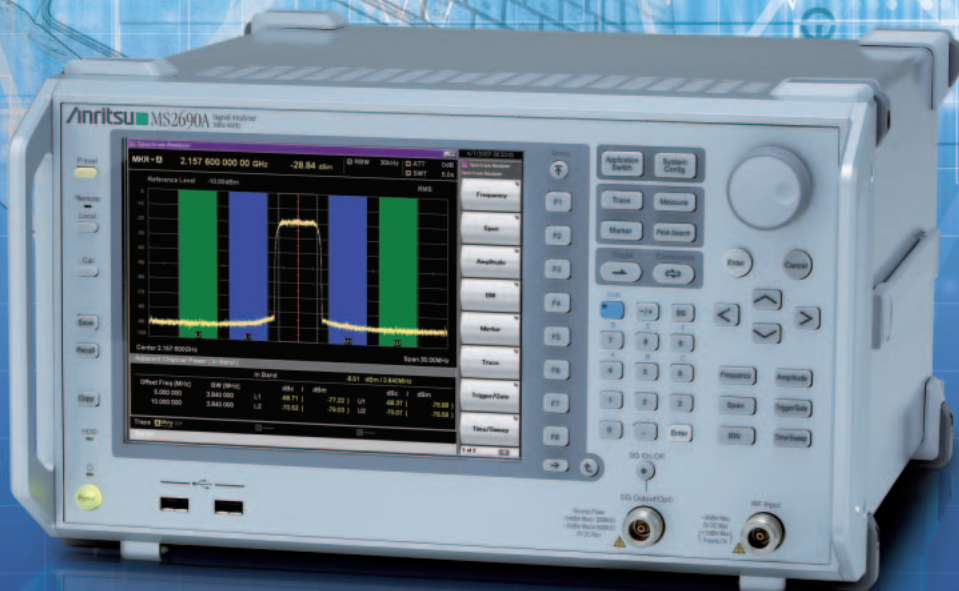


# MS2690A/MS2691A

## Signal Analyzer

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





## Signal Analyzer Solving Next-Generation Wireless Communications Issues

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 signal analyzer uses leading-edge architecture offering a basic band that goes to 6 GHz. The MS2690A supports world-class absolute amplitude accuracy, modulation precision and wideband analysis across a frequency range from 50 Hz to 6 GHz.

The MS2690A/MS2691A has a built-in vector signal analysis function that performs FFT analysis over a 31.25 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

## Signal Analyzer

MS2690A: 50 Hz to 6.0 GHz, MS2691A: 50 Hz to 13.5 GHz



## ■ MS2690A/MS2691A Signal Analyzer

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

### Spectrum Analyzer

#### ■ World-class Dynamic Range and Total Level Accuracy

- Display Average Noise Level : -155 dBm/Hz, TOI :  $\geq$  +22 dBm
- Total Level Accuracy :  $\pm 0.5$  dB (50Hz to 6 GHz)

### Vector Signal Analysis (VSA) Function

- Wideband FFT Analysis up to 31.25 MHz Included as Standard
- World-class Dynamic Range, Total Level Accuracy, and Measurement Speed

- Display Average Noise Level : -152.5 dBm/Hz, TOI :  $\geq$  +22 dBm
- Total Level Accuracy :  $\pm 0.5$  dB (50Hz to 6 GHz)

### Digitize Function

- High Accuracy Waveform Capture Based on High-performance RF
- Large 128 M sample Memory Built-in as Standard

### Vector Signal Generator (Option)

- Covers Frequencies up to 6 GHz
- 120 MHz RF Modulation Band
- Superior ACLR function

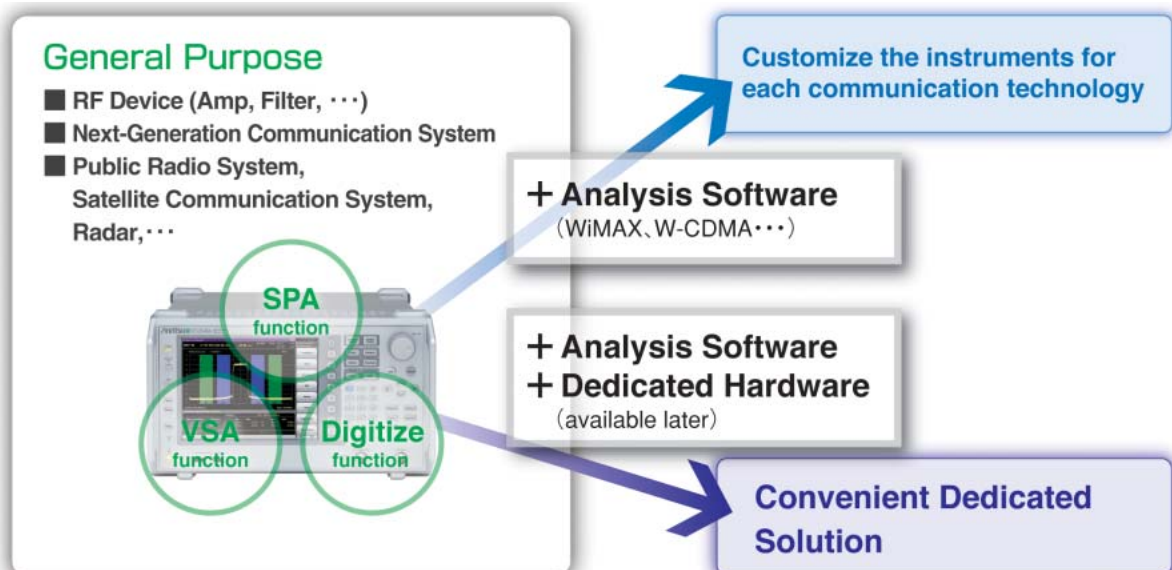
### IQproducer (Option)

HSDPA/HSUPA,  
TDMA, Multi-carrier,  
Mobile WiMAX

### Analysis Software (Option)

Mobile WiMAX,  
W-CDMA BS...

- **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**

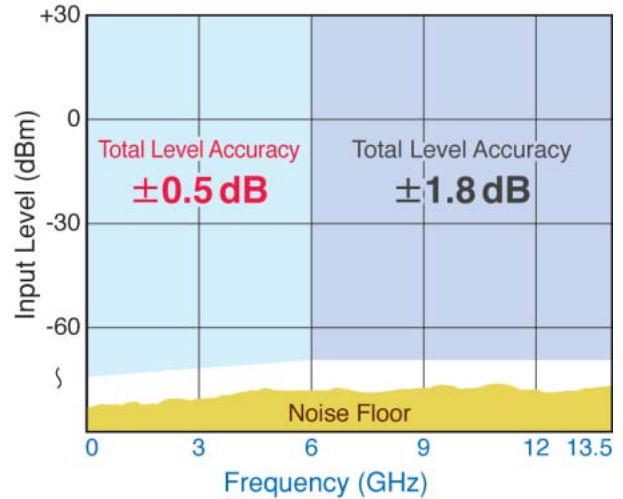


# Top Class RF Performance Based on Advanced Architecture

The MS2690A/MS2691A 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 to demonstrate a total level accuracy of  $\pm 0.5$  dB from 50 Hz to 6 GHz.

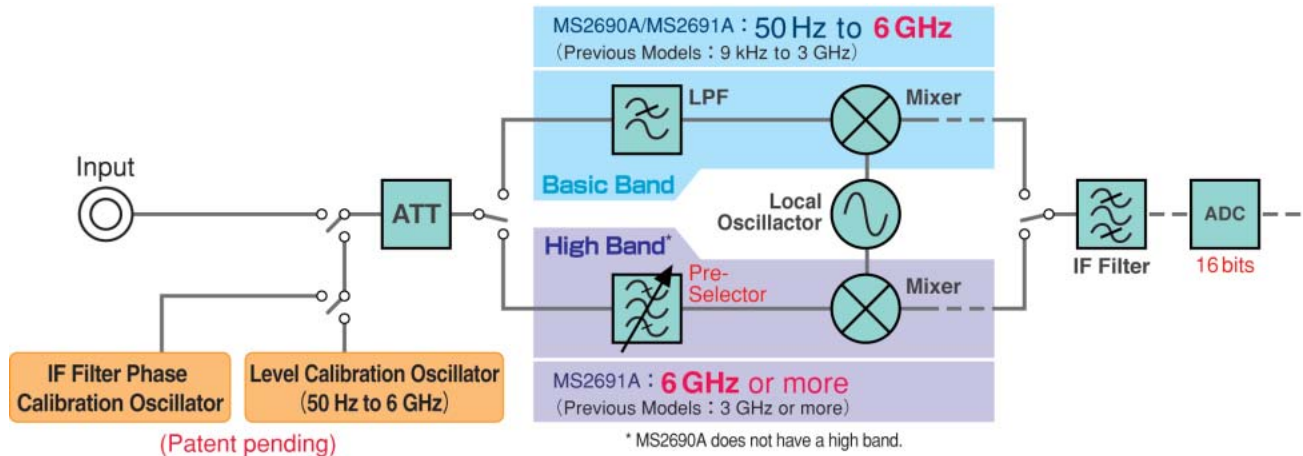
The built-in phase calibration oscillator compensates for IF Filter frequencies and allows the analyzer to achieve the superior modulation accuracy required for WiMAX, 3G LTE, and other wideband technologies.

