** | Referenced to 10 dB input attenuator  
Frequency band mode: Normal  
Frequency ≤6.0 GHz: ±0.2 dB (10 to 60 dB)  
Frequency >6.0 GHz: ±0.75 dB (10 to 60 dB) (MS2691A/MS2692A)  
Frequency band mode: Spurious  
Frequency <3.0 GHz: ±0.2 dB (10 to 60 dB) (MS2691A/MS2692A)  
Frequency ≥3.0 GHz: ±0.75 dB (10 to 60 dB) (MS2691A/MS2692A) |
| **Setting Range** | Log scale: −120 to +50 dBm or equivalent level  
Linear scale: 22.4 µV to 70.7 V  
Setting resolution: 0.01 dB or equivalent level |
| **Units** | Log scale: dBm, dBµV, dBmV, dBµV (emf), dBµV/m, V, W  
Linear scale: V |
| **Reference Level** | Excluding the noise floor effect  
±0.07 dB (Mixer input level: ≤−20 dBm)  
±0.10 dB (Mixer input level: ≤−10 dBm)  
Frequency band mode: Normal  
±0.15 dB (Mixer input level: ≤0 dBm, Frequency ≤6.0 GHz)  
±0.50 dB (Mixer input level: ≤0 dBm, Frequency >6.0 GHz) (MS2691A)  
±0.60 dB (Mixer input level: ≤0 dBm, Frequency >6.0 GHz) (MS2692A)  
Frequency band mode: Spurious  
±0.15 dB (Mixer input level: ≤0 dBm, Frequency <3.0 GHz) (MS2691A/MS2692A)  
±0.50 dB (Mixer input level: ≤0 dBm, Frequency ≥3.0 GHz) (MS2691A)  
±0.60 dB (Mixer input level: ≤0 dBm, Frequency ≥3.0 GHz) (MS2692A)  
Linearity Error |
**RF Frequency Characteristics**

At +18˚ to +28˚C, after CAL, at input attenuator = 10 dB ±0.35 dB
(9 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (MS2691A/MS2692A)
At +18˚ to +28˚C, after pre-selector tuning (MS2691A/MS2692A) ±1.50 dB
(6.0 GHz < Frequency ≤ 13.5 GHz, Frequency band mode: Normal)
(3.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Spurious) (MS2691A/MS2692A)

**1 dB Gain Compression**

At mixer input level ≥+3 dBm
(100 MHz ≤ Frequency < 600 MHz) ≥+7 dBm
(400 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (MS2691A/MS2692A)
(3.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Spurious)
(6.0 GHz < Frequency ≤ 13.5 GHz)
≥0 dBm (MS2692A)
(3.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Spurious)
(6.0 GHz < Frequency ≤ 26.5 GHz)

**Spurious Response**

2nd Harmonic Distortion

At mixer input level: –30 dBm

<table>
<thead>
<tr>
<th>Harmonic [dBc]</th>
<th>SHI [dBm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤–60</td>
<td>≤+80</td>
</tr>
<tr>
<td>≤–75</td>
<td>≤+45</td>
</tr>
</tbody>
</table>

At mixer input level: –10 dBm (MS2691A/MS2692A)

<table>
<thead>
<tr>
<th>Harmonic [dBc]</th>
<th>SHI [dBm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤–80</td>
<td>≤+80</td>
</tr>
<tr>
<td>≤–90</td>
<td>≤+80</td>
</tr>
</tbody>
</table>

**Residual Response**

Frequency ≥1 MHz, at input attenuator = 0 dB ≤–100 dBm

**RF Input**

Front panel, N-J, 50 Ω
VSWR: At +18˚ to +28˚C, Input attenuator ≥10 dB
≤1.2 (typ., 40 Hz ≤ Frequency ≤ 3.0 GHz)
≤1.5 (typ., 3.0 GHz < Frequency ≤ 6.0 GHz)
≤2.0 (typ., 6.0 GHz < Frequency ≤ 13.5 GHz) (MS2691A)
≤2.0 (typ., 6.0 GHz < Frequency ≤ 26.5 GHz) (MS2692A)

**IF Output**

Back panel, BNC-J, 50 Ω (typ.)
Frequency: 875 MHz
Gain: At RF input level reference, RF frequency 1 GHz, input attenuator = 0 dB, 0 dB (typ.)
IF Bandwidth: 120 MHz (typ.)

**External Reference Input**

Back panel, BNC-J, 50 Ω (typ.)
Frequency: 10 MHz
Operation range: ±1 ppm
Input level: –15 dBm ≤ Level ≤ +20 dBm, 50 Ω (AC coupling)

**Reference Signal Output**

Back panel, BNC-J, 50 Ω (typ.)
Frequency: 10 MHz
Output level: ≥0 dBm (AC coupling)

**Sweep Status Output**

Back panel, BNC-J
Output level: TTL Level (High level at sweeping or waveform capture)