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



- \* Eliminates effect of noise floor
- \* Used only when Uncal does not occur

## MS2690A/MS2691A Block Diagram



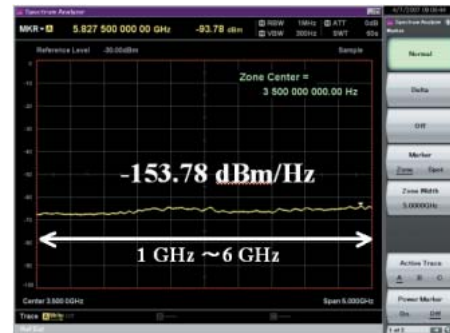
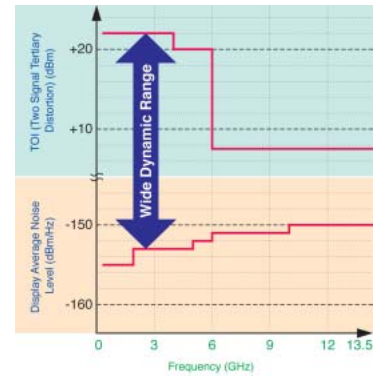
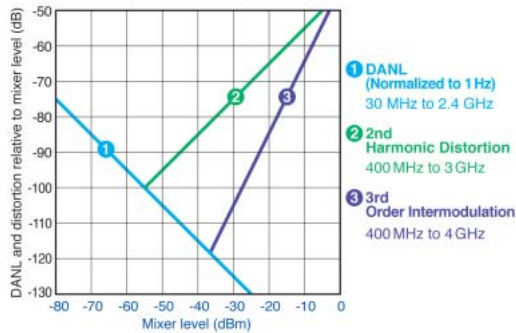
### Pre-selector

The MS2690A/MS2691A 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.

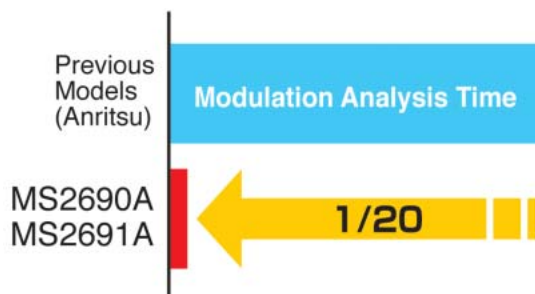
## Wide Dynamic Range for True Value Measurements

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)  $\geq +22$  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.

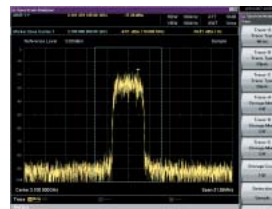


## World-class Measurement Speed

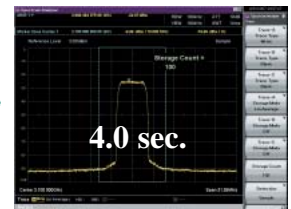
Taking full advantage of advanced software and high-speed CPUs, these analyzers use the full power of FFT (Fast Fourier Transform) technology to achieve world-class measurement speeds for modulation analysis measurements over span of 31.25 MHz. The speed of the analysis software has been stepped up, 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.



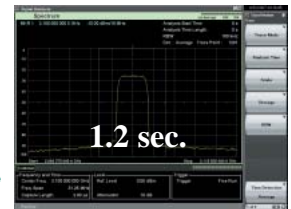
Spectrum Analyzer



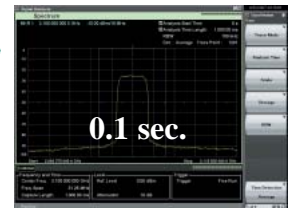
100-times Averaging



100-times Averaging (Analysis Time Length: Min)



1-times Measurement (Analysis Time Length: 1 ms)



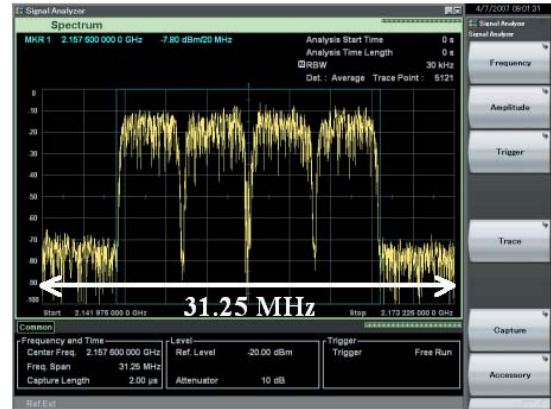
Vector Signal Analysis



# Leading Vector Signal Analysis Function Combining Speed and Reliable RF Performance

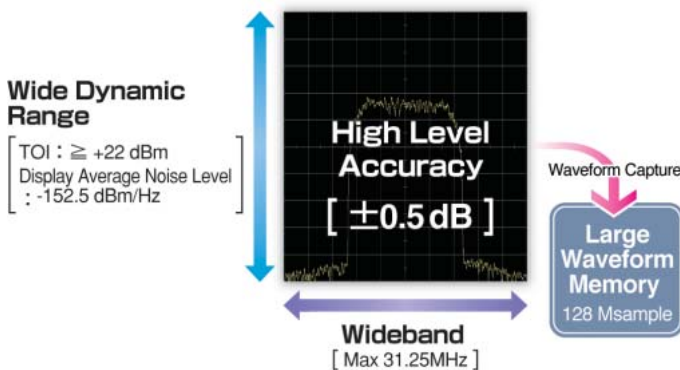
## High-speed, High-performance FFT Analysis over Range up to 31.25 MHz

The built-in VSA function of the MS2690A/MS2691A 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.



## Powerful Digitizing Function Accurately Captures Waveforms up to 31.25 MHz Wide

Due to the superior level accuracy and high-performance RF analysis over the wide dynamic range, the MS2690A/MS2691A can accurately capture waveforms over an uninterrupted range up to 31.25 MHz.



## Built-in Large-capacity 128 Msample Waveform Memory

A large-capacity 128M sample 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.

Frequency Span	Sampling Rate	Max. Capture Time
1 kHz	2 kHz	2000 s
2.5 kHz	5 kHz	2000 s
5 kHz	10 kHz	2000 s
10 kHz	20 kHz	2000 s
25 kHz	50 kHz	2000 s
50 kHz	100 kHz	1000 s
100 kHz	200 kHz	500 s
250 kHz	500 kHz	200 s
500 kHz	1 MHz	100 s
1 MHz	2 MHz	50 s
2.5 MHz	5 MHz	20 s
5 MHz	10 MHz	10 s
10 MHz	20 MHz	5 s
25 MHz	50 MHz	2 s
31.25 MHz	50 MHz	2 s

Table 1



## Diverse Analysis of Captured Waveforms using VSA Function

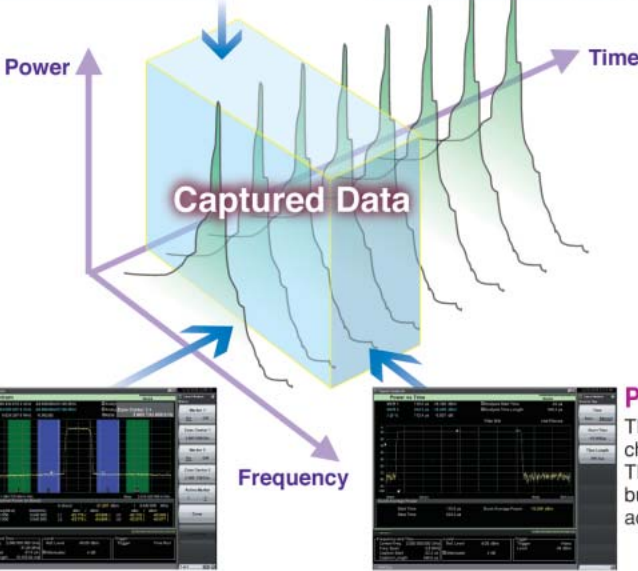
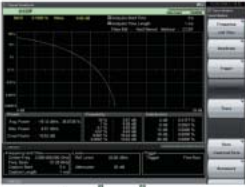
### Frequency versus Time

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.



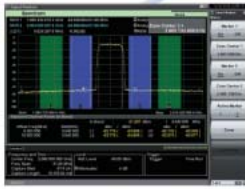
### CCDF

This function is ideal for evaluating W-CDMA base station power amps requiring a 20 MHz bandwidth for four carriers. The CCDF analysis can be performed over bandwidths up to 29.761 MHz.



### Spectrum

This function captures waveforms without interruption across a span of up to 31.25 MHz using FFT and displays them in real time. Measurements such as ACP, Channel Power, and OBW functions are built-in as standard.



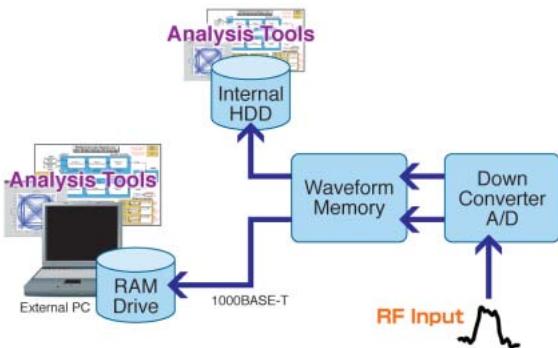
### Power versus Time

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

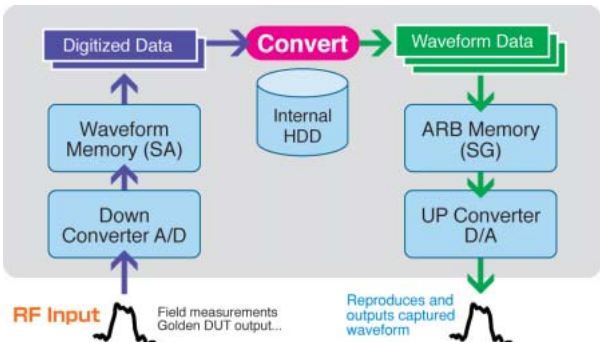
Other digitizers may exhibit severe degradation of the RF channel during capture, requiring troublesome calibration of the captured data when using analysis tools. The MS2690A/2691A uses high-performance RF and two built-in calibration oscillators to minimize the degradation and eliminate the need for 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

Waveforms captured using the digitizing function can be regenerated by using with the optional MS2690A/MS2691A-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.



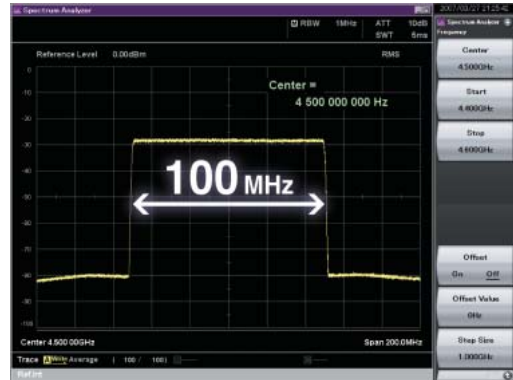
# High-Performance Vector Signal Generator Option

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

The MS2690A/MS2691A-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.

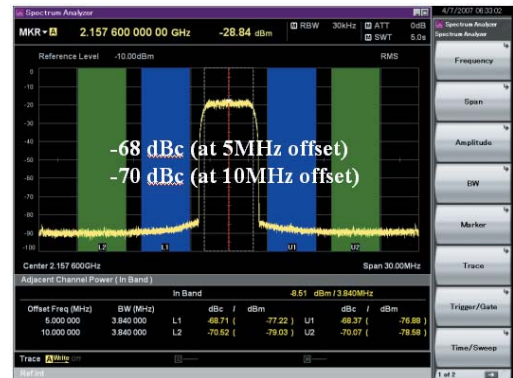
- Frequency: 125 MHz to 6 GHz
- 120 MHz wide vector modulation band
- 256 Msample large-capacity waveform memory
- Absolute level accuracy:  $\pm 0.5$  dB, Linearity:  $\pm 0.2$  dB (typ.)
- Excellent ACLR performance
  - $\leq -64$  dBc @ 5 MHz offset
  - $\leq -67$  dBc @ 10 MHz offset
- BER Measurement and AWGN addition functions



100 MHz Bandwidth Waveform Output Example (4.5 GHz)



Wanted signal + AWGN signal output from one unit



ACLR (W-CDMA, Test Model 1, 64DPCH)

## Versatile Multiple Waveform Generation

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

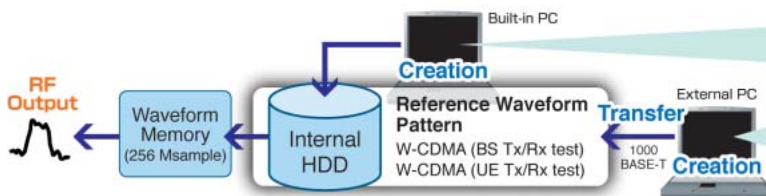
### Creating Waveform Using IQproducer

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 main frame.

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

### Creating Any Waveform

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



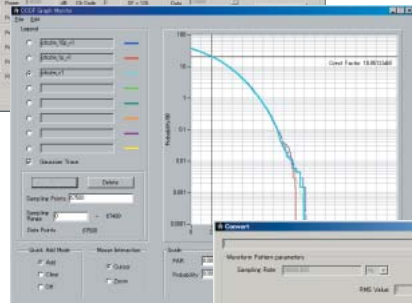
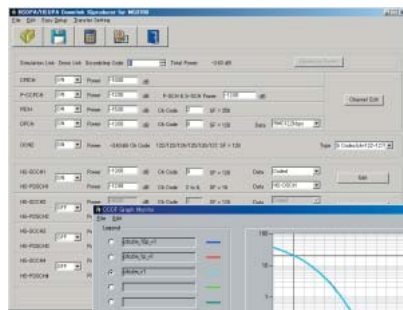


## Useful IQproducer Waveform Generation Software

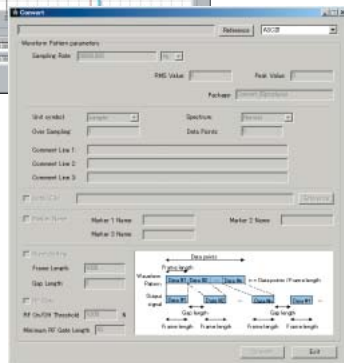
IQproducer is application software for a PC for editing, creating and transferring waveform patterns using the MS2690A/MS2691A arbitrary waveform generation option. It has the following three main functions.

- **Parameter Editing:** Function for easily editing parameters matching each communication method
- **Simulation:** Function for checking generated waveform pattern before transfer to CCDC and FFT graphs
- **Conversion:** Function for converting ASCII format waveform patterns created by simulation software, files captured using digitizing function, and MG3700 waveform patterns, into files that can be used by MS2690A/MS2691A-20

Parameter Setting Screen (HSDPA/HSUPA IQproducer)



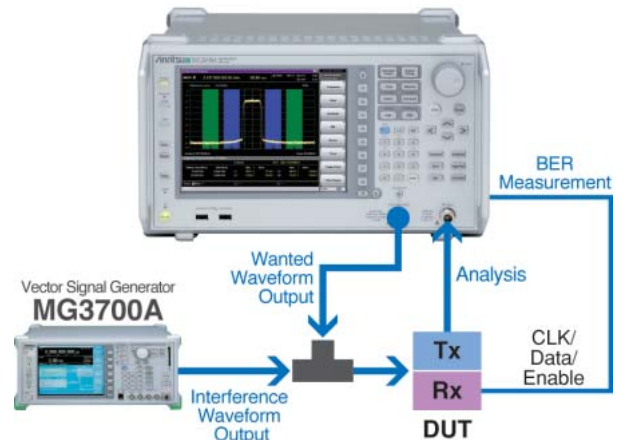
Simulation Screen (CCDF)



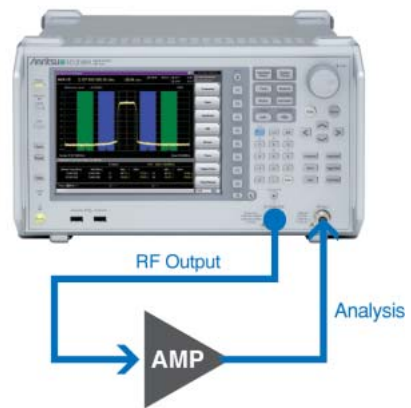
Convert Screen

## Application

### Simplified Tx Test Setup

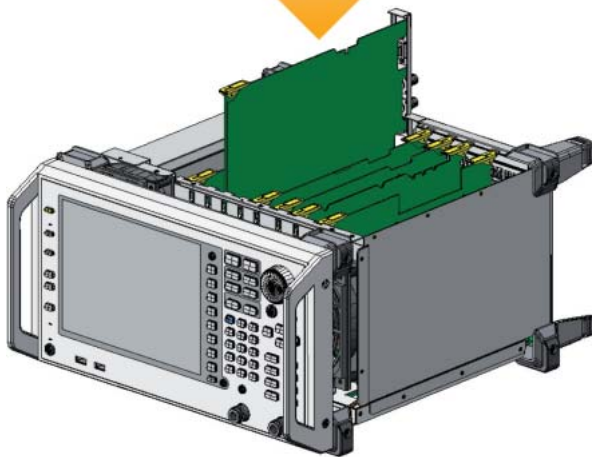
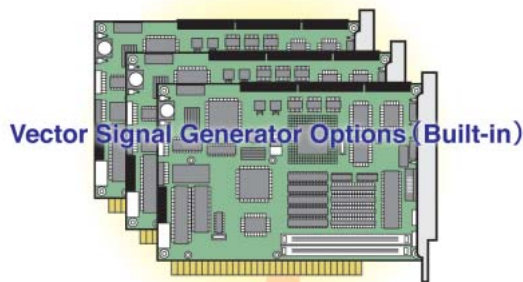


### Easy AMP Test



# Future-proof Platform

The MS2690A/MS2691A 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.



\*Unique option lineup for sequential expansion

## Options

### Hardware Options

#### MS2690A/MS2691A-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-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.

#### MS2690A/MS2691A-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.

### IQproducer™ License for MS2690A/2691A-20 VSG

Waveforms generated by IQproducer can be downloaded to the MS2690A/MS2691A main frame in which the MS2690A/MS2691A-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

This license supports output of a waveform pattern created by changing the HSDPA Uplink/Downlink-related parameters.

#### MX269902A TDMA IQproducer

This license supports output of a waveform pattern created by changing the TDMA-related parameters. Parameters such as Modulation, Frame, Slot, Data, and Filter can be edited.

#### MX269904A Multi-Carrier IQproducer

This license supports output of a waveform pattern with multi-carrier modulation and tone signals for various communications methods.

#### MX269905A Mobile WiMAX IQproducer

This license supports output of a waveform pattern created by changing the Mobile WiMAX-related parameters. Some parameters for MAC management Messages such as DL/UL-MAP and DCD/UCD can be edited.