**Trigger Input**

Back panel, BNC-J
Input level: TTL Level

**External Control**

Control from external controller (excluding power-on)
<table>
<thead>
<tr>
<th>Connector</th>
<th>Ethernet (10/100/1000BASE-T)</th>
<th>Back panel, RJ-45</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GPIB</td>
<td>IEEE488.2, Back panel, IEEE488 bus connector</td>
</tr>
<tr>
<td></td>
<td>Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>USB (B)</td>
<td>USB2.0, Back panel, USB-B connector</td>
</tr>
<tr>
<td></td>
<td>USB</td>
<td>USB2.0 Supporting waveform hard copy to external device, and saving main frame settings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>USB-A Connector (2 ports on front panel and 2 ports on back panel)</td>
</tr>
<tr>
<td></td>
<td>Monitor Output</td>
<td>Back panel, VGA compatible, mini D-Sub 15 pin</td>
</tr>
<tr>
<td></td>
<td>Aux</td>
<td>When using Option 020 trigger input/output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Back panel, 68 pins (DX10BM-68S equivalent)</td>
</tr>
<tr>
<td></td>
<td>Display</td>
<td>XGA Color LCD (1024 x 768 resolution), 8.4 inch (213 mm)</td>
</tr>
<tr>
<td>General Specifications</td>
<td>Dimensions</td>
<td>340 (W) x 200 (H) x 350 (D) mm (excluding projections)</td>
</tr>
<tr>
<td>General Specifications</td>
<td>Mass</td>
<td>≤12.5 kg (excluding options, MS2690A), ≤13.5 kg (excluding options, MS2691A/MS2692A)</td>
</tr>
<tr>
<td>General Specifications</td>
<td>Power Supply</td>
<td>100 to 120 Vac, 200 to 240 Vac (–15/+10% but 250 V max.), 50 to 60 Hz (±5%)</td>
</tr>
<tr>
<td>General Specifications</td>
<td></td>
<td>≤260 VA (excluding options), ≤440 VA (including all options, max.)</td>
</tr>
<tr>
<td>General Specifications</td>
<td>Temperature</td>
<td>Operating range: +5˚ to +45˚C, Storage range: –20˚ to +60˚C</td>
</tr>
<tr>
<td>General Specifications</td>
<td>EMC</td>
<td>EN61326, EN61000-3-2</td>
</tr>
<tr>
<td>General Specifications</td>
<td>LVD</td>
<td>EN61010-1</td>
</tr>
</tbody>
</table>
### Vector Signal Analysis Function

<table>
<thead>
<tr>
<th>Common</th>
<th>Trace Mode</th>
<th>Spectrum, Power versus Time, Frequency versus Time, CCDF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>Specified analysis bandwidth from center frequency</td>
<td>Range: 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz</td>
</tr>
<tr>
<td>Sampling Rate</td>
<td>Auto-setting depending on RBW</td>
<td>Range: 2 kHz to 50 MHz (1-2-5 sequence)</td>
</tr>
<tr>
<td>Capture Time</td>
<td>Capture time length: Set length of capture time</td>
<td>Min. capture time length: 2 µs to 50 ms (determined depending on analysis bandwidth)</td>
</tr>
<tr>
<td></td>
<td>Max. capture time length: 2 to 2000 s (determined depending on analysis bandwidth)</td>
<td>Setting mode: Auto, Manual</td>
</tr>
<tr>
<td>Trigger</td>
<td>Trigger mode: Free Run (Trig Off), Video, Wide IF Video, External (TTL)</td>
<td>SG Marker (when Option 020 installed)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function Outline</th>
<th>Displays any time length in captured waveform data and spectrum in frequency range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis Time Range</td>
<td>Analysis start time: Set analysis start time point from waveform data header</td>
</tr>
<tr>
<td>Frequency</td>
<td>Set center frequency and SPAN in frequency range of waveform data</td>
</tr>
<tr>
<td>Resolution Bandwidth (RBW)</td>
<td>Setting range: 1 Hz to 1 MHz (1-3 sequence)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Absolute Amplitude Accuracy</th>
<th>At +18˚ to +28˚C, after CAL, input attenuator = ±10 dB, mixer input level: ±0 dBm, RBW = Auto, Time Detection = Average, Marker Result = Integration or Peak (Accuracy), center frequency, CW, excluding the noise floor effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>±0.5 dB</td>
</tr>
<tr>
<td></td>
<td>(50 Hz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)</td>
</tr>
<tr>
<td></td>
<td>(50 Hz ≤ Frequency &lt; 3.0 GHz, Frequency band mode: Spurious) (MS2691A/MS2692A) After pre-selector tuning (MS2691A/MS2692A)</td>
</tr>
<tr>
<td></td>
<td>±1.8 dB</td>
</tr>
<tr>
<td></td>
<td>(6.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Normal)</td>
</tr>
<tr>
<td></td>
<td>(3.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Spurious) After pre-selector tuning (MS2692A)</td>
</tr>
<tr>
<td></td>
<td>±3.0 dB</td>
</tr>
<tr>
<td></td>
<td>(13.5 GHz ≤ Frequency ≤ 26.5 GHz)</td>
</tr>
<tr>
<td></td>
<td>The absolute amplitude accuracy is found from the RF characteristics, linearity error, and root sum of squares (RSS) of the input attenuator switching error.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display Average Noise Level</th>
<th>At +18˚ to +28˚C, at input attenuator = 0 dB, frequency band mode = Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Max.</td>
</tr>
<tr>
<td>100 kHz</td>
<td>–132.5 [dBm/Hz]</td>
</tr>
<tr>
<td>1 MHz</td>
<td>–142.5 [dBm/Hz]</td>
</tr>
<tr>
<td>30 MHz</td>
<td>–152.5 [dBm/Hz]</td>
</tr>
<tr>
<td>2.4 GHz</td>
<td>–150.5 [dBm/Hz]</td>
</tr>
<tr>
<td>4.0 GHz</td>
<td>–149.5 [dBm/Hz]</td>
</tr>
<tr>
<td>6.0 GHz</td>
<td>–148.5 [dBm/Hz]</td>
</tr>
<tr>
<td>10.0 GHz</td>
<td>–147.5 [dBm/Hz]</td>
</tr>
<tr>
<td>13.5 GHz</td>
<td>–144.5 [dBm/Hz]</td>
</tr>
<tr>
<td>20.0 GHz</td>
<td>–140.5 [dBm/Hz]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adjacent Channel Leakage Power Measurement (ACP)</th>
<th>Reference: Span Total, Carrier Total, Both Sides of Carriers, Carrier Select</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel Power</td>
<td>Absolute value measurement: dBm, dBm/Hz</td>
</tr>
<tr>
<td>Occupied Bandwidth (OBW)</td>
<td>N% of Power, X dB Down</td>
</tr>
<tr>
<td>Function Outline</td>
<td>Displays variation in frequency of input signal with time from captured waveform data</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Analysis Time Range | Analysis start time: Sets analysis start time point from waveform data header  
Analysis time length: Sets analysis time length  
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  
Display frequency range: 1/25, 1/10, 1/5 of RBW  
Input frequency range: 10 MHz to 6 GHz |
| Display Accuracy | At input level –17 to +30 dBm, SPAN ≤31.25 MHz, and scale = SPAN/25  
At CW input:  
± (Reference oscillator accuracy x center frequency + display frequency range x 0.01) Hz |
| Peak to Peak Measurement | Displays CCDF and APD of waveform data captures for fixed time  
+Peak, –Peak, (P-P)/2, Average |
| Display | Displays CCDF and APD as graph  
Histogram resolution: 0.01 dB  
Numeric display: Average Power, Max Power, Crest Factor |
| RBW | Filter type: Rectangle, Off (Default: Off)  
Filter frequency offset: Sets center frequency in waveform data frequency band |
| Digitize Function | Outputs captured waveform data to internal hard disk or external device |
| Waveform Data | Format: I, Q (32 bit Float Binary format)  
Level: Sets 0 dBm input to $\sqrt{I^2 + Q^2} = 1$  
Level accuracy: Same as signal analyzer absolute amplitude accuracy |
| External Output | Output to external PC via Ethernet |
### Spectrum Analyzer Function