# Measurement Software

## 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
- 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
- Power Spectrum versus Subcarrier
- Power versus Time

### Measurement Performance

- Residual Vector Error: <0.6% (rms)
- Spectrum Flatness Accuracy:  $\pm 0.3$  dB
- Amplitude Measurement Accuracy:  $\pm 0.6$  dB

### Easy One-Touch Analysis

Spectrum Flatness



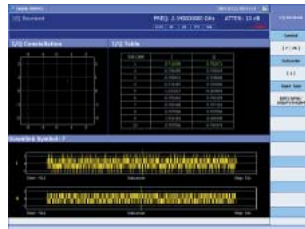
Error Vector versus Symbol



DL MAP Information



IQ Data versus Time



## 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
- Spurious Emission Mask

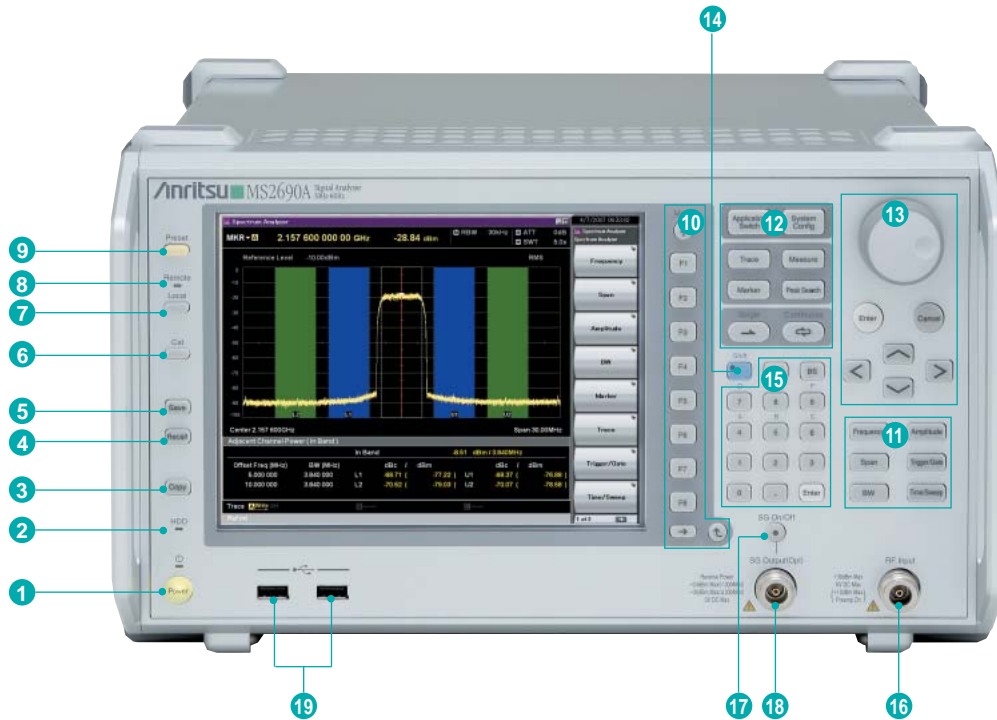
### Measurement Performance

- Residual Vector Error:  $\leq 1.0\%$  (rms)
- Code Domain Power Accuracy:  $\pm 0.02$  dB
- Tx Power Measurement Accuracy:  $\pm 0.6$  dB
- ACLR:  $-65$  dB (5 MHz offset)  
 $-66$  dB (10 MHz offset)
- SEM:  $-78$  dB/30 kHz ( $\geq 2.515$  MHz offset)

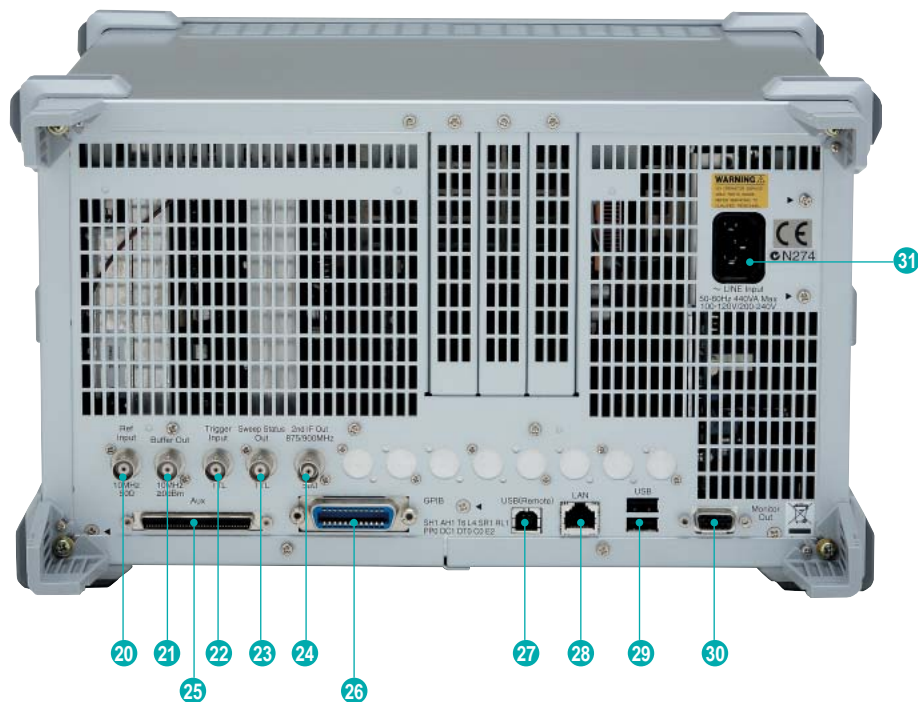


100 ms High-Speed Batch Measurement

# 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 in the operating mode.
- 2 Hard disk access lamp: Lights up when the MS2690A/MS2691A 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 MS2690A/MS2691A is in a remote control state.
- 9 Preset key: Resets parameters to their initial settings. Function keys: Used for selecting or executing function menu displayed on the right of the screen.
- 10 Main function keys 1: Used to set or execute main functions of the MS2690A/MS2691A.
- 11 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. 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 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-020/MS2691A-02 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.



- 20 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, or for synchronizing the frequency of the MS2690A/MS2691A to that of another device.
- 21 Buffer Out connector (reference frequency signal output connector): Outputs the reference frequency signal (10 MHz) generated inside the MS2690A/MS2691A. It is used for synchronizing the frequencies between other devices and the MS2690A/MS2691A 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. 874.878 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.

- 25 AUX connector: This is a complex connector for inputting an error rate measurement signal (optional) and inputting a baseband clock reference signal of the MS2690A-020/MS2691A-020 Vector Signal Generator (optional).
- 26 GPIB connector: Used when controlling the MS2690A/MS2691A externally via GPIB.
- 27 USB connector (type B): Used when controlling the MS2690A/MS2691A 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 MS2690A/MS2691A.
- 30 Monitor Out connector: Used for connection with an external display.
- 31 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 Signal Analyzer Vector Signal Analysis Function/Spectrum Analyzer Function Common

Frequency	Frequency Range	50 Hz to 6.0 GHz (MS2690A), 50 Hz to 13.5 GHz (MS2691A)						
	Frequency Bands	50 Hz to 6.0 GHz (Band 0) 3.0 to 6.0 GHz (Band 1 – L) (when MS2691A-003 installed, MS2691A) 5.9 to 8.0 GHz (Band 1–) (MS2691A) 7.9 to 13.5 GHz (Band 1+) (MS2691A)						
	Pre-Selector Range	5.9 to 13.5 GHz (Frequency band mode: At Normal) 3.0 to 13.5 GHz (Frequency band mode: At Spurious, Settable only when MS2691A-003 installed)						
	Frequency Setting	Setting range: 0 Hz to 6.0 GHz (MS2690A), 0 Hz to 13.5 GHz (MS2691A) Setting resolution: 1 Hz						
	Internal Reference Oscillator	Start-up characteristics (Referenced to frequency at 24 h after power-on at 23°C): ±5 x 10 <sup>-7</sup> (2 minutes after power-on), ±5 x 10 <sup>-8</sup> (5 minutes after power-on) Aging rate: ±1 x 10 <sup>-7</sup> /year Temperature characteristics: ±2 x 10 <sup>-8</sup> (+5° to +45°C) When Option 001 Rubidium Reference Oscillator installed Start-up characteristics (Referenced to frequency at 24 h after power-on at 23°C): ±1 x 10 <sup>-9</sup> (7 minutes after power-on) Aging rate: ±1 x 10 <sup>-10</sup> /month Temperature characteristics: ±1 x 10 <sup>-9</sup> (+5° to +45°C)						
Single Sideband Noise	At +18° to +28°C, 2 GHz <table border="1"> <thead> <tr> <th>Frequency Offset</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td>100 kHz</td> <td>-116 dBc/Hz</td> </tr> <tr> <td>1 MHz</td> <td>-137 dBc/Hz</td> </tr> </tbody> </table>		Frequency Offset	Max.	100 kHz	-116 dBc/Hz	1 MHz	-137 dBc/Hz
Frequency Offset	Max.							
100 kHz	-116 dBc/Hz							
1 MHz	-137 dBc/Hz							
Amplitude	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 GHz: ±0.2 dB (10 to 60 dB) Frequency >6 GHz: ±0.75 dB (10 to 60 dB) (MS2691A) Frequency band mode: Spurious Frequency <3 GHz: ±0.2 dB (10 to 60 dB) (MS2691A) Frequency ≥3 GHz: ±0.75 dB (10 to 60 dB) (MS2691A)						
Reference Level	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						
	Linearity Error	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 GHz) ±0.50 dB (Mixer input level: ≤0 dBm, Frequency >6 GHz) (MS2691A) Frequency band mode: Spurious (MS2691A) ±0.15 dB (Mixer input level: ≤0 dBm, Frequency <3 GHz) ±0.50 dB (Mixer input level: ≤0 dBm, Frequency ≥3 GHz)						
	RF Frequency Characteristics	After CAL, at input attenuator = 10 dB, +18° to +28°C ±0.25 dB (9 kHz ≤Frequency ≤6 GHz, Frequency band mode: Normal) (9 kHz ≤Frequency <3 GHz, Frequency band mode: Spurious) (MS2691A) After pre-selector tuning, at +18° to +28°C (MS2691A) ±1.50 dB (6 GHz <Frequency ≤13.5 GHz, Frequency band mode: Normal) (3 GHz <Frequency ≤13.5 GHz, Frequency band mode: Spurious)						

Reference Level	1 dB Gain Compression	At mixer input level $\geq +3$ dBm (100 MHz $\leq$ Frequency $\leq$ 400 MHz) $\geq +7$ dBm (400 MHz $\leq$ Frequency $\leq$ 6.0 GHz, Frequency band mode: Normal) (400 MHz $\leq$ Frequency $<$ 3.0 GHz, Frequency band mode: Spurious) (MS2691A) $\geq +3$ dBm (MS2691A) (3.0 GHz $\leq$ Frequency $\leq$ 6.0 GHz, Frequency band mode: Spurious) $\geq +3$ dBm (MS2691A) (6.0 GHz $<$ Frequency $\leq$ 13.5 GHz)												
Spurious Response	2nd Harmonic Distortion	At mixer input level $-30$ dBm <table border="1"> <thead> <tr> <th>Harmonic [dBc]</th> <th>SHI [dBm]</th> </tr> </thead> <tbody> <tr> <td><math>\leq -60</math></td> <td><math>\leq +30</math> (10 MHz <math>\leq</math> Frequency <math>\leq</math> 400 MHz)</td> </tr> <tr> <td><math>\leq -75</math></td> <td><math>\leq +45</math> (400 MHz <math>&lt;</math> Frequency <math>\leq</math> 3.0 GHz)</td> </tr> </tbody> </table> At mixer input level $-10$ dBm (MS2691A) <table border="1"> <thead> <tr> <th>Harmonic [dBc]</th> <th>SHI [dBm]</th> </tr> </thead> <tbody> <tr> <td><math>\leq -90</math></td> <td><math>\leq +80</math> (6 GHz <math>&lt;</math> Frequency, Frequency band mode: Normal)</td> </tr> <tr> <td><math>\leq -90</math></td> <td><math>\leq +80</math> (3 GHz <math>\leq</math> Frequency, Frequency band mode: Spurious)</td> </tr> </tbody> </table>	Harmonic [dBc]	SHI [dBm]	$\leq -60$	$\leq +30$ (10 MHz $\leq$ Frequency $\leq$ 400 MHz)	$\leq -75$	$\leq +45$ (400 MHz $<$ Frequency $\leq$ 3.0 GHz)	Harmonic [dBc]	SHI [dBm]	$\leq -90$	$\leq +80$ (6 GHz $<$ Frequency, Frequency band mode: Normal)	$\leq -90$	$\leq +80$ (3 GHz $\leq$ Frequency, Frequency band mode: Spurious)
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Harmonic [dBc]	SHI [dBm]													
$\leq -90$	$\leq +80$ (6 GHz $<$ Frequency, Frequency band mode: Normal)													
$\leq -90$	$\leq +80$ (3 GHz $\leq$ Frequency, Frequency band mode: Spurious)													
	Residual Response	Frequency $\geq 1$ MHz, at input attenuator = 0 dB $\leq -100$ dBm												
Connector	RF Input	Front panel, N-J, 50 $\Omega$ VSWR: Input attenuator $\geq 10$ dB, $+18^\circ$ to $+28^\circ$ C 1.2 (typ., 40 Hz $\leq$ Frequency $\leq$ 3.0 GHz) 1.5 (typ., 3.0 GHz $<$ Frequency $\leq$ 6.0 GHz) 2.0 (typ., 6.0 GHz $<$ Frequency $\leq$ 13.5 GHz)												
	IF Output	Back panel, BNC-J, 50 $\Omega$ (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 $\Omega$ (typ.) Frequency: 10 MHz Operation range: $\pm 1$ ppm Input level: $-15$ dBm $\leq$ Level $\leq +20$ dBm, 50 $\Omega$ (AC coupling)												
	Reference Signal Output	Back panel, BNC-J, 50 $\Omega$ (typ.) Frequency: 10 MHz Output level: $\geq 0$ 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)												
	Ethernet (10/100/1000BASE-T)	Back panel, RJ-45												
	GPIO	IEEE488.2, Back panel, IEEE488 bus connector Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2												

Connector	USB (B)	USB2.0, Back panel, USB-B connector
	USB	USB2.0 Supporting waveform hard copy to external device, and saving main frame settings USB-A Connector (2 ports on front panel and 2 ports on back panel)
	Monitor Output	Back panel, VGA compatible, mini D-Sub 15 pin
	Aux	When using Option 020 trigger input/output Back panel, 68 pins (DX10BM-68S equivalent)
	Display	XGA Color LCD (1024 x 768 resolution), 8.4 inch (213 mm)
General Specifications	Dimensions	340 (W) x 200 (H) x 350 (D) mm (excluding projections)
	Mass	≤12.5 kg (excluding options, MS2690A), ≤13.5 kg (excluding options, MS2691A)
	Power	100 to 120 Vac, 200 to 240 Vac (-15/+10% but 250 V max.), 50 to 60 Hz (±5%) ≤260 VA (excluding options), ≤440 VA (including all options, max.)
	Temperature	Operating range: +5° to +40°C, Storage range: -20° to +60°C
Environmental Performance	Conducted Noise	EN61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003 Compliance
	Radiated Noise	EN61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003 Compliance
	Harmonic Current Emissions	EN61000-3-2: 2000 + A2: 2005 Compliance
	Static Discharge	EN61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003 Compliance
	EMF Immunity	EN61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003 Compliance
	Fast Transients/Bursts	EN61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003 Compliance
	Surge	EN61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003 Compliance
	Conducted RF	EN61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003 Compliance
	PS Frequency Field	EN61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003 Compliance
	Voltage Drop/Transients	EN61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003 Compliance



• Vector Signal Analysis Function

Common	Trace Mode	Spectrum, Power versus Time, Frequency versus Time, CCDF																											
	Bandwidth	Specified analysis bandwidth from center frequency Range: 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz																											
	Sampling Rate	Auto-setting depending on RBW Range: 2 kHz to 50 MHz (1-2-5 sequence)																											
	Capture Time	Capture time length: Set length of capture time Min. capture time length: 2 $\mu$ s to 50 ms (determined depending on analysis bandwidth) Max. capture time length: 2 to 2000 s (determined depending on analysis bandwidth) Setting mode: Auto, Manual																											
	Trigger	Trigger mode: Free Run (Trig Off), Video, Wide IF Video, External (TTL) SG Marker (when Option 020 installed)																											
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 Analysis time length: Set analysis time length Setting mode: Auto, Manual																											
	Frequency	Set center frequency and SPAN in frequency range of waveform data																											
	Resolution Bandwidth (RBW)	Setting range: 1 Hz to 1 MHz (1-3 sequence) Selectivity: (-60 dB/-3 dB) 4.5:1, typ.																											
	Absolute Amplitude Accuracy	After CAL, at +18° to +28°C, input attenuator = $\geq 10$ dB, mixer input level: $\leq 0$ dBm, RBW = Auto, Detection = Average, center frequency, CW, excluding the noise floor effect $\pm 0.5$ dB (50 Hz $\leq$ Frequency $\leq 6$ GHz, Frequency band mode: Normal) (50 Hz $\leq$ Frequency $< 3$ GHz, Frequency band mode: Spurious) (MS2691A) After pre-selector tuning (MS2691A) $\pm 1.8$ dB (6 GHz $<$ Frequency $\leq 13.5$ GHz, Frequency band mode: Normal) (3 GHz $\leq$ Frequency $\leq 13.5$ GHz, Frequency band mode: Spurious) The absolute amplitude accuracy is found from the RF characteristics, linearity error, and root sum of squares (RSS) of the input attenuator switching error.																											
	Display Average Noise Level	At input attenuator 0 dB, +18° to +28°C <table border="1"> <thead> <tr> <th>Frequency</th> <th>Max.</th> <th></th> </tr> </thead> <tbody> <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 <math>\leq</math> Frequency <math>&lt; 2.4</math> GHz</td> <td>-152.5 [dBm/Hz]</td> <td></td> </tr> <tr> <td>2.4 GHz <math>\leq</math> Frequency <math>&lt; 4.0</math> GHz</td> <td>-150.5 [dBm/Hz]</td> <td></td> </tr> <tr> <td>4.0 GHz <math>\leq</math> Frequency <math>\leq 6.0</math> GHz</td> <td>-149.5 [dBm/Hz]</td> <td>(MS2690A)</td> </tr> <tr> <td>4.0 GHz <math>\leq</math> Frequency <math>&lt; 6.0</math> GHz</td> <td>-149.5 [dBm/Hz]</td> <td>(MS2691A)</td> </tr> <tr> <td>6.0 GHz <math>\leq</math> Frequency <math>&lt; 10.0</math> GHz</td> <td>-148.5 [dBm/Hz]</td> <td>(MS2691A)</td> </tr> <tr> <td>10.0 GHz <math>\leq</math> Frequency <math>\leq 13.5</math> GHz</td> <td>-147.5 [dBm/Hz]</td> <td>(MS2691A)</td> </tr> </tbody> </table>	Frequency	Max.		100 kHz	-132.5 [dBm/Hz]		1 MHz	-142.5 [dBm/Hz]		30 MHz $\leq$ Frequency $< 2.4$ GHz	-152.5 [dBm/Hz]		2.4 GHz $\leq$ Frequency $< 4.0$ GHz	-150.5 [dBm/Hz]		4.0 GHz $\leq$ Frequency $\leq 6.0$ GHz	-149.5 [dBm/Hz]	(MS2690A)	4.0 GHz $\leq$ Frequency $< 6.0$ GHz	-149.5 [dBm/Hz]	(MS2691A)	6.0 GHz $\leq$ Frequency $< 10.0$ GHz	-148.5 [dBm/Hz]	(MS2691A)	10.0 GHz $\leq$ Frequency $\leq 13.5$ GHz	-147.5 [dBm/Hz]	(MS2691A)
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Adjacent Channel Leakage Power Measurement (ACP)	Reference: Total Power or In-band Channel Power Adjacent channel specification: 3 channel x 2																												
Channel Power	Absolute value measurement: dBm, dBm/Hz																												
Occupied Bandwidth (OBW)	N% of Power, X dB Down																												