**Frequency SPAN**
- Range:
  - 0 Hz, 300 Hz to 6.0 GHz (MS2690A)
  - 0 Hz, 300 Hz to 13.5 GHz (MS2691A)
  - 0 Hz, 300 Hz to 26.5 GHz (MS2692A)
- Resolution: 2 Hz, SPAN Accuracy: ±0.2%

**Display Frequency Accuracy**
\[
± [\text{Display frequency} \times \text{reference oscillator accuracy} + \text{SPAN frequency} \times \text{SPAN accuracy} + \text{RBW} \times 0.05 + 2 \times N + \text{SPAN frequency}/(\text{number of trace points} – 1)] \text{ Hz}
\]
N = Mixer harmonic order

**RBW**
- Setting range: 30 Hz to 3 MHz (1-3 sequence), 5, 10, 20 MHz
- Selectivity: (–60 dB/–3 dB) 4.5:1 (typ.)

**Video Bandwidth (VBW)**
- Setting range: 1 Hz to 10 MHz (1-3 sequence), off
- VBW Mode: Video Average/Power Average

---

### Amplitude

**Display Average Noise Level**
At +18° to +28°C, Detector = Sample, VBW = 1 Hz (Video Average), input attenuator = 0 dB, Frequency band mode: Normal

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 kHz</td>
<td>–135.0 [dBm/Hz]</td>
</tr>
<tr>
<td>1 MHz</td>
<td>–145.0 [dBm/Hz]</td>
</tr>
<tr>
<td>30 MHz ≤Frequency &lt;2.4 GHz</td>
<td>–155.0 [dBm/Hz] (MS2690A)</td>
</tr>
<tr>
<td>2.4 GHz ≤Frequency &lt;4.0 GHz</td>
<td>–153.0 [dBm/Hz] (MS2690A)</td>
</tr>
<tr>
<td>4.0 GHz ≤Frequency ≤6.0 GHz</td>
<td>–152.0 [dBm/Hz] (MS2690A)</td>
</tr>
<tr>
<td>4.0 GHz ≤Frequency ≤8.0 GHz</td>
<td>–152.0 [dBm/Hz] (MS2691A/MS2692A)</td>
</tr>
<tr>
<td>6.0 GHz ≤Frequency ≤10.0 GHz</td>
<td>–151.0 [dBm/Hz] (MS2691A/MS2692A)</td>
</tr>
<tr>
<td>10.0 GHz ≤Frequency ≤13.5 GHz</td>
<td>–150.0 [dBm/Hz] (MS2691A/MS2692A)</td>
</tr>
<tr>
<td>13.5 GHz ≤Frequency ≤20.0 GHz</td>
<td>–147.0 [dBm/Hz] (MS2692A)</td>
</tr>
<tr>
<td>20.0 GHz ≤Frequency ≤26.5 GHz</td>
<td>–143.0 [dBm/Hz] (MS2692A)</td>
</tr>
</tbody>
</table>

**Absolute Amplitude Accuracy**
At +18° to +28°C, after CAL, input attenuator = ±10 dB, mixer input level: ±0 dBm, Auto Sweep Time Select = Normal, RBW: ≤1 MHz, Detection = Positive, CW, excluding the noise floor effect

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 Hz ≤Frequency ≤6.0 GHz, Frequency band mode: Normal</td>
<td>(50 Hz ≤Frequency ≤3.0 GHz, Frequency band mode: Spurious) (MS2691A)</td>
</tr>
<tr>
<td>After pre-selector tuning (MS2691A/MS2692A)</td>
<td>±0.5 dB</td>
</tr>
<tr>
<td>6.0 GHz ≤Frequency ≤13.5 GHz, Frequency band mode: Normal</td>
<td>(3.0 GHz ≤Frequency ≤13.5 GHz, Frequency band mode: Spurious) (MS2691A/MS2692A)</td>
</tr>
<tr>
<td>After pre-selector tuning (MS2692A)</td>
<td>±1.8 dB</td>
</tr>
<tr>
<td>13.5 GHz ≤Frequency ≤26.5 GHz</td>
<td>±3.0 dB (13.5 GHz ≤Frequency ≤26.5 GHz)</td>
</tr>
</tbody>
</table>

The absolute amplitude accuracy is found from the RF characteristics, linearity error, and root sum of squares (RSS) of the input attenuator switching error.