Power versus 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 Analysis Time Length: Sets analysis time length Setting mode: Auto, Manual
	Resolution Bandwidth	Filter type: Rect, Gaussian, Nyquist, Root Nyquist, Off (Default: Off) Roll-off ratio: 0.01 to 1 (Set for Nyquist, Root Nyquist) Filter frequency offset: Set center frequency of filter in wavelength data frequency band
	Peak to Peak Measurement	Measures by marker function +Peak, -Peak, (P-P)/2, Average
	Burst Average Power	Measures average power of burst signal
Frequency versus 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 Analysis Time Length: Sets analysis time length Setting mode: Auto, Manual
	Operation Level Range	-17 to +30 dBm (Input attenuator $\geq 10$ 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 Frequency Accuracy	At input level -17 to +30 dBm, and scale = SPAN/25 At CW input: $\pm$ (Reference oscillator accuracy x center frequency + display frequency range x 0.01) Hz
	Peak to Peak Measurement	Measures by marker function +Peak, -Peak, (P-P)/2, Average
CCDF Display Function	Function Outline	Displays CCDF and APD of waveform data captures for fixed time
	Analysis Time Range	Analysis start time: Set analysis start time point from waveform data header Analysis time length: Set analysis time length Setting mode: Auto, Manual
	Display	Displays CCDF or 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 filter center frequency in waveform data frequency band
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) 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) Resolution: 2 Hz, SPAN Accuracy: $\pm 0.2\%$																		
	Display Frequency Accuracy	$\pm [\text{Display frequency} \times \text{reference oscillator accuracy} + \text{SPAN frequency} \times \text{SPAN accuracy} + \text{RBW} \times 0.05 + 2 \times N + \text{SPAN frequency}/(\text{number of trace points} - 1)] \text{ Hz}$ N = Mixer harmonic order																		
	RBW	Setting range: 30 Hz to 3 MHz (1-3 sequence), 5 MHz, 10 MHz, 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 Detector = Sample, VBW = 1 Hz (Video Average), input attenuator = 0 dB, +18° to +28°C, Frequency band mode: Normal <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Frequency</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td>100 kHz</td> <td>-135 [dBm/Hz]</td> </tr> <tr> <td>1 MHz</td> <td>-145 [dBm/Hz]</td> </tr> <tr> <td>30 MHz <math>\leq</math> Frequency &lt; 2.4 GHz</td> <td>-155 [dBm/Hz]</td> </tr> <tr> <td>2.4 GHz <math>\leq</math> Frequency &lt; 4.0 GHz</td> <td>-153 [dBm/Hz]</td> </tr> <tr> <td>4.0 GHz <math>\leq</math> Frequency <math>\leq</math> 6.0 GHz</td> <td>-152 [dBm/Hz]</td> </tr> <tr> <td>4.0 GHz <math>\leq</math> Frequency &lt; 6.0 GHz</td> <td>-152 [dBm/Hz]</td> </tr> <tr> <td>6.0 GHz <math>\leq</math> Frequency &lt; 10.0 GHz</td> <td>-151 [dBm/Hz]</td> </tr> <tr> <td>10.0 GHz <math>\leq</math> Frequency <math>\leq</math> 13.5 GHz</td> <td>-150 [dBm/Hz]</td> </tr> </tbody> </table>	Frequency	Max.	100 kHz	-135 [dBm/Hz]	1 MHz	-145 [dBm/Hz]	30 MHz $\leq$ Frequency < 2.4 GHz	-155 [dBm/Hz]	2.4 GHz $\leq$ Frequency < 4.0 GHz	-153 [dBm/Hz]	4.0 GHz $\leq$ Frequency $\leq$ 6.0 GHz	-152 [dBm/Hz]	4.0 GHz $\leq$ Frequency < 6.0 GHz	-152 [dBm/Hz]	6.0 GHz $\leq$ Frequency < 10.0 GHz	-151 [dBm/Hz]	10.0 GHz $\leq$ Frequency $\leq$ 13.5 GHz	-150 [dBm/Hz]
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Absolute Amplitude Accuracy	After CAL, at +18° to +28°C, input attenuator = $\geq 10$ dB, mixer input level: $\leq 0$ dBm, Auto Sweep Time Select = Normal, RBW: $\leq 1$ MHz, Detection = Positive, CW, excluding the noise floor effect $\pm 0.5$ dB (50 Hz $\leq$ Frequency $\leq 6.0$ GHz, Frequency band mode: Normal) (50 Hz $\leq$ Frequency < 3.0 GHz, Frequency band mode: Spurious) (MS2691A) After pre-selector tuning (MS2691A) $\pm 1.8$ dB (6.0 GHz < Frequency $\leq 13.5$ GHz, Frequency band mode: Normal) (3.0 GHz $\leq$ Frequency $\leq 13.5$ GHz, Frequency band mode: Spurious) 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	Two Signal Tertiary Distortion	At Mixer input level = -15 dBm (per waveform), $\geq 300$ kHz separation, +18° to +28°C $\leq -60$ dBc (TOI = +15 dBm) (30 MHz $\leq$ Frequency < 400 MHz) $\leq -66$ dBc (TOI = +18 dBm) (400 MHz $\leq$ Frequency < 700 MHz) $\leq -74$ dBc (TOI = +22 dBm) (700 MHz $\leq$ Frequency $\leq 4.0$ GHz, Frequency band mode: Normal) (700 MHz $\leq$ Frequency $\leq 3.0$ GHz, Frequency band mode: Spurious) (MS2691A) $\leq -66$ dBc (TOI = +18 dBm) (4.0 GHz $\leq$ Frequency $\leq 6.0$ GHz, Frequency band mode: Normal) $\leq -45$ dBc (TOI = +7.5 dBm) (6.0 GHz < Frequency $\leq 13.5$ GHz, Frequency band mode: Normal) (MS2691A) (3.0 GHz $\leq$ Frequency $\leq 13.5$ GHz, Frequency band mode: Spurious) (MS2691A)																		
	Image Response	$\leq -70$ dBc																		
Sweep	Sweep Mode	Single, Continuous																		
	Sweep Time	Setting range: 2 ms to 1000 s (SPAN $\geq 300$ Hz), 1 $\mu$ s 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) Reference: Total power or in-band channel power Specified adjacent channels: 3 x 2																		
	Burst Average	In time domain, displays average power in specified time																		

• Hardware Options

<p>MS2690A/MS2691A-001 Rubidium Reference Oscillator</p>	<p>Generates 10 MHz reference signal with higher frequency stability Operating characteristics: <math>\pm 1 \times 10^{-9}</math> (7 minutes after power-on) *Referenced to frequency at 24 hours after power-on, at 23°C Aging rate: <math>\pm 1 \times 10^{-10}</math>/month Temperature characteristics: <math>\pm 1 \times 10^{-9}</math> (+5° to +45°C)</p>																					
<p>MS2691A-003 Pre-selector Extended Lower Limit (3 GHz)</p>	<p>Extends lower limit of pre-selector to 3 GHz</p>																					
<p>MS2690A/ MS2691A-020 Vector Signal Generator</p>	<p>Usage</p>	<p>Adds vector signal generation function</p>																				
	<p>Frequency</p>	<p>Range: 125 MHz to 6 GHz, Resolution: 0.01 Hz steps</p>																				
	<p>Output Level</p>	<p>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 CW, +18° to +28°C Output level p [dBm]  <table border="0"> <tr> <td>-120 ≤ p ≤ +5</td> <td>±0.5 dB</td> <td>(≤3 GHz)</td> </tr> <tr> <td>-110 ≤ p ≤ +5</td> <td>±0.8 dB</td> <td>(&gt;3 GHz)</td> </tr> <tr> <td>-127 ≤ p &lt; -120</td> <td>±0.7 dB</td> <td>(≤3 GHz)</td> </tr> <tr> <td>-127 ≤ p &lt; -110</td> <td>±2.5 dB typ.</td> <td>(&gt;3 GHz)</td> </tr> <tr> <td>-136 ≤ p &lt; -127</td> <td>±1.5 dB typ.</td> <td>(≤3 GHz)</td> </tr> </table> <p>Output level linearity: At CW, +18° to +28°C, referenced to -5 dBm output Output level p [dBm]  <table border="0"> <tr> <td>-120 ≤ p ≤ -5</td> <td>±0.2 dB typ.</td> <td>(≤3 GHz)</td> </tr> <tr> <td>-110 ≤ p ≤ -5</td> <td>±0.3 dB typ.</td> <td>(&gt;3 GHz)</td> </tr> </table> <p>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 GHz) 1.9 (&gt;3 GHz) Max. reverse input: Reverse input power: 1 W<sub>peak</sub> (≥300 MHz), 0.25 W<sub>peak</sub> (&lt;300 MHz)</p> </p></p>	-120 ≤ p ≤ +5	±0.5 dB	(≤3 GHz)	-110 ≤ p ≤ +5	±0.8 dB	(>3 GHz)	-127 ≤ p < -120	±0.7 dB	(≤3 GHz)	-127 ≤ p < -110	±2.5 dB typ.	(>3 GHz)	-136 ≤ p < -127	±1.5 dB typ.	(≤3 GHz)	-120 ≤ p ≤ -5	±0.2 dB typ.	(≤3 GHz)	-110 ≤ p ≤ -5	±0.3 dB typ.
-120 ≤ p ≤ +5	±0.5 dB	(≤3 GHz)																				
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-120 ≤ p ≤ -5	±0.2 dB typ.	(≤3 GHz)																				
-110 ≤ p ≤ -5	±0.3 dB typ.	(>3 GHz)																				
<p>Signal Purity</p>	<p>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  <table border="0"> <tr> <td>&lt; -68 dBc</td> <td>(125 MHz ≤ Frequency ≤ 500 MHz)</td> </tr> <tr> <td>&lt; -62 dBc</td> <td>(500 MHz &lt; Frequency ≤ 1 GHz)</td> </tr> <tr> <td>&lt; -56 dBc</td> <td>(1 GHz &lt; Frequency ≤ 2 GHz)</td> </tr> <tr> <td>&lt; -50 dBc</td> <td>(2 GHz &lt; Frequency ≤ 6 GHz)</td> </tr> </table> </p>	< -68 dBc	(125 MHz ≤ Frequency ≤ 500 MHz)	< -62 dBc	(500 MHz < Frequency ≤ 1 GHz)	< -56 dBc	(1 GHz < Frequency ≤ 2 GHz)	< -50 dBc	(2 GHz < Frequency ≤ 6 GHz)													
< -68 dBc	(125 MHz ≤ Frequency ≤ 500 MHz)																					
< -62 dBc	(500 MHz < Frequency ≤ 1 GHz)																					
< -56 dBc	(1 GHz < Frequency ≤ 2 GHz)																					
< -50 dBc	(2 GHz < Frequency ≤ 6 GHz)																					
<p>Vector Modulation</p>	<p>Vector accuracy: At W-CDMA (DL1 code), SG Level Auto CAL = On, output level -5 dBm max., output frequency 800 to 2700 MHz, +18° to +28°C ≤ 2% (rms) Carrier leak: At output frequency 300 MHz max., SG Level Auto CAL = On, +18° to +28°C ≤ -40 dBc Image rejection: At output frequency 300 MHz max., SG Level Auto CAL = On, +18° to +28°C, using 10 MHz max. sine wave ≤ -40 dBc ACLR: At +18° 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 AWGN signal with bandwidth of 5 MHz, SG Level Auto CAL = On, output frequency 300 MHz min., +18° to +28°C, output level p [dBm]  <table border="0"> <tr> <td>p ≤ -15</td> <td>±0.2 dB</td> </tr> </table> <p>At output level -15 to -5 dBm  <table border="0"> <tr> <td>-15 &lt; p ≤ -5</td> <td>±0.4 dB typ.</td> </tr> </table> <p>Spectrum inversion: Supported</p> </p></p>	p ≤ -15	±0.2 dB	-15 < p ≤ -5	±0.4 dB typ.																	
p ≤ -15	±0.2 dB																					
-15 < p ≤ -5	±0.4 dB typ.																					



MS2690A/ MS2691A- 020 Vector Signal Generator	Pulse Modulation	<p>On/Off ratio: <math>\geq 60</math> dB</p> <p>Rising/falling edge time: <math>\leq 90</math> ns (10 to 90%)</p> <p>Pulse repetition frequency: DC to 1 MHz (Duty 50%)</p> <p>External panel modulation signal input: Back-panel AUX connector, 600 <math>\Omega</math>, 0 to 5 V, threshold value approx. 1 V</p>
	Arbitrary Waveform Generator	<p>Waveform resolution: 14 bits</p> <p>Marker output: Three signal (three signals in waveform pattern, or real-time three signal generation), TTL, polarity inversion function</p> <p>Internal baseband Reference clock Range: 20 kHz to 160 MHz Resolution: 0.001 Hz</p> <p>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 <math>\Omega</math>), or TTL</p> <p>Waveform memory Memory: 256 Msamples</p> <p>AWGN Addition function CN Ratio absolute value: <math>\leq 40</math> dB</p>
	BER Measurement	<p>Connector: Back-panel AUX connector</p> <p>Input level: TTL Level</p> <p>Input signal: Data, Clock, Enable</p> <p>Input bit rate: 100 bps to 10 Mbps</p> <p>Measured patterns: PN9, PN11, PN15, PN20, PN23, ALL0, ALL1, 01 Repeat PN9Fix, PN11Fix, PN15Fix, PN20Fix, PN23Fix, User Define</p> <p>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</p> <p>Resync evaluation conditions: x/y y = Measured bit count: Select from 500, 5000, 50000 x = y bit error bit count: setting range 1 to y/2</p> <p>Measured bit count: <math>\leq 2^{32} - 1</math> bits Measured error bit count: <math>\leq 2^{31} - 1</math> bits</p> <p>Measurement end conditions: Measured bit count, measured error bit count</p> <p>Auto-resync function: On/off</p> <p>Operation at resync: Select from Count Clear, and Count Keep</p> <p>Measurement mode: Single, Endless, Continuous</p> <p>Display: Status, Error, Error Rate, Error Count, Sync Loss Count, Measured bit count</p> <p>Polarity inversion function: Data, Clock, Enable polarity inversion</p> <p>Clear measurement function: Clear measured value saved at sync during BER measurement, and select measurement from 0</p>



• **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 EVM = 1% of 1 wave multiple signal $\pm$ (Reference frequency accuracy x carrier frequency + 4 Hz) Residual vector error Input level range: Input Level to Input Level -10 dB Test Model 1 64 DPCH multiple signal $\leq 1.0\%$ (rms)
Code Domain Analysis	Code domain power accuracy Input level range: Input Level to Input Level -10 dB Test Model 2 Signal $\pm 0.02$ dB (Code Domain Power $\geq -10$ dB), $\pm 0.10$ dB (Code Domain Power $\geq -30$ dB) Code domain error Input level range: Input Level to Input Level -10 dB Test Model 3 signal Residual error: $\leq -50$ dB Accuracy: $\pm 0.75$ dB (versus -40 dBc error)
Amplitude Measurement	Tx Power accuracy After CAL, at +18° to +28°C Input level range: Input Level to Input Level -10 dB $\pm 0.6$ 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 ( $\alpha = 0.22$ ) 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 ( $\geq 2.515$ MHz offset)

• **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.

Modulation and Frequency Measurement	Analysis Length	5 ms
	Bandwidth and Modulation Method	Bandwidth: 10 MHz, 8.75 MHz, 7 MHz, 5 MHz Modulation method: 64QAM, 16QAM, QPSK
	Target Signal	Downlink, Uplink
	Waveform Display (Downlink)	(1) Compression (2) Power spectrum versus carrier number (3) Power versus time (4) IQ Data versus subcarrier number (5) Downlink map data (zone burst) (6) Vector error versus subcarrier number (7) Vector error versus symbol number (8) Spectrum flatness
	Waveform Display (Uplink)	(1) Constellation (2) Power spectrum versus subcarrier number (3) Power versus time
	Measured Frequency Range	2.3 GHz to 3.8 GHz
	Measured Level Range	-15 to +30 dBm (average power of measured target signal)
	Carrier Frequency Accuracy	$\pm$ (Reference frequency accuracy x carrier frequency + 20) Hz
	Modulation Accuracy Residual Vector Error	<0.6% (rms)
	Spectrum Flatness Accuracy	$\pm 0.3$ dB
	Amplitude Measurement Accuracy	At +18° to +28°C, $\pm 0.6$ 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.

# Ordering Information

Please specify the model/order number, name and quantity when ordering.

The following name of articles is an order name. The actual name may differ name from the product.