**Spurious Response**
At +18° to +28°C, at Mixer input level = –15 dBm (per waveform), ≥300 kHz separation

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 MHz ≤Frequency ≤400 MHz</td>
<td>≤60 dBc (TOI = +15 dBm)</td>
</tr>
<tr>
<td>400 MHz ≤Frequency &lt;700 MHz</td>
<td>≤66 dBc (TOI = +18 dBm)</td>
</tr>
<tr>
<td>700 MHz ≤Frequency ≤4.0 GHz, Frequency band mode: Normal</td>
<td>≤74 dBc (TOI = +22 dBm)</td>
</tr>
<tr>
<td>700 MHz ≤Frequency ≤3.0 GHz, Frequency band mode: Spurious (MS2691A/MS2692A)</td>
<td>≤66 dBc (TOI = +18 dBm)</td>
</tr>
<tr>
<td>4.0 GHz ≤Frequency ≤6.0 GHz, Frequency band mode: Normal</td>
<td>(4.0 GHz ≤Frequency ≤6.0 GHz, Frequency band mode: Normal) (MS2691A)</td>
</tr>
<tr>
<td>4.0 GHz ≤Frequency ≤3.0 GHz, Frequency band mode: Spurious (MS2691A/MS2692A)</td>
<td>≤45 dBc (TOI = +7.5 dBm)</td>
</tr>
<tr>
<td>6.0 GHz ≤Frequency ≤13.5 GHz, Frequency band mode: Normal (MS2691A)</td>
<td>(6.0 GHz ≤Frequency ≤13.5 GHz, Frequency band mode: Normal) (MS2691A/MS2692A)</td>
</tr>
<tr>
<td>6.0 GHz ≤Frequency ≤26.5 GHz, Frequency band mode: Normal (MS2692A)</td>
<td>(6.0 GHz ≤Frequency ≤26.5 GHz, Frequency band mode: Normal (MS2692A)</td>
</tr>
<tr>
<td>3.0 GHz ≤Frequency ≤26.5 GHz, Frequency band mode: Spurious (MS2692A)</td>
<td>(3.0 GHz ≤Frequency ≤26.5 GHz, Frequency band mode: Spurious (MS2692A)</td>
</tr>
</tbody>
</table>

**Image Response**
≤–70 dBc (Frequency ≤13.5 GHz)
≤–65 dBc (13.5 GHz ≤Frequency ≤26.5 GHz) (MS2692A)
### 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)
- **Detection Mode**: Pos&Neg, Positive Peak, Sample, Negative Peak, RMS
- **No. of Data Points**: 1001, 2001, 5001, 10001
- **Scale**: Log display (10 div): 20 to 0.1 dB/div, 1-2-5 sequence
  - 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), SG Marker (when Option 020 installed)
- **Gate Function**: Gate mode: Off, Wide IF, External, SG Marker (when Option 020 installed)

### Measurement Functions
- **Adjacent Channel Leakage Power (ACP)**: Adjacent channel leakage power (ACP)
  - Reference: SPAN Total, Carrier Total, Both side of Carrier, Carrier Select
  - Specified adjacent channels: 3 x 2
- **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
**Rubidium Reference Oscillator**
Generates 10 MHz reference signal with higher frequency stability

**Pre-selector Extended Lower Limit**
Extends lower limit of pre-selector to 3 GHz

| Bandwidth | This option adds the 50, 100, and 125 MHz bandwidths to the standard analysis bandwidths. |
| Sampling Rate | Auto-setting depending on RBW |
| Range: 100, 200 MHz |
| Capture Time | Capture time length: Set length of capture time |
| Max. capture time length: 500 ns to 1 µs (determined depending on analysis bandwidth) |
| Min. capture time length: 500 ms |
| RBW | Setting range: 3 kHz to 10 MHz (1-3 sequence) |
| Selectivity: (–60 dB/–30 dB) 4.5:1 (typ.) |
| Frequency | 100 MHz to 6.0 GHz |
| Amplitude | Display average noise level: At +18˚ to +28˚C, input attenuator = 0 dB |
When Option 008 is not installed, or preamplifier OFF |
| Frequency | Max. |
| 100 MHz ≤ Frequency ≤2.4 GHz | –143.0 [dBm/Hz] |
| 2.4 GHz ≤ Frequency ≤4.0 GHz | –141.0 [dBm/Hz] |
| 4.0 GHz ≤ Frequency ≤6.0 GHz | –139.0 [dBm/Hz] |
When preamplifier ON |
| Frequency | Max. |
| 100 MHz ≤ Frequency ≤2.4 GHz | –156.0 [dBm/Hz] |
| 2.4 GHz ≤ Frequency ≤4.0 GHz | –154.0 [dBm/Hz] |
| 4.0 GHz ≤ Frequency ≤6.0 GHz | –150.0 [dBm/Hz] |

Absolute amplitude accuracy:
At +18˚ to +28˚C, after CAL, input attenuator ≥10 dB, mixer input level: ≤0 dBm, RBW = Auto, Time Detection = Average, Marker Result = Integration or Peak (Accuracy), center frequency, CW, when option 008 is not installed or preamplifier OFF, excluding the noise floor effect ±0.5 dB (100 MHz ≤ Frequency ≤6.0 GHz, Frequency band mode: Normal)
The absolute amplitude accuracy is found from the RF characteristics, linearity error, and root sum of squares (RSS) of the input attenuator switching error.

**Reference Level**
Linearity error: At frequency band mode: Normal, excluding the noise floor effect
When Option 008 is not installed, or preamplifier OFF
| Frequency | Max. |
| ±0.07 dB (Mixer input level: ≤–20 dBm) |
| ±0.10 dB (Mixer input level: ≤–10 dBm) |
| ±0.30 dB (Mixer input level: ≤0 dBm) |
When preamplifier ON
| ±0.07 dB (Mixer input level: ≤–40 dBm) |
| ±0.10 dB (Mixer input level: ≤–30 dBm) |
| ±0.50 dB (Mixer input level: ≤–20 dBm) |
RF frequency characteristics: At +18˚ to +28˚C, after CAL, input attenuator ≥10 dB
When Option 008 is not installed or preamplifier OFF
| ±0.35 dB (100 MHz ≤ Frequency ≤6.0 GHz, Frequency band mode: Normal) |
When preamplifier ON
| ±0.65 dB (100 MHz ≤ Frequency ≤6.0 GHz, Frequency band mode: Normal) |
MS2690A/MS2691A/MS2692A-008
6 GHz
Preamplifier

### Frequency

- **Range**: 100 kHz to 6 GHz
- **Measurement range**: Display average noise level to +10 dBm
- **Max. input level**: +10 dBm (Input attenuator = 0 dB)
- **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)
  - 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)
- **Display average noise level**:
  - At +18˚ to +28˚C, detector = sample, VBW = 1 Hz (Video average), input attenuator = 0 dB
  - When Preamplifier = ON
  - When Preamplifier = OFF

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Max. (Spectrum analyzer function)</th>
<th>Max. (Signal analyzer function)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 kHz</td>
<td>−150.0 [dBm/Hz]</td>
<td>−135.0 [dBm/Hz]</td>
</tr>
<tr>
<td>1 MHz</td>
<td>−159.0 [dBm/Hz]</td>
<td>−145.0 [dBm/Hz]</td>
</tr>
<tr>
<td>30 MHz ≤ Frequency &lt; 2.4 GHz</td>
<td>−166.0 [dBm/Hz]</td>
<td>−153.0 [dBm/Hz]</td>
</tr>
<tr>
<td>2.4 GHz ≤ Frequency &lt; 3.0 GHz</td>
<td>−165.0 [dBm/Hz]</td>
<td>−152.0 [dBm/Hz]</td>
</tr>
<tr>
<td>3.0 GHz ≤ Frequency &lt; 4.0 GHz</td>
<td>−164.0 [dBm/Hz]</td>
<td>−151.0 [dBm/Hz]</td>
</tr>
<tr>
<td>4.0 GHz ≤ Frequency &lt; 5.0 GHz</td>
<td>−161.0 [dBm/Hz]</td>
<td>−150.0 [dBm/Hz]</td>
</tr>
<tr>
<td>5.0 GHz ≤ Frequency ≤ 6.0 GHz</td>
<td>−159.0 [dBm/Hz]</td>
<td>−149.0 [dBm/Hz]</td>
</tr>
</tbody>
</table>

### Amplitude

- **Frequency band mode**: Normal
- **Frequency ≤ 6.0 GHz**: ±0.65 dB (10 to 60 dB)
- **Input attenuator switching error**
  - Frequency band mode: Normal
  - Frequency ≤ 6.0 GHz: ±0.5 dB
- **Reference Level**
- **RF frequency characteristics**: At +18˚ to +28˚C, after CAL, input attenuator = 10 dB
- **Linearity error**: Excluding the noise floor effect
  - ±0.07 dB (Preamplifier input level*: ≤–40 dBm)
  - ±0.10 dB (Preamplifier input level*: ≤–30 dBm)
- **Frequency band mode**: Normal
  - ±0.5 dB (Preamplifier input level*: ≤–20 dBm, frequency ≤6.0 GHz)
  - 1 dB gain compression: Preamplifier input level*
  - ±20 dBm (100 MHz ≤ Frequency ≤ 400 MHz)
  - ±15 dBm
  - (400 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
  - (400 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)
### Spurious Response

**2nd harmonic distortion:** Preamplifier input level* = –45 dBm

- SHI ≤ –50 dBc
- ≤ +5 dB (10 MHz ≤ Frequency ≤ 400 MHz)
- ≤ –55 dBc
- ≤ +10 dBm (400 MHz ≤ Frequency ≤ 3.0 GHz)

**Two signal tertiary distortion:**

At +18˚ to +28˚C, preamplifier input level* = –45 dBm (per waveform), ≥300 kHz separation

- –73 dBc (TOI = –8.5 dBm)
- –78 dBc (TOI = –6 dBm)
- (400 MHz ≤ Frequency ≤ 700 MHz)
- –81 dBc (TOI = –4.5 dBm)
- (700 MHz ≤ Frequency ≤ 4.0 GHz, Frequency band mode: Normal)
- (700 MHz ≤ Frequency ≤ 3.0 GHz, Frequency band mode: Spurious)

**Output Level**

- –120 sp ≤ +5 dBm ≤ +0.5 dB (≤3.0 GHz)
- –110 sp ≤ +5 dBm ≤ +0.8 dB (>3.0 GHz)
- –127 sp ≤ –120 dBm ≤ +0.7 dB (≤3.0 GHz)
- –127 sp ≤ –110 dBm ≤ +2.5 dB (typ.) (>3.0 GHz)
- –136 sp ≤ –127 dBm ≤ +1.5 dB (typ.) (≤3.0 GHz)

**Output level linearity:** At CW, +18˚ to +28˚C, referenced to –5 dBm output

- –120 sp ≤ –5 dBm ≤ +0.2 dB (typ.) (≤3.0 GHz)
- –110 sp ≤ –5 dBm ≤ +0.3 dB (typ.) (>3.0 GHz)

**Output connector:** N-J Connector, 50 Ω [front panel, SG Output (Opt.)]

**VSWR**

- Output level: At CW, –5 dBm max., –15 dBm max at modulation
  - 1.3 (≤3.0 GHz)
  - 1.9 (>3.0 GHz)

**Max. reverse input:** Reverse input power: 1 Wpeak (≤300 MHz), 0.25 Wpeak (>300 MHz)

### Usage

Adds vector signal generation function

**Frequency**

- Range: 125 MHz to 6 GHz, Resolution: 0.01 Hz steps

**Output Level**

- Setting range: –140 to +10 dBm (at CW), –140 to 0 dBm (at Modulation)
- Units: dBm, dBµV (terminated, open)
- Resolution: 0.01 dB

**Output level accuracy:** At +18˚ to +28˚C, at CW

- Output level p
  - –120 sp ≤ +5 dBm ≤ +0.5 dB (≤3.0 GHz)
  - –110 sp ≤ +5 dBm ≤ +0.8 dB (>3.0 GHz)
  - –127 sp ≤ –120 dBm ≤ +0.7 dB (≤3.0 GHz)
  - –127 sp ≤ –110 dBm ≤ +2.5 dB (typ.) (>3.0 GHz)
  - –136 sp ≤ –127 dBm ≤ +1.5 dB (typ.) (≤3.0 GHz)

**Output level linearity:** At CW, +18˚ to +28˚C, referenced to –5 dBm output

- Output level p
  - –120 sp ≤ –5 dBm ≤ +0.2 dB (typ.) (≤3.0 GHz)
  - –110 sp ≤ –5 dBm ≤ +0.3 dB (typ.) (>3.0 GHz)

**Output connector:** N-J Connector, 50 Ω [front panel, SG Output (Opt.)]

**VSWR**

- Output level: At CW, –5 dBm max., –15 dBm max at modulation
  - 1.3 (≤3.0 GHz)
  - 1.9 (>3.0 GHz)

### Signal Purity

**Harmonic spurious:** At Output level ≤ +5 dBm, CW, Output frequency 300 MHz max.

- ≤ –30 dBc

**Non-harmonic spurious:** At Output level ≤ +5 dBm, CW, min. 15 kHz offset from output frequency

- ≤ –68 dBc (125 MHz ≤ Frequency ≤ 500 MHz)
- ≤ –62 dBc (500 MHz ≤ Frequency ≤ 1.0 GHz)
- ≤ –56 dBc (1.0 GHz ≤ Frequency ≤ 2.0 GHz)
- ≤ –50 dBc (2.0 GHz ≤ Frequency ≤ 6.0 GHz)

*Preamplifier input level = RF input level – input attenuator setting value
### Vector Modulation

- **Vector accuracy:** At +18°C to +28°C, at W-CDMA (DL1 code), SG Level Auto CAL = On, output level −5 dBm max., output frequency 800 to 2700 MHz ≤2% (rms)
- **Carrier leak:** At +18°C to +28°C, at output frequency 300 MHz max., SG Level Auto CAL = On ≤−40 dBc
- **Image rejection:** At +18°C to +28°C, at output frequency 300 MHz max., SG Level Auto CAL = On, using 10 MHz max. sine wave ≤−40 dBc
- **ACLR:** At +18°C to +28°C, SG Level Auto CAL = On, output level −5 dBm max.
  Using W-CDMA (Test Model 1 64DPCH) signal, 300 MHz ≤Output frequency ≤2.4 GHz
  5 MHz offset: ≤−64 dBc/3.84 MHz, 10 MHz offset: ≤−67 dBc/3.84 MHz
- CW and level error at vector modulation:
  At +18°C to +28°C, at AWGN signal with bandwidth of 5 MHz, SG Level Auto CAL = On,
  output level p−15 dBm
  −15 < p ≤−5 dBm ≤−64 dBc/3.84 MHz
- **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:**
  - Back-panel AUX connector, 600 Ω, 0 to 5 V, threshold value approx. 1 V

### Arbitrary Waveform Generator

- **Waveform resolution:** 14 bits
- Marker output: Three signal (three signals in waveform pattern, or real-time three signal generation), TTL, polarity inversion function
- **Internal baseband Reference clock**
  - Range: 20 kHz to 160 MHz
  - Resolution: 0.001 Hz
- **External baseband Reference clock input**
  - Range: 20 kHz to 40 MHz
  - Division, multiplier function: 1, 2, 4, 8, 16, 1/2, 1/4, 1/8, 1/16 of input signal
- **Input connector:** Back-panel AUX connector, 0.7 Vp-p min. (AC/50 Ω), or TTL
- **Waveform memory**
  - Memory: 256 Msamples
- **AWGN Addition function**
  - CN Ratio absolute value: ≤40 dB

### BER Measurement

- **Connector:** Back-panel AUX connector
- **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, PN9Fix, PN11Fix, PN15Fix, PN20Fix, PN23Fix, User Define
- **Sync establishment conditions**
  - PN Signal: PN stage x 2 bit error free
  - At PNFix Signal: 0 PN stage x 2 bit error free, PN signal and sync establishment, establish sync with PNFix signal at PN stage error free from PNFix signal header bit
  - ALL0, ALL1, 01Repeat: 10 bit error free
- **User Define:** 8 to 1024 bits (variable) error free, Select header bit used at sync detection
- **Resync evaluation conditions:**
  - \( y = \frac{y \text{ bit error count}}{2^{\text{range}} \text{ to } y/2} \)
  - Measured bit count ≤252 – 1 bits
  - Measured error bit count ≤251 – 1 bits
- **Measurement end conditions:** Measured bit count, measured error bit count
- **Auto-resync 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
Input/Output Connector

- Terminal number: 1 port (1.5M/2M common)
- Terminal shape: RJ-45, 100 Ω (1.5M), 120 Ω (2M)
- Pin layout
- Output level: 2.4 to 3.6 V0-P (typ.)
- Input level: 2.4 to 3.6 V0-P (typ.)
- Bit rate: 1.544 Mbps
- Code: B8ZS
  2M
- Output level: 3 ±0.3 V0-P (typ.)
- Input level: 3 ±0.3 V0-P (typ.)
- Bit rate: 2.048 Mbps
- Code: HDB3

Transmit/Receive Control

- Controls patterns below:
  - Test Model 1 16/32/64 DPCH
  - Test Model 2
  - Test Model 3 16/32 DPCH
  - Test Model 4 with/without P-CPICH
  - Test Model 5 8/4/2 HS-PDSCH

Error Rate Measurement

- Measurement function: BER (Bit Error Rate), BLER (Block Error Rate)
- Bit rate: 12.1, 64, 144, 384 kbps
- Measured pattern: PN9, PN15
- Resync evaluation conditions: (PN x 2) bit error free
- Measured time: 104 to 109 bit (104 bit step), 102 to 104 block (102 block step)
- Display: Error rate, Error bit count, Measured bit count

- **MX269010A Mobile WiMAX Measurement Software**
The product meets following specification under the condition that boosting is 0 dB over all bursts and optimum value is set to input level for the input signal.

<table>
<thead>
<tr>
<th>Modulation and Frequency Measurement</th>
<th>Analysis Length</th>
<th>Bandwidth and Modulation Method</th>
<th>Target Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 ms</td>
<td>Bandwidth: 10, 8.75, 7, 5, 3.5 MHz</td>
<td>Downlink, Uplink</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waveform Display (Downlink)</th>
<th>Waveform Display (Uplink)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Constellation</td>
<td>(1) Constellation</td>
</tr>
<tr>
<td>(2) Power spectrum versus carrier number</td>
<td>(2) Power spectrum versus subcarrier number</td>
</tr>
<tr>
<td>(3) Power versus time</td>
<td>(3) Power versus time</td>
</tr>
<tr>
<td>(4) IQ Data versus subcarrier number</td>
<td>(4) Spectral flatness</td>
</tr>
<tr>
<td>(5) Downlink map data (zone burst)</td>
<td></td>
</tr>
<tr>
<td>(6) Vector error versus subcarrier number</td>
<td></td>
</tr>
<tr>
<td>(7) Vector error versus symbol number</td>
<td></td>
</tr>
<tr>
<td>(8) Spectral flatness</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measured Frequency Range</th>
<th>2.3 to 3.8 GHz</th>
</tr>
</thead>
</table>
| Measured Level Range       | When preamplifier option is not installed, or preamplifier OFF
-15 to +30 dBm
When preamplifier ON
-30 to +20 dBm (Numeric value is an average power of the measurement signal) |
| Carrier Frequency Accuracy | ± (Reference frequency accuracy x carrier frequency + 20) Hz |
| Modulation Accuracy Residual Vector Error | <0.6% (rms) |
| Spectrum Flatness Accuracy | ±0.3 dB |
| Amplitude Measurement Accuracy | At +18˚ to +28˚C, after CAL, ±0.6 dB (when preamplifier OFF), ±1.1 dB (when preamplifier ON) |
|                            | The absolute amplitude accuracy is found from the RF characteristics, linearity error, and root sum of squares (RSS) of the input attenuator switching error.
• MX269030A W-CDMA BS Measurement Software

| Common | Frequency range: 400 MHz to 3.0 GHz  
Input level setting range: –4 to +30 dBm |
| --- | --- |
| Modulation/Frequency Measurement | Carrier frequency accuracy  
Input level range: Input Level to Input Level –10 dB (Input level: ≥–4 dBm)  
EVM = 1% of 1 wave multiple signal  
± (Reference frequency accuracy x carrier frequency + 4 Hz)  
Residual vector error  
Input level range: Input Level to Input Level –10 dB (Input level: ≥–4 dBm)  
Test Model 1 64 DPCH multiple signal  
≤1.0% (rms) |
| Code Domain Analysis | Code domain power accuracy  
Input level range: Input Level to Input Level –10 dB (Input level: ≥–4 dBm)  
Test Model 2 signal  
±0.02 dB (Code Domain Power ≥–10 dB), ±0.10 dB (Code Domain Power ≥–30 dB)  
Code domain error  
Input level range: Input Level to Input Level –10 dB (Input level: ≥–4 dBm)  
Test Model 3 signal  
Residual error: ≤–50 dB  
Accuracy: ±0.75 dB (versus –40 dBc error) |
| Amplitude Measurement | Tx Power accuracy  
At +18˚ to +28˚C, after CAL  
Input level range: Input Level to Input Level –10 dB (Input level: ≥–4 dBm)  
±0.6 dB  
The absolute amplitude accuracy is found from the RF characteristics, linearity error, and root sum of squares (RSS) of the input attenuator switching error. |
| Occupied Frequency Band Measurement | Measurement method: 99% Law for spectrum waveform using FFT |
| Adjacent Channel Leakage Power Measurement | Measurement method: RRC Filter (α = 0.22) for spectrum waveform using FFT  
Dynamic range:  
At +18˚ to +28˚C, single carrier with optimum input level setting  
–65 dB (5 MHz offset), –66 dB (10 MHz offset) |
| Spectrum Emission Mask Measurement | Dynamic range:  
At +18˚ to +28˚C, single carrier with optimum input level setting  
–78 dB/30 kHz (≥2.515 MHz offset) |

Reference Data

SSB Phase Noise (This data is only for reference and is not guaranteed as specifications.)

- **MS269xA Signal Analyzer**

![SSB Phase Noise Graph for MS269xA Signal Analyzer](image1)

- **MS269xA-020 Vector Signal Generator**

![SSB Phase Noise Graph for MS269xA-020 Vector Signal Generator](image2)
## Ordering Information

Please specify the model/order number, name and quantity when ordering. The following names are used for orders; the actual product names may be different.

Model/Order No. | Name |
---|---|
MS2690A | MS2691A | MS2692A
- **Main Frame** - | Signal Analyzer (50 Hz to 6.0 GHz) | Signal Analyzer (50 Hz to 13.5 GHz) | Signal Analyzer (50 Hz to 26.5 GHz)
- **Standard Accessories** - | Power Cord (2.6 m long 100 Vac, 3 core, gray): 1 pc | USB Memory (256 MB USB2.0 Flash Driver): 1 pc | USB Mouse: 1 pc
- **Options** - | Rubidium Reference Oscillator (Aging rate $1 \times 10^{-10}$/month): 1 pc | Rubidium Reference Oscillator (Aging rate $1 \times 10^{-10}$/month): 1 pc |
| MS2690A-001 | MS2690A-004 | MS2690A-030
| Rubidium Reference Oscillator (Aging rate $1 \times 10^{-10}$/month): 1 pc | Rubidium Reference Oscillator (Aging rate $1 \times 10^{-10}$/month): 1 pc |
| MS2691A-001 | MS2691A-004 | MS2691A-030
| Rubidium Reference Oscillator (Aging rate $1 \times 10^{-10}$/month): 1 pc | Rubidium Reference Oscillator (Aging rate $1 \times 10^{-10}$/month): 1 pc |
| MS2692A-001 | MS2692A-004 | MS2692A-030
| MS2690A-101 | MS2690A-104 | MS2690A-130
| Rubidium Reference Oscillator Retrofit (Aging rate $1 \times 10^{-10}$/month): 1 pc | Rubidium Reference Oscillator Retrofit (Aging rate $1 \times 10^{-10}$/month): 1 pc |
| MS2691A-101 | MS2691A-104 | MS2691A-130
| Rubidium Reference Oscillator Retrofit (Aging rate $1 \times 10^{-10}$/month): 1 pc | Rubidium Reference Oscillator Retrofit (Aging rate $1 \times 10^{-10}$/month): 1 pc |
| MS2692A-101 | MS2692A-104 | MS2692A-130
| MX269010A | MX269012A | MX269015A
| MX269012A | MX269015A | MX269018A
| MX269015A | MX269018A | MX269021A
| MX269021A | MX269024A | MX269030A
| MX269030A | MX269033A | MX269090A
| TDM IQproducer (CD-ROM, license and instruction manual): 1 pc | TDM IQproducer (CD-ROM, license and instruction manual): 1 pc |
| MX269090A | MX269093A | MX269095A
| MX269095A | MX269098A | MX269902A
- **- Warranty Service** - | MS2690A-ES210 | MS2690A-ES210 |
| 2-year Extended Warranty Service | 2-year Extended Warranty Service |
| MS2690B-ES210 | MS2690B-ES210 |
| 3-year Extended Warranty Service | 3-year Extended Warranty Service |
| MS2690A-ES510 | MS2690B-ES510 |
| 5-year Extended Warranty Service | 5-year Extended Warranty Service |
| MS2691A-ES210 | MS2691A-ES210 |
| 2-year Extended Warranty Service | 2-year Extended Warranty Service |
| MS2691B-ES210 | MS2691B-ES210 |
| 3-year Extended Warranty Service | 3-year Extended Warranty Service |
| MS2691A-ES510 | MS2691B-ES510 |
| 5-year Extended Warranty Service | 5-year Extended Warranty Service |
| MS2692A-ES210 | MS2692A-ES210 |
| 2-year Extended Warranty Service | 2-year Extended Warranty Service |
| MS2692B-ES210 | MS2692B-ES210 |
| 3-year Extended Warranty Service | 3-year Extended Warranty Service |
| MS2692A-ES510 | MS2692B-ES510 |
| 5-year Extended Warranty Service | 5-year Extended Warranty Service |

### Application Parts

- **Install CD-ROM**
- **Application Parts**
- **Options**
- **Warranty Service**

**Product Brochure** | MS2690A/MS2691A/MS2692A 27