Model/Order No.	Name	
MS2690A MS2691A	<b>- Main Frame -</b> Signal Analyzer (50 Hz to 6.0 GHz) Signal Analyzer (50 Hz to 13.5 GHz)	
J0017F J0266 P0031A Z0541A	<b>- Standard Accessories -</b> Power Cord (2.6 m long 100 Vac, 3 core, gray): 1 pc Conversion Adapter (3-pin to 2-pin power adapter): 1 pc USB Memory (256 MB USB2.0 Flash Driver): 1 pc USB Mouse: 1 pc Install CD-ROM (Application software, instruction manual CD-ROM): 1 disc Windows XP Professional (English) (English OS CD-ROM): 1 pc	
MS2690A-001 MS2690A-020 MS2691A-001 MS2691A-003 MS2690A-020 MS2691A-020	<b>- Options -</b> Rubidium Reference Oscillator (Aging rate $\pm 1 \times 10^{-10}$ /month) Vector Signal Generator (125 MHz to 6 GHz) Rubidium Reference Oscillator (Aging rate $\pm 1 \times 10^{-10}$ /month) Pre-Selector Extended Lower Limit (3 GHz) (Extends lower limit of pre-selector to 3 GHz) Vector Signal Generator (125 MHz to 6 GHz) Vector Signal Generator (125 MHz to 6 GHz)	
MS2690A-101 MS2690A-120 MS2691A-101 MS2691A-103 MS2690A-120 MS2691A-120	<b>- Retrofit Options -</b> Rubidium Reference Oscillator Retrofit (Aging rate $\pm 1 \times 10^{-10}$ /month) Vector Signal Generator Retrofit (125 MHz to 6 GHz) Rubidium Reference Oscillator Retrofit (Aging rate $\pm 1 \times 10^{-10}$ /month) Pre-Selector Extended Lower Limit (3 GHz) Retrofit (Extends lower limit of pre-selector to 3 GHz) Vector Signal Generator Retrofit (125 MHz to 6 GHz) Vector Signal Generator Retrofit (125 MHz to 6 GHz)	
MX269010A MX269030A MX269901A MX269902A MX269904A MX269905A	<b>- Software Options -</b> Mobile WiMAX Measurement Software (CD-ROM, license and instruction manual) W-CDMA BS Measurement Software (CD-ROM, license and instruction manual) HSDPA/HSUPA IQproducer™ (CD-ROM, license and instruction manual) TDMA IQproducer™ (CD-ROM, license and instruction manual) Multi-Carrier IQproducer™ (CD-ROM, license and instruction manual) Mobile WiMAX IQproducer™ (CD-ROM, license and instruction manual)	
MS2690A-ES210 MS2690A-ES310 MS2690A-ES510 MS2691A-ES210 MS2691A-ES310 MS2691A-ES510	<b>- Warranty Service -</b> 2-year Extended Warranty Service 3-year Extended Warranty Service 5-year Extended Warranty Service 2-year Extended Warranty Service 3-year Extended Warranty Service 5-year Extended Warranty Service	
W2850AE W2851AE W2852AE W2853AE W2854AE W2855AE W2856AE W2857AE W2914AE W2929AE W2919AE W2860AE W2860AE W2915AE W2916AE W2917AE W2918AE K240B MA1612A MP752A MA2512A J0576B J0576D J0127A J0127B J0127C J0322A J0322B J0322C J0322D J1264 J1261A J1261B J1261C J1261D J0008 J1373A B0597A B0589A Z0975A	<b>- Application Parts -</b> MS2690A/MS2691A Operation Manual (Main frame Operation, Printed version) MS2690A/MS2691A Operation Manual (Main frame Remote Control, Printed version) MS2690A/MS2691A Operation Manual (Signal Analyzer Function Operation, Printed version) MS2690A/MS2691A Operation Manual (Signal Analyzer Function Remote Control, Printed version) MS2690A/MS2691A Operation Manual (Spectrum Analyzer Function Operation, Printed version) MS2690A/MS2691A Operation Manual (Spectrum Analyzer Function Remote Control, Printed version) MS2690A/MS2691A Option 020 Operation Manual (Operation, Printed version) MS2690A/MS2691A Option 020 Operation Manual (Remote Control, Printed version) MS2690A/MS2691A Option 020 Operation Manual (IQproducer™, Printed version) MS2690A/MS2691A Option 020 Operation Manual (Standard Waveform Pattern, Printed version) MX269010A Operation Manual (Printed version) MX269030A Operation Manual (Operation, Printed version) MX269030A Operation Manual (Remote control, Printed version) MX269901A Operation Manual (Printed version) MX269902A Operation Manual (Printed version) MX269904A Operation Manual (Printed version) MX269905A Operation Manual (Printed version) Power Divider (K connector, DC to 26.5 GHz, 50 $\Omega$ , K-J, 1 W max) Four-Port Junction Pad (5 MHz to 3 GHz, N-J) Termination (DC to 12.4 GHz, 50 $\Omega$ , N-P) Band Pass Filter (for W-CDMA, 1.92 to 2.17 GHz) Coaxial Cord (N-P · 5D-2W · N-P), 1 m Coaxial Cord (N-P · 5D-2W · N-P), 2 m Coaxial Cord (BNC-P · RG58A/U · BNC-P), 1 m Coaxial Cord (BNC-P · RG58A/U · BNC-P), 2 m Coaxial Cord (BNC-P · RG58A/U · BNC-P), 0.5 m Coaxial Cord (SMA-P · 50 $\Omega$ SUCOFLEX104 · SMA-P), 0.5 m (DC to 18 GHz) Coaxial Cord (SMA-P · 50 $\Omega$ SUCOFLEX104 · SMA-P), 1 m (DC to 18 GHz) Coaxial Cord (SMA-P · 50 $\Omega$ SUCOFLEX104 · SMA-P), 1.5 m (DC to 18 GHz) Coaxial Cord (SMA-P · 50 $\Omega$ SUCOFLEX104 · SMA-P), 2 m (DC to 18 GHz) SMA-N Conversion Adapter (50 $\Omega$ N-P · SMA-J, DC to 18 GHz) Ethernet Cable (Shield type, straight), 1 m Ethernet Cable (Shield type, straight), 3 m Ethernet Cable (Shield type, cross), 1 m Ethernet Cable (Shield type, cross), 3 m GPIO Connection Cable, 2.0 m AUX Conversion Adapter (AUX → BNC, for vector signal generator option) Rack Mount Kit Carrying Case (Hard type, with casters) Keyboard (USB)	

## Anritsu Corporation

5-1-1 Onna, Atsugi-shi, Kanagawa, 243-8555 Japan  
Phone: +81-46-223-1111  
Fax: +81-46-296-1264

## ● U.S.A.

### Anritsu Company

1155 East Collins Blvd., Suite 100, Richardson,  
TX 75081, U.S.A.  
Toll Free: 1-800-267-4878  
Phone: +1-972-644-1777  
Fax: +1-972-671-1877

## ● Canada

### Anritsu Electronics Ltd.

700 Silver Seven Road, Suite 120, Kanata,  
Ontario K2V 1C3, Canada  
Phone: +1-613-591-2003  
Fax: +1-613-591-1006

## ● Brazil

### Anritsu Eletrônica Ltda.

Praca Amadeu Amaral, 27 - 1 Andar  
01327-010-Paraiso-São Paulo-Brazil  
Phone: +55-11-3283-2511  
Fax: +55-11-3288-6940

## ● U.K.

### Anritsu EMEA Ltd.

200 Capability Green, Luton, Bedfordshire, LU1 3LU, U.K.  
Phone: +44-1582-433200  
Fax: +44-1582-731303

## ● France

### Anritsu S.A.

9 Avenue du Québec, Z.A. de Courtabœuf  
91951 Les Ulis Cedex, France  
Phone: +33-1-60-92-15-50  
Fax: +33-1-64-46-10-65

## ● Germany

### Anritsu GmbH

Nemetschek Haus, Konrad-Zuse-Platz 1  
81829 München, Germany  
Phone: +49-89-442308-0  
Fax: +49-89-442308-55

## ● Italy

### Anritsu S.p.A.

Via Elio Vittorini 129, 00144 Roma, Italy  
Phone: +39-6-509-9711  
Fax: +39-6-502-2425

## ● Sweden

### Anritsu AB

Borgaffjordsgatan 13, 164 40 KISTA, Sweden  
Phone: +46-8-534-707-00  
Fax: +46-8-534-707-30

## ● Finland

### Anritsu AB

Teknobulevardi 3-5, FI-01530 VANTAA, Finland  
Phone: +358-20-741-8100  
Fax: +358-20-741-8111

## ● Denmark

### Anritsu A/S

Kirkebjerg Allé 90, DK-2605 Brøndby, Denmark  
Phone: +45-72112200  
Fax: +45-72112210

## ● Spain

### Anritsu EMEA Ltd.

#### Oficina de Representación en España

Edificio Veganova  
Avda de la Vega, n° 1 (edf 8, pl 1, of 8)  
28108 ALCOBENDAS - Madrid, Spain  
Phone: +34-914905761  
Fax: +34-914905762

## ● United Arab Emirates

### Anritsu EMEA Ltd.

#### Dubai Liaison Office

P O Box 500413 - Dubai Internet City  
Al Thuraya Building, Tower 1, Suit 701, 7th Floor  
Dubai, United Arab Emirates  
Phone: +971-4-3670352  
Fax: +971-4-3688460

## ● Singapore

### Anritsu Pte. Ltd.

10, Hoe Chiang Road, #07-01/02, Keppel Towers,  
Singapore 089315  
Phone: +65-6282-2400  
Fax: +65-6282-2533

## ● India

### Anritsu Pte. Ltd.

#### India Branch Office

Unit No. S-3, Second Floor, Esteem Red Cross Bhavan,  
No. 26, Race Course Road, Bangalore 560 001, India  
Phone: +91-80-32944707  
Fax: +91-80-22356648

## ● P.R. China (Hong Kong)

### Anritsu Company Ltd.

Units 4 & 5, 28th Floor, Greenfield Tower, Concordia Plaza,  
No. 1 Science Museum Road, Tsim Sha Tsui East,  
Kowloon, Hong Kong  
Phone: +852-2301-4980  
Fax: +852-2301-3545

## ● P.R. China (Beijing)

### Anritsu Company Ltd.

#### Beijing Representative Office

Room 1515, Beijing Fortune Building,  
No. 5, Dong-San-Huan Bei Road,  
Chao-Yang District, Beijing 10004, P.R. China  
Phone: +86-10-6590-9230  
Fax: +86-10-6590-9235

## ● Korea

### Anritsu Corporation, Ltd.

8F Hyunjuk Building, 832-41, Yeoksam Dong,  
Kangnam-ku, Seoul, 135-080, Korea  
Phone: +82-2-553-6603  
Fax: +82-2-553-6604

## ● Australia

### Anritsu Pty. Ltd.

Unit 21/270 Ferntree Gully Road, Notting Hill,  
Victoria 3168, Australia  
Phone: +61-3-9558-8177  
Fax: +61-3-9558-8255

## ● Taiwan

### Anritsu Company Inc.

7F, No. 316, Sec. 1, Neihu Rd., Taipei 114, Taiwan  
Phone: +886-2-8751-1816  
Fax: +886-2-8751-1817

Please Contact: