

MS2681A/2683A

Spectrum Analyzer
9 kHz to 3/7.8 GHz



For Analyzing Next-generation Radio Communication Systems and Devices

The IMT-2000 (2 GHz band) service for third-generation mobile radio communication has started. Bluetooth, has been adopted for close-range radio communication between portable remote terminals and peripheral equipment, and R&D of MMAC, IEEE802.11a, and HiperLAN2 (High Performance European Radio Local Area Network Type2) for higher speed access have been conducted in various countries.

The MS2681A/2683A Spectrum Analyzer delivers optimum performance over a wide dynamic range (156 dB, typical value), wide resolution bandwidth (20 MHz), to high-speed sweep (refresh rate of 20 times/s), required for evaluating next-generation radio communication systems and devices.

It can be used not only as a spectrum analyzer but also to perform various measurements easily and quickly by installing measurement software.





Features

- Wide resolution band width up to 20 MHz.
- Data transmission speed approximately 10 times faster.
(GPIB transmission speed : 120 kB/s)
- Optional measurement software (sold separately) for high-speed modulation analysis.
(1.5 sec. with W-CDMA, 0.5 sec with IEEE802.11a)
- Optional narrow resolution bandwidth from 1 Hz.



Basic Specifications

■ For Research and Development of Radio Systems and Devices

- Frequency range: 9 kHz to 3 GHz (MS2681A)
9 kHz to 7.8 GHz (MS2683A)
- Span accuracy: $\pm 1\%$
- Resolution bandwidth:
300 Hz to 3 MHz, 5 MHz, 10 MHz, and 20 MHz
1 Hz to 1 kHz (option 02, FFT)
10 Hz to 1 MHz (option 04)
- Average noise level: ≤ -146 dBm/Hz (1 MHz to 2.5 GHz)
- 1 dB gain compression: +3 dBm (typ.), +10 dBm, 2 GHz)
- Two-signal third-order distortion: ≤ -85 dBc (0.1 GHz to 7.8 GHz)
- Input attenuator: 0 to 62 dB (2 dB steps)
- W-CDMA ACP measurement performance
-68 dBc (5 MHz offset at 3.84 MHz)
-75 dBc (10 MHz offset at 3.84 MHz)

■ For Installation and Maintenance of Radio Stations

- Save/recall of set parameters:
up to 12 into/from internal memory
- Output of measurement results:
BMP, CSV format or printer
(ESC/P compatible model)
- PC card interface: PC compatible ATA card
(ATA card equipped as standard for 20 MB or over)
- Display: 6.5 inch (17 cm) color TFT-LCD
- Dimensions, weight:
320 (W) \times 177 (H) \times 411 (D) mm, 16 kg

A carrybone and soft carrying case convenient for field use are also available.



■ For High-speed Measurement on Radio System/Device Manufacturing Line

- Sweep time: 10 ms to 1000 s (frequency span)
1 μ s to 1000 s (time span)
- Sweep refresh rate: 20 trace/s
- I/O interface:
GPIB, RS-232C, and Centronics equipped as standard.
Ethernet (option 09) allows network control by 10BASE-T.
- GP-IB transfer rate: 120 kB/s
- Measure: One-touch measurement of occupied frequency bandwidth, channel power, and adjacent channel leakage power

■ Options

- Option 01: Precision frequency reference
(aging rate: $\pm 5 \times 10^{-10}$ /day)
 - Option 02: Narrow resolution bandwidth (FFT)
 - Option 03: Extension of preselector lower limit to 1.6 GHz*
 - Option 04: Digital resolution bandwidth (RMS detection)
 - Option 08: Pre-amplifier
 - Option 09: Ethernet interface
 - Option 17: I/Q balanced input
 - Option 18: I/Q unbalanced input
 - Option 34: 4 GHz LO output*
 - Option 46: Auto power recovery
 - Option 47: Rack mount (IEC) without handles
 - Option 48: Rack mount (JIS) without handles
- *: Available only for MS2683A.

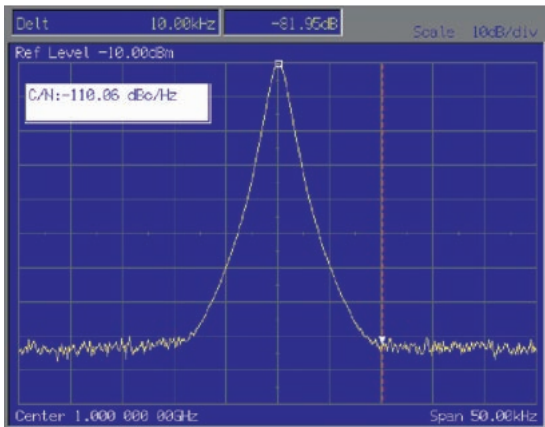
■ Warranty

- Option 90: Extended three years warranty service
- Option 91: Extended five years warranty service

Excellent Basic Performance

High C/N Ratio to Securely Capture Adjacent Signals

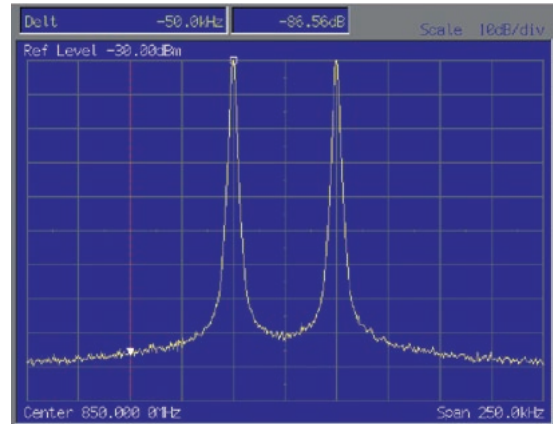
The MS2681A/2683A has excellent noise sideband characteristics of -108 dBc/Hz or lower (1 GHz, 10 kHz offset), which is ideal for analyzing weak signals adjacent to strong signals or a narrow bandwidth carrier.



Example of C/N characteristic waveform

Extremely Low Distortion Rate Suited for Power Amplification or Harmonic Measurement

The MS2681A/2683A has extremely low harmonic distortion levels, including second harmonic distortion of -90 dBc and two-signal third-order distortion of -85 dBc, making it suitable for evaluating the non-linearity of high-power amplifiers and for measuring harmonics.

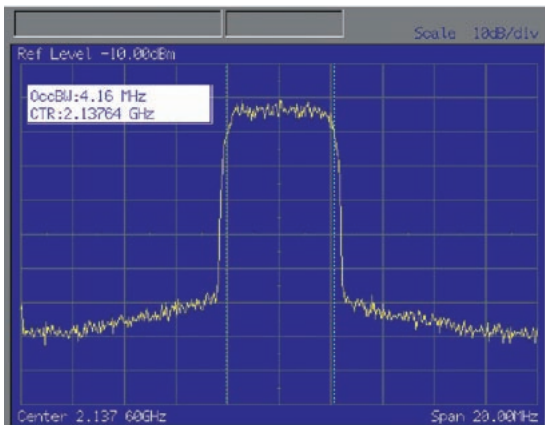


Example of two-signal third-order distortion waveform

Instantaneous Evaluation of Various Radio Devices Standard Measure Functions

The MS2681A/2683A has a wealth of measuring functions to perform various high-speed evaluations of radio devices such as channel power measurement, frequency measurement, adjacent channel leakage power (ACP) measurement, and occupied bandwidth (OBW) measurement.

Optional measurement software is also available for instantaneously analyzing various digital communication systems by just installing the software.



Example of occupied bandwidth

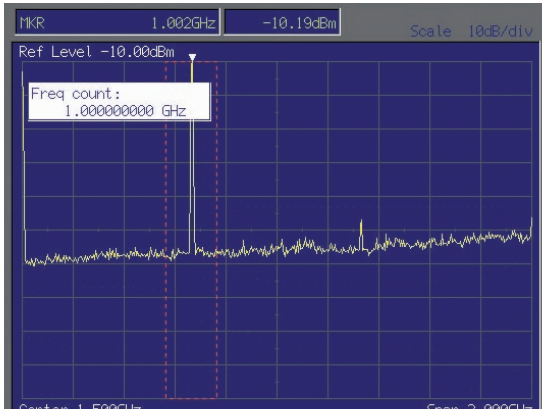
Optimum Level Measurement Standard 2 dB Step Attenuator

The MS2681A/2683A features a 2 dB step input attenuator for the first time in this class, which allows fine level setting, with minimal mixer distortion and noise inside the analyzer. The built-in pre-amplifier (option 08) which permits optimum level signal analysis improves the reliability of measurement results.

Convenient and Easy-to-Use Functions

1 Hz Resolution Built-in Frequency Counter

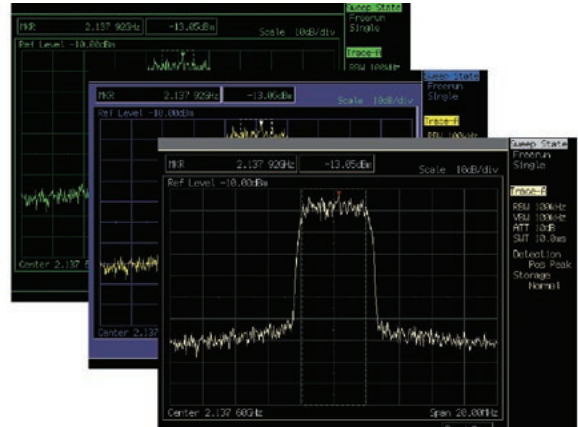
The built-in frequency counter is convenient for measuring frequency signals arbitrarily selected from multiple signals. High resolution of 1 Hz even at full span is assured.



Example of frequency counter

Bright and Easy-to-see 6.5 inch (17 cm) Color TFT Display

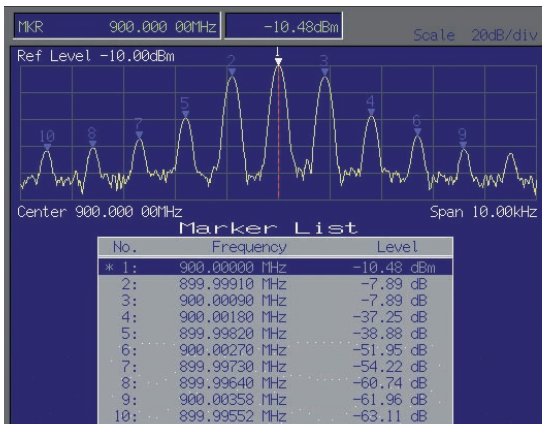
The MS2681A/2683A has a 6.5 inch (17 cm) color TFT-LCD. Intensity and color can be adjusted freely according to the operating conditions.



Example of coloring change

Multiple Waveform Display and Multimarkers

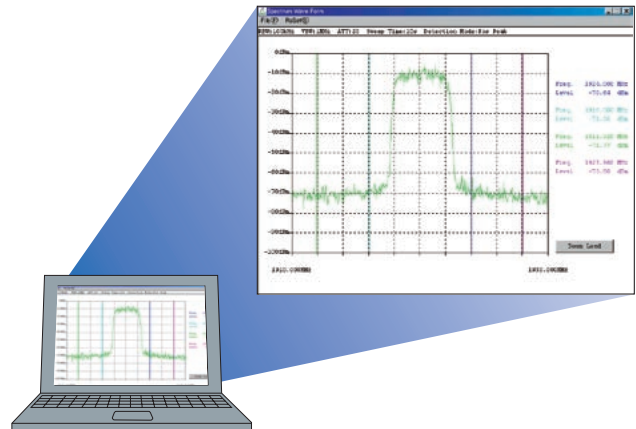
The MS2681A/2683A is equipped with multiple waveform display function that allows superimposition of two waveforms or simultaneous display of analysis of frequency domain and time domain. It also has substantial marker functions that allow up to 10-point multimarkers to be displayed for comparison of waveforms and measurement of harmonics.



Example of harmonics measurement

Easy Measurement Data Control Allowed by Various Interfaces

The results of measurement can be saved at the touch of a button (in BMP or CSV format; data can also be output to a printer). The large-capacity memory card instead of a floppy disk which is susceptible to mechanical failure allows accurate and high-speed storage of important data. Various interfaces such as RS-232C, Centronics, GPIB, and Ethernet (optional) permit easy connection to a PC for data collection.



Example of capture soft (standard)

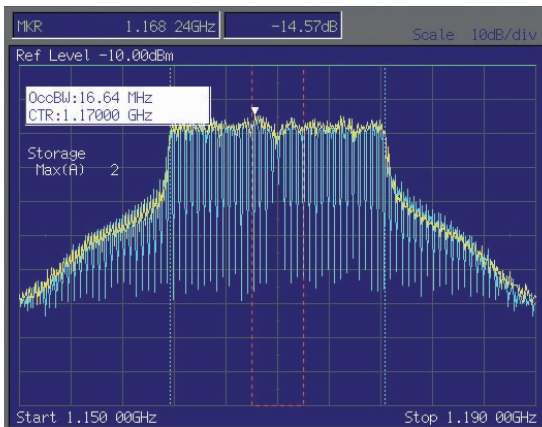


For Research and Development of Radio Communication Systems/Devices

Suitable for Analysis of Broadband Signals Wide Resolution Bandwidth of up to 20 MHz

The MS2681A/2683A comes with a high-performance DSP as standard. Various modulation analysis functions can be added simply by installing measurement software. In signal analysis mode, analysis by I/Q input (option 17 or 18 is required) can be performed.

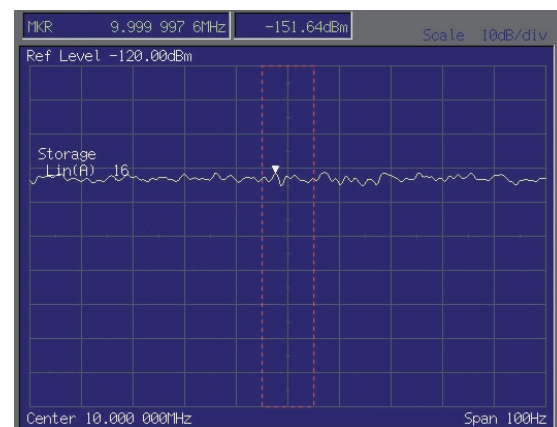
The resolution bandwidth is up to 20 MHz, which allows the analysis of wireless LAN.



Example of wide bandwidth signal measurement

High-speed Measurement by FFT Narrow Resolution Bandwidth (optional)

Optional narrow resolution bandwidth with FFT (Fast Fourier Transform) is available (option 02, 1 Hz to 1 kHz). This option permits state-of-the-art high-speed measurement in a narrow band that used to be impossible with the conventional sweep method.



Example of narrow resolution bandwidth measurement

Wide Dynamic Range and Low Average Noise Level

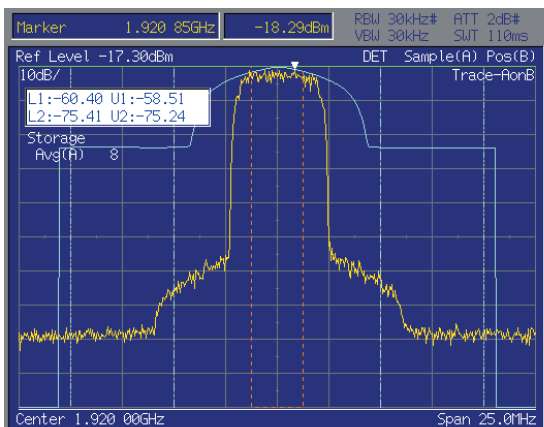
The MS2681A/2683A has a dynamic range of 156 dB (typical value), and its average noise level is -146 dBm/Hz (1 MHz to 2.5 GHz), which is suitable for research and development of radio communication systems, for high-performance evaluation at low cost.



For High-speed Measurement on Radio System/Device Manufacturing Line

High-speed Measurement for Construction of Automatic Manufacturing Line

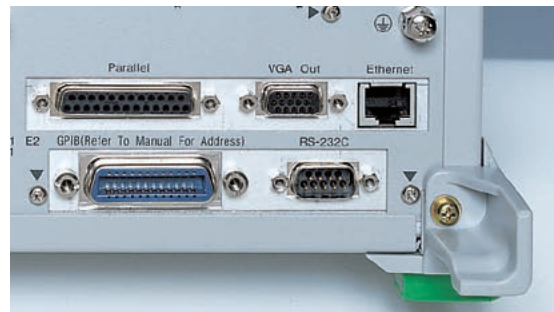
The MS2681A/2683A has a rapid sweep refresh rate of 20 times/s. A slight change can thus be accurately captured and measured at high speed, which helps speedup the manufacturing line of next-generation radio communication systems and devices.



Example of automatic measurement of adjacent channel leakage power

High-speed Data Transmission 10 Times Faster than the Conventional Model-ideal for Automatic Measurement Systems

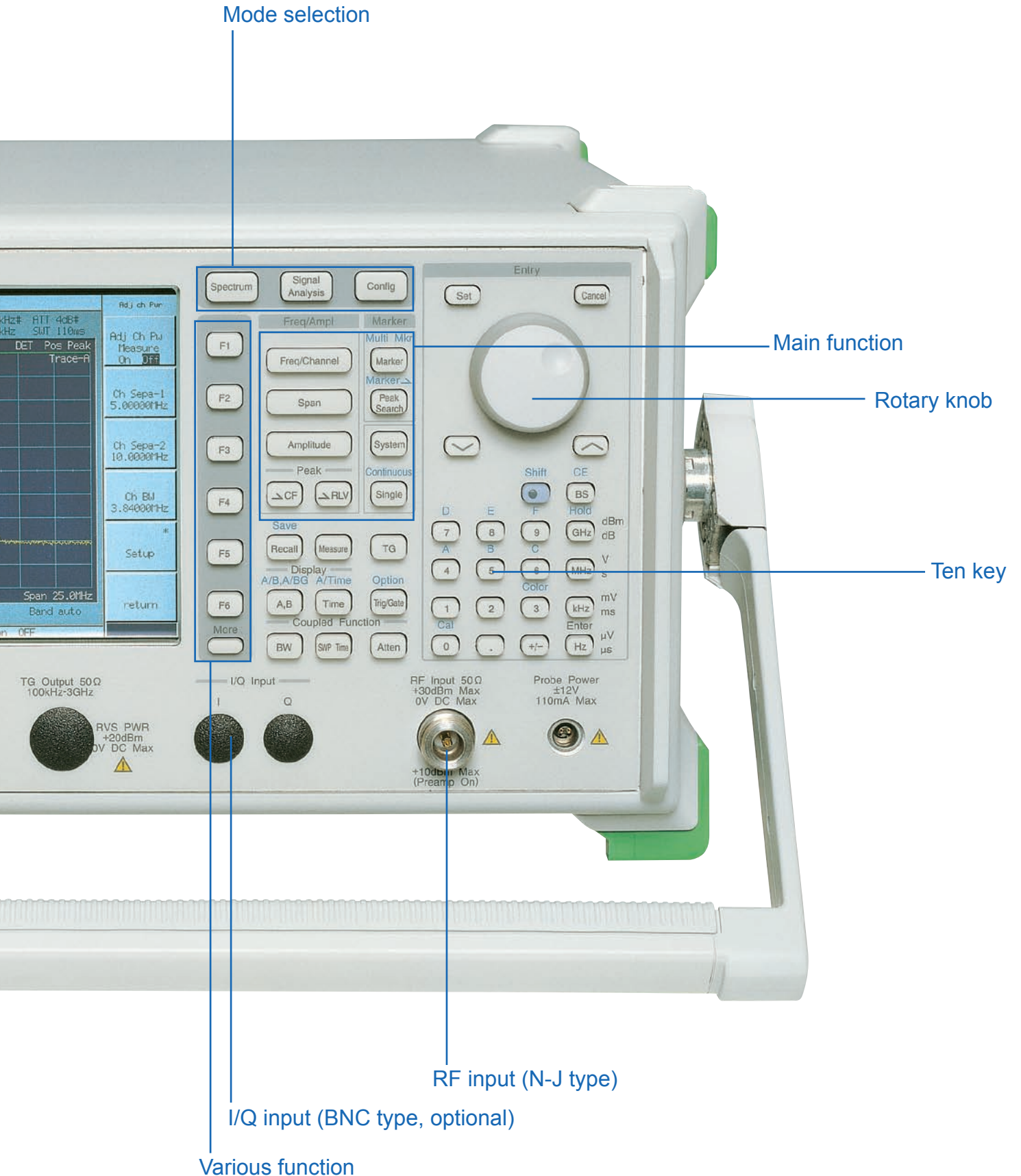
The MS2681A/2683A can transmit GPIB data at the high rate of 120 kB/s. High-speed data transmission 10 times faster than our conventional model helps speed up the construction of automatic measurement systems. The analyzer can be connected to a LAN via an Ethernet interface (option 09), and centralized management via a network and high-speed measurement makes the product ideal for building an efficient manufacturing line.



Easy-to-Use Panel Design

- 1 IF output (BNC type)
- 2 Reference input/output (BNC type)
- 3 Power
- 4 AC input
- 5 Ethernet interface (10BASE-T, optional)
- 6 RS-232C interface
- 7 VGA output
- 8 GPIB interface
- 9 Parallel interface (D-Sub25)
- 10 Trigger input (BNC type)
- 11 Video signal output (BNC type)





Mode selection

Main function

Rotary knob

Ten key

Various function

RF input (N-J type)

I/Q input (BNC type, optional)

Versatile Options for Improving Performance and Functions

[option 01]

■ Precision Frequency Reference

Highly-stable reference crystal oscillator option with frequency of 10 MHz, and aging rate of $\pm 5 \times 10^{-10}$ /day.

[option 17]

■ I/Q Balanced Input

Mounts 4 connectors for I/Q sync input and operating input (BNC type) to the front panel.

* Measurement software corresponding to I/Q input is required for actual measurement.

[option 02]

■ Narrow Resolution Bandwidth

Realizes narrow RBW of 1 Hz to 1 KHz with FFT adopted.

[option 18]

■ I/Q Unbalanced Input

Mounts 2 connectors for I/Q synch inputs and operating inputs (BNC type) to the front panel.

* Measurement software corresponding to I/Q input is required for actual measurement.

[option 03]

■ Extension of Pre-selector Lower Limit to 1.6 GHz

Extends the lower limit of frequency from 3.15 GHz to 1.6 GHz.

* Available only for MS2683A.

[option 34]

■ 4 GHz LO Output

Outputs internal 2nd local signal through rear connector.

* Available only for MS2683A.

[option 04]

■ Digital Resolution Bandwidth

Adds RMS director and expands resolution bandwidth (10 Hz to 1 MHz).

[option 46]

■ Auto Power Recovery

Disables the power switch on the front panel. Power is automatically reset after the line is restored.

[option 08]

■ Pre-amplifier

Installs a pre-amplifier with 20 dB gain typical value and frequency range from 100 kHz to 3 GHz.

[option 47]

■ Rack Mount (IEC) without Handles

Mounts an IEC standard rack mount. When mounted, the (standard) tilt handle is eliminated.

[option 09]

■ Ethernet Interface

Allows external control via 10BASE-T.

[option 48]

■ Rack Mount (JIS) without Handles

Mounts a JIS standard rack mount. When mounted, the (standard) tilt handle is eliminated.

Application Software

Optional measurement software is available for instantaneously analyzing various digital communication systems by just installing the software.

For details, please see the data sheet of each software.

Communication system	Applicable software
W-CDMA	W-CDMA Measurement Software
GSM	GSM Measurement Software
cdmaOne, CDMA2000 1X	CDMA Measurement Software
CDMA2000 1xEV-DO	CDMA2000 1xEV-DO Measurement Software
PDC/PHS/NADC (IS-136), STD-39/T79, STD-T61	$\pi/4$ DQPSK Measurement Software
IEEE802.11a/11b/11g, HiSWANa, HiperLAN2	Wireless LAN Measurement Software
TD-SCDMA	TD-SCDMA Measurement Software

Specifications

Model		MS2681A	MS2683A
Frequency	Frequency range	9 kHz to 3 GHz	9 kHz to 7.8 GHz
	Frequency band	—	Band 0: 9 kHz to 3.2 GHz, Band 1–L: 1.6 GHz to 3.2 GHz (option 03), Band 1: 3.15 GHz to 6.3 GHz, Band 1+: 6.2 GHz to 7.8 GHz
	Pre-selector range	—	3.15 GHz to 7.8 GHz, 1.6 GHz to 7.8 GHz (option 03)
	Display frequency accuracy	\pm (Display frequency \times reference frequency accuracy + span \times span accuracy + resolution bandwidth \times 0.15 + 10 Hz)	
	Frequency counter resolution	1, 10, 100 Hz, 1 kHz (counts the received frequency at the peak point inside the zone, RBW 3 MHz or less)	
	Frequency counter accuracy	\pm (Display frequency \times reference frequency accuracy + 2 Hz + 1 LSD) (at S/N 20 dB or more and RBW 3 MHz or less)	
	Frequency span	Setting range: 0 Hz, and 5 kHz to 3.0 GHz Accuracy: $\pm 1.0\%$ (at data point of 1001)	Setting range: 0 Hz, and 5 kHz to 7.8 GHz Accuracy: $\pm 1.0\%$ (at data point of 1001)
	Resolution bandwidth (RBW) [3 dB bandwidth]	Setting range: 300 Hz to 3 MHz (1-3 sequence), 5, 10, 20 MHz (MS2683A: band 0) *Manually settable, or automatically settable according to frequency span Accuracy: $\pm 20\%$ (300 Hz to 10 MHz), $\pm 40\%$ (20 MHz) Selectivity (60 dB: 3 dB): $\leq 15 : 1$	
	Video bandwidth (VBW)	1 Hz to 3 MHz (1-3 sequence), Off *Manually settable, or automatically settable according to RBW	
	Signal purity	Sideband noise: ≤ -108 dBc/Hz (1 GHz, 10 kHz offset) ≤ -120 dBc/Hz (1 GHz, 100 kHz offset)	
Reference oscillator	Frequency: 10 MHz Start-up characteristics: $\leq 5 \times 10^{-8}$ (after 10 minutes warm-up, with frequency after 24 hours warm-up referenced) Aging rate: $\leq 2 \times 10^{-8}$ /day, $\leq 1 \times 10^{-7}$ /year (with frequency after 24 hours of warm-up referenced) Temperature characteristics: $\pm 5 \times 10^{-8}$ (0° to 50°C, with frequency at 25°C referenced)		
Amplitude	Level measurement	Measurement range: Average noise level to +30 dBm Maximum input level: +30 dBm (Continuous average power, RF ATT: ≥ 10 dB) Peak pulse input: +47 dBm (pulse width: ≤ 1 μ s, duty ratio: $\leq 1\%$, RF ATT: ≥ 30 dB) DC voltage: 0 V	
		<p>Average noise level display RBW: 300 Hz, VBW: 1 Hz, RF ATT 0 dB, in SAMPLE detection mode [Without option 08] ≤ -124 dBm + f [GHz] dB (1 MHz to 2.5 GHz) ≤ -120 dBm + f [GHz] dB (2.5 GHz to 3 GHz) [With option 08] ≤ -122 dBm + 1.5f [GHz] dB (1 MHz to 2.5 GHz) ≤ -120 dBm + 1.5f [GHz] dB (2.5 GHz to 3 GHz) Residual response: ≤ -100 dBm (1 MHz to 3 GHz)</p> <p>Average noise level display RBW: 300 Hz, VBW: 1 Hz, RF ATT 0 dB, in SAMPLE detection mode [Without option 08] ≤ -124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, band 0) ≤ -120 dBm + f [GHz] dB (2.5 GHz to 3.2 GHz, band 0) ≤ -122 dBm + 0.5f [GHz] dB (3.15 GHz to 7.8 GHz, band 1) [With option 08] ≤ -122 dBm + 1.5f [GHz] dB (1 MHz to 2.5 GHz, band 0) ≤ -120 dBm + 1.5f [GHz] dB (2.5 GHz to 3.2 GHz, band 0) ≤ -122 dBm + 0.5f [GHz] dB (3.15 GHz to 7.8 GHz, band 1) Residual response: ≤ -100 dBm (1 MHz to 3.2 GHz, band 0) ≤ -90 dBm (3.15 GHz to 7.8 GHz, band 1)</p>	
Reference level	<p>Setting range Log scale: -100 to $+40$ dBm, or equivalent level Linear scale: 2.24 μV to 22.4 V Unit Log scale: dBm, dBμV, dBmV, dBμV (emf), W, V, dBμV/m Linear scale: V Reference level accuracy: ± 0.5 dB (-49.9 to 0 dBm), ± 0.75 dB ($+0.1$ to $+30$ dBm, -69.9 to -50 dBm), ± 1.5 dB (-80 to -70 dBm) *After calibration, at 50 MHz, span: 1 MHz (when RF ATT, RBW, VBW, and sweep time set to AUTO) RBW switching uncertainty: ± 0.3 dB (300 Hz to 5 MHz), ± 0.5 dB (10, 20 MHz) *After calibration, with RBW 3 kHz referenced Input attenuator (RF ATT) Setting range: 0 to 62 dB (2 dB step), manually settable, or automatically settable according to reference level Switching uncertainty: ± 0.3 dB (10 to 50 dB), ± 0.5 dB (52 to 62 dB) *After calibration, with 50 MHz, RF ATT: 10 dB referenced Input attenuator switching mode: 2, 10 dB step mode</p>		

Model		MS2681A	MS2683A
Amplitude	Frequency response	±0.6 dB (9 kHz to 3 GHz) *With 50 MHz referenced, RF ATT: 10 dB, 18° to 28°C ±1.0 dB (9 kHz to 3 GHz) *With 50 MHz referenced, RF ATT: 10 to 62 dB	±0.6 dB (9 kHz to 3.2 GHz, band 0) ±1.0 dB (3.15 GHz to 7.8 GHz, band 1) ±1.0 dB (option 03, 1.6 GHz to 7.8 GHz, band 1) *With 50 MHz referenced, RF ATT: 10 dB, 18° to 28°C ±1.0 dB (9 kHz to 3.2 GHz, band 0) ±2.0 dB (3.15 GHz to 7.8 GHz, band 1) ±2.0 dB (1.6 GHz to 7.8 GHz, band 1) *With 50 MHz referenced, RF ATT: 10 to 62 dB after pre-selector tuning for band 1.
	Waveform display	Scale: 10 div (single scale) Log scale: 10, 5, 2, 1 dB/div Linear scale: 10, 5, 2, 1%/div Linearity (after calibration) Log scale: ±0.4 dB (-20 to 0 dB, RBW: ≤1 kHz), ±1.0 dB (-70 to 0 dB, ≤1 kHz), ±1.2 dB (-90 to 0 dB, ≤1 kHz) Linear scale: 4% of reference level Marker level resolution Log scale: 0.01 dB, Linear scale: 0.02%	
	Spurious response	2nd harmonic distortion: ≤-60 dBc (10 MHz to 200 MHz) ≤-75 dBc (200 MHz to 850 MHz) ≤-70 dBc (850 MHz to 1.5 GHz) *Mixer input: -30 dBm Two-signal third-order intermodulation distortion (Frequency difference of two signals: ≥50 kHz, Mixer input: -30 dBm): ≤-70 dBc (10 MHz to 100 MHz) ≤-85 dBc (100 MHz to 3 GHz) Image response: ≤-70 dBc	2nd harmonic distortion: ≤-60 dBc (10 MHz to 200 MHz) ≤-75 dBc (200 MHz to 850 MHz, band 0) ≤-70 dBc (850 MHz to 1.6 GHz, band 0) *Mixer input: -30 dBm ≤-90 dBc (1.6 GHz to 3.9 GHz, band 1) ≤-90 dBc (option 03, 800 MHz to 3.9 GHz, band 1) *Mixer input: -10 dBm Two-signal third-order intermodulation distortion (Frequency difference of two signals: ≥50 kHz, Mixer input: -30 dBm): ≤-70 dBc (10 MHz to 100 MHz) ≤-85 dBc (100 MHz to 7.8 GHz) Image response: ≤-70 dBc
	1 dB gain compression	≥0 dBm (≥100 MHz) ≥+3 dBm (≥500 MHz)	≥0 dBm (≥100 MHz) ≥+3 dBm (≥500 MHz, band 1) ≥0 dBm (≥3.15 GHz, band 1) ≥0 dBm (option 03: ≥1.6 GHz, band 1)
	Maximum dynamic range	1 dB gain compression to average noise level [Without Option 08] ≥124 dB - f [GHz] dB (typ., 0.1 GHz to 3 GHz) [With Option 08] ≥122 dB - 1.5f [GHz] dB (typ., 0.1 GHz to 3 GHz)	1 dB gain compression to average noise level [Without option 08] ≥124 dB - f [GHz] dB (typ., 0.1 GHz to 3.2 GHz, band 0) ≥122 dB - 0.5f [GHz] dB (typ., 3.15 GHz to 7.8 GHz, band 1) [With option 08] ≥122 dB - 1.5f [GHz] dB (typ., 0.1 GHz to 3.2 GHz, band 0) ≥122 dB - 0.5f [GHz] dB (typ., 3.15 GHz to 7.8 GHz, band 1)
Frequency sweep	Sweep mode	Continuous, Single	
	Sweep time	Setting range: 10 ms to 1000 s *Manually settable, or automatically settable according to RBW and VBW Set resolution: 5 ms (5 ms to 1 s), Top three digits (≥1 s) Accuracy: ±3%	
	Trigger switch	Free run, Triggered	
	Trigger source	Wide IF video, External (TTL), External (±10 V), Line	
	Gate sweep mode	Off, Random sweep mode Setting range Gate delay range: 0 to 65.5 ms (Resolution: 1 μs) Gate length range: 2 μs to 65.5 ms (Resolution: 1 μs) Gate end: Internal/External	
	Zone sweep	Sweeps the indicated range in the zone only.	—
Tracking sweep	Sweeps following the peak point inside the zone marker (zone sweep also available)	—	
Time sweep	Sweep mode	Continuous, Single	
	Sweep time	Setting range/resolution: 1 μs to 50 μs (1-2-5 sequence), 100 μs to 4.9 ms (100 μs resolution), 5.0 ms to 1 s (5 ms resolution), 1 ms to 1000 s (setting of top three digits) Accuracy: ±1%	
	Trigger switch	Free run, Triggered	
	Trigger source	Wide IF video, Video, External (TTL), External (±10 V), Line	
	Trigger delay	Pre-trigger (displays waveform before trigger occurrence point) Setting range: - time span to 0 s Trigger delay: Resolution: time span/500 ns or 100 ns, whichever is larger Post-trigger Setting range: 0 to 65.5 ms Resolution: 100 ns (sweep time: ≤4.9 ms), 1 μs (sweep time: ≥5 ms)	

Model	MS2681A	MS2683A
Functions	Number of data points	Selectable between 501 and 1001
	Detection mode	NORMAL, POSITIVE PEAK, NEGATIVE PEAK, SAMPLE, AVERAGE
	Display functions	TRACE A, TRACE B, TRACE A/BG, TRACE A/TIME Trace calculation: A → B, B → A, A ↔ B, A + B → A, A - B → A, A - B + DL → A
	Storage functions	NORMAL, VIEW, MAX HOLD, MIN HOLD, AVERAGE, CUMULATIVE, OVER WRITE
	Marker	Signal search: AUTO TUNE, PEAK → CF, PEAK → REF, SCROLL Zone marker: NORMAL, DELTA Marker functions: MARKER → CF, MARKER → REF, MARKER → CF STEP SIZE, ΔMARKER → SPAN, ZONE → SPAN Peak search: PEAK, NEXT PEAK, MIN DIP, NEXT DIP Multi marker: 10 max. (highest 10, harmonics, manually)
	Measure	Noise power: dBm/Hz, dBm/CH, dBμV/√Hz C/N: dBc/Hz, dBc/CH Occupied bandwidth: Power N% method, X-dB down method Adjacent channel leakage power REF: Total power/Reference level/In-band level method Display: Channel designate display: 3 channels × 2, Graphic display Average power within burst signal: Average power in the designated range of time domain waveform Template comparison (at time sweep): Upper limit × 2, Lower limit × 2 MASK (at frequency sweep): Upper limit × 2, Lower limit × 2
Correction	Frequency response can be corrected arbitrarily up to 150 points	
Others	Display	Color TFT-LCD, VGA 6.5-inch
	Color	Number of colors: 4096, RGB, Each 16-scale settable
	Intensity	Settable in 5 steps (display off included)
	Contents	Scale, Waveform data, Setting condition, Menu, Title
	Save/Recall	Saves and recalls setting conditions and waveform data to internal memory (max. 12) or memory card
	Hard copy	Displayed data can be hard-copied with the printer via parallel interface (PCL level 3 or lower, or ESC/P-J83, J84 compatible models only)
	GPIB	Meets IEEE488.2. Controllable with external controller (except for power switch) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
	Parallel interface	Centronics-compatible, Outputs print data to printer, D-Sub 25 pin connector (jack) Data line exclusive for output: 8, Control line: 4 (BUSY, DTSB, ERROR, PE)
	PC card interface	Saves and recalls setting condition and waveform data, ATA flash card accessible (3.3 V/5 V), Connector: Type I or Type II of PC card
RS-232C	Controllable with external controller (except for power switch) Baud rate: 1200, 2400, 4800, 9600 bps, 19.2, 38.4, 56, 115 kbps	
Input/Output connector	Input connector: N-J, 50 Ω (nominal) Impedance: VSWR ≤1.5 (typ., RF ATT: ≥10 dB) Video output: outputs analog RGB, D-Sub 15 pin connector (jack) IF output: BNC connector, 50 Ω (nominal, 66/10.69 MHz) Level: -10 dBm (typ., frequency 50 MHz, display scale upper edge, 50 Ω terminated) Broadband IF output: BNC connector, 50 Ω (nominal, 60.69/66 MHz) Gain: 0 dB typ. (50 MHz, RF ATT: 0 dB, for RF input level) Video output (Y): BNC connector Level: 0 to 0.5 V ± 0.1 V (typ., log scale), 0 to 0.4 V ± 0.1 V (typ., linear scale), (50 MHz, from upper edge to lower edge at 10 dB/div or 10%/div, 75 Ω terminated) Buffered Output: BNC connector, Level: 2 to 5 V (p-p) (200 Ω terminated) Sweep Output (X): BNC connector, Level: 0 to 10 V ± 0.1 V (100 kΩ termination, from the left edge to the right edge of the display scale, single band sweep) Sweep Status Output (Z): BNC connector, Level: TTL (low level at sweep) Probe source: 4 pole connector, +12 V, -12 V, ±10% each, 110 mA max. each. Trig/Gate input: BNC connector, level: ±10 V (0.1 V resolution), or TTL level External reference input: BNC connector, Frequency: 10 MHz ±10 Hz, 13 MHz ±13 Hz, Level: ≥0 dBm	
Dimensions and mass	320 (W) × 177 (H) × 411 (D) mm (handle, leg, front cover, fan cover excluded), ≤16 kg (nominal value)	
Power supply	100 to 120 VAC/200 to 240 VAC (-15/+10%, 250 V max., wide range input), 47.5 Hz to 63 Hz, ≤400 VAC	
Ambient temperature and humidity	0° to +50°C, RH ≤85% (no condensation allowed)	
Storage temperature range	-20° to +60°C	
EMC	EN61326-1, EN61000-3-2	
LVD	EN61010-1	

Options

■ MS2681A/MS2683A Options

Option 01: Precision Frequency Reference

Frequency	10 MHz
Start-up characteristics	$\leq \pm 5 \times 10^{-8}$ (≤ 7 minutes, 25°C, typ.)
Aging rate	$\leq \pm 5 \times 10^{-10}$ /day (With the frequency at 24 hours after the power is turned on referenced)
Temperature characteristics	$\leq \pm 5 \times 10^{-10}$ (With the frequency at 0° to 50°C and 25°C referenced)

■ MS2681A/MS2683A Options

Option 02: Narrow Resolution Bandwidths (FFT)

	MS2681A	MS2683A
Resolution bandwidth	Setting range: 1 Hz to 1 kHz (1-3 sequence) Bandwidth accuracy: $\pm 10\%$ (RBW = 30, 300 Hz), $\pm 10\%$ (typ., RBW = 1, 3, 10, 100 Hz, 1 kHz) RBW selectivity (60 dB: 3 dB): $\leq 5:1$ RBW switching uncertainty: ± 0.5 dB	
Span setting	Minimum setting span: 100 Hz	
Average noise level display	When RBW is 1 Hz and RF ATT is 0 dB [Without Option 08] ≤ -148.3 dBm + f [GHz] dB (typ., 1 MHz to 2.5 GHz) ≤ -146.3 dBm + f [GHz] dB (typ., 2.5 GHz to 3 GHz) [With Option 08] ≤ -146.3 dBm + 1.5f [GHz] dB (typ., 1 MHz to 2.5 GHz) ≤ -144.3 dBm + 1.5f [GHz] dB (typ., 2.5 GHz to 3 GHz)	When RBW is 1 Hz and RF ATT is 0 dB [Without Option 08] ≤ -146.5 dBm + f [GHz] dB (typ., 1 MHz to 2.5 GHz, band 0) ≤ -142.5 dBm + f [GHz] dB (typ., 2.5 GHz to 3.2 GHz, band 0) ≤ -144.5 dBm + 0.5f [GHz] dB (typ., 3.15 GHz to 7.8 GHz, band 1) [With Option 08] ≤ -144.5 dBm + 1.5f [GHz] dB (typ., 1 MHz to 2.5 GHz, band 0) ≤ -140.5 dBm + 1.5f [GHz] dB (typ., 2.5 GHz to 3.2 GHz, band 0) ≤ -138.5 dBm + 0.5f [GHz] dB (typ., 3.15 GHz to 7.8 GHz, band 1)

■ MS2683A Options

Option 03: Extension of Pre-selector Lower Limit to 1.6 GHz

Function	Extends the lowest frequency of pre-selector from 3.15 GHz to 1.6 GHz
Frequency band	0 band: 9 kHz to 3.2 GHz, 1-L band: 1.6 GHz to 3.2 GHz, 1- band: 3.15 GHz to 6.3 GHz, 1+ band: 6.2 GHz to 7.8 GHz
Pre-selector range	1.6 GHz to 7.8 GHz (band: 1-L, 1-, 1+)
Average noise level	≤ -122 dBm + 0.5f [GHz] dB (1.6 GHz to 7.8 GHz, band 1, RBW: 300 Hz, VBW: 1 Hz, RF ATT: 0 dB)
Residual response	≤ -90 dBm (1.6 GHz to 7.8 GHz, band 1, RF ATT: 0 dB, input terminated at 50 Ω)
Frequency response	± 1.0 dB (with 1.6 GHz to 7.8 GHz, band 1, and 50 MHz referenced, when RF ATT is 10 dB and temperature is 18° to 28°C) ± 2.0 dB (1.6 GHz to 7.8 GHz, band 1, RF ATT: 10 to 62 dB) *After pre-selector tuning for band 1
2nd harmonic distortion	≤ -90 dBc (0.8 GHz to 3.9 GHz, band 1, mixer input: -10 dBm)
1 dB gain compression	≥ 0 dBm (1.6 GHz to 7.8 GHz, band 1)
Maximum dynamic range	≥ -122 dB + 0.5f [GHz] dB (1.6 GHz to 7.8 GHz, band 1)

■ MS2681A/MS2683A Options

Option 04: Digital Resolution Bandwidth

	MS2681A	MS2683A
Resolution bandwidth	Setting range: 10 Hz to 1 MHz (1-3 sequence) Bandwidth accuracy: $\pm 10\%$ (RBW: ≥ 100 Hz), $\pm 10\%$ (typ., RBW: ≤ 30 Hz) Bandwidth selectivity (60 dB: 3 dB): $\leq 5:1$ (RBW ≥ 100 Hz), $\leq 5:1$ (typ., RBW: ≤ 30 Hz) RBW switching uncertainty: ± 0.5 dB	
Span setting	Minimum span setting: 1 kHz	
Detection mode	NORMAL, POSITIVE PEAK, NEGATIVE PEAK, SAMPLE, RMS RMS: Displays root-mean-square value of average power between sample points	
Average noise level	When RBW is 10 Hz and RF ATT is 0 dB [Without Option 08]: ≤ -136.5 dBm + f [GHz] dB (typ., 1 MHz to 2.5 GHz) ≤ -132.5 dBm + f [GHz] dB (typ., 2.5 GHz to 3 GHz) [With Option 08]: ≤ -134.5 dBm + 1.5f [GHz] dB (typ., 1 MHz to 2.5 GHz) ≤ -130.5 dBm + 1.5f [GHz] dB (typ., 2.5 GHz to 3 GHz)	When RBW is 10 Hz and RF ATT is 0 dB [Without Option 08] ≤ -136.5 dBm + f [GHz] dB (typ., 1 MHz to 2.5 GHz, band 0) ≤ -132.5 dBm + f [GHz] dB (typ., 2.5 GHz to 3.2 GHz, band 0) ≤ -134.5 dBm + 0.5f [GHz] dB (typ., 3.15 GHz to 7.8 GHz, band 1) [With Option 08] ≤ -134.5 dBm + 1.5f [GHz] dB (typ., 1 MHz to 2.5 GHz, band 0) ≤ -130.5 dBm + 1.5f [GHz] dB (typ., 2.5 GHz to 3.2 GHz, band 0) ≤ -134.5 dBm + 0.5f [GHz] dB (typ., 3.15 GHz to 7.8 GHz, band 1)

■ MS2681A/MS2683A Options

Option 08: Pre-amplifier*1

	MS2681A	MS2683A
Frequency range	100 kHz to 3 GHz	
Gain	20 dB (typ.)	
Noise figure	6.5 dB (typ., input frequency: ≤2 GHz), 12 dB (typ., input frequency: >2 GHz)	
Level measurement range	Average noise level display to +10 dBm	
Max. input level	CW average power: +10 dBm	
Reference level	Setting range Log scale: -120 to +10 dBm, or equivalent Linear scale: 2.24 μV to 707 mV Reference level accuracy: ±0.9 dB (-69.9 to +10 dBm), ±1.5 dB (-90 to -70 dBm) *After calibration, with 50 MHz referenced, 1 MHz span (RF ATT, RBW, VBW, and sweep time set to AUTO) RBW switching uncertainty: ±0.5 dB (300 Hz to 5 MHz), ±0.75 dB (10, 20 MHz) RF ATT switching uncertainty: ±0.5 dB (10 to 50 dB), ±0.75 dB (52 to 62 dB) *With 50 MHz and RF ATT 10 dB referenced	
Average noise level display	-137 dBm + 2f [GHz] dB (1 MHz to 3 GHz)	-137 dBm + 2f [GHz] dB (1 MHz to 2.5 GHz, band 0)
	*When RBW is 300 Hz, VBW is 1 Hz, RF ATT is 0 dB, and detection mode is set to SAMPLE	
Frequency response	±2.0 dB (100 kHz to 3 GHz) *With 50 MHz referenced, when RF ATT is 10 to 50 dB, and temperature is 18° to 28°C	
Linearity of waveform display	Log scale (after calibration): ±0.5 dB (-20 to 0 dB, RBW: ≤1 kHz), ±1.0 dB (-60 to 0 dB, RBW: ≤1 kHz), ±1.5 dB (-75 to 0 dB, RBW: ≤1 kHz) Linear scale (after calibration): ±5% (relative to reference level)	
Spurious response	≤-70 dBc (10 MHz to 3 GHz) *Frequency difference of two signals: ≥50 kHz, At pre-amplifier input level of -55 dBm*2	
1 dB gain compression	≥-35 dBm (input frequency ≥100 MHz) *At pre-amplifier input level	

*1: Overall specification with pre-amplifier ON (Noise figure and gain are single performance of pre-amplifier.)

*2: Pre-amplifier input level is shown by the Right equation: Pre-amplifier input level = RF input level - RF ATT setting level

■ MS2681A/MS2683A Options

Option 09: Ethernet Interface

Function	Control with external controller (except for power switch)
Connector	10BASE-T

■ MS2681A/MS2683A Options

Option 17: I/Q Balanced Input

Connector	BNC
Impedance	Selectable between 1 MΩ (parallel capacity <100 pF) and 50 Ω
Input level range	Differential voltage range: 0.1 to 1 Vp-p (at input terminal) In-phase voltage range: ±2.5 V (at input terminal)

■ MS2681A/MS2683A Options

Option 18: I/Q Unbalanced Input

Connector	BNC
Impedance	Selectable between 1 MΩ (parallel capacity <100 pF) and 50 Ω
Input level range	Differential voltage range: 0.1 to 1 Vp-p (at input terminal) Changeable between DC connection and AC connection

■ MS2683A Options

Option 34: 4 GHz LO Output

Frequency	Frequency: 4 GHz Frequency accuracy: ± (4 GHz × reference frequency accuracy) ±1 Hz
Output level	-10 dBm (typ.)
Spurious	≤-40 dBc (typ.)

■ MS2681A/MS2683A Options

Option 46: Auto Power Recovery

Function	Disables the power switch on the front panel and automatically restores power after power failure. ON/OFF operation can be performed using the standby switch on the rear panel. *Power switch on the front panel of this unit does not have a latching function. Therefore, if power is interrupted in the ON status, the standby status is kept even after power is restored.
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■ MS2681A/MS2683A Options

Option 47: Rack Mount (IEC)

Function	Mounts the rack mount for IEC standard-compatible rack. When mounted, the tilt handle (standard) is eliminated.
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■ MS2681A/MS2683A Options

Option 48: Rack Mount (JIS)

Function	Mounts the rack mount for JIS standard-compatible rack. When mounted, the tilt handle (standard) is eliminated.
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Ordering Information

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

Model/Order No.	Name
MS2681A MS2683A	Main frame Spectrum Analyzer Spectrum Analyzer
	Standard accessories
J0996B	Power Cord, 2.6 m: 1 pc
Z0808	RS-232C Cable: 1 pc
F0014	Memory Card: 1 pc
MX268001A	Fuse, 6.3 A: 1 pc
W1754AE	File Transfer Utility: 1 pc MS2681A/2683A Operation Manual: 1 copy
	Options
MS2681A-01	Precision Frequency Reference (aging rate: $\pm 5 \times 10^{-10}/\text{day}$)
MS2681A-02	Narrow Resolution Bandwidths (FFT)
MS2681A-04	Digital Resolution Bandwidth
MS2681A-08	Pre-amplifier
MS2681A-09	Ethernet Interface
MS2681A-17	I/Q Balanced Input
MS2681A-18	I/Q Unbalanced Input
MS2681A-46	Auto Power Recovery
MS2681A-47	Rack Mount (IEC) without Handles
MS2681A-48	Rack Mount (JIS) without Handles
MS2683A-01	Precision Frequency Reference (aging rate: $\pm 5 \times 10^{-10}/\text{day}$)
MS2683A-02	Narrow Resolution Bandwidths (FFT)
MS2683A-03	Extension of Pre-selector Lower Limit to 1.6 GHz
MS2683A-04	Digital Resolution Bandwidth
MS2683A-08	Pre-amplifier
MS2683A-09	Ethernet Interface
MS2683A-17	I/Q Balanced Input
MS2683A-18	I/Q Unbalanced Input
MS2683A-34	4 GHz LO Output
MS2683A-46	Auto Power Recovery
MS2683A-47	Rack Mount (IEC) without Handles
MS2683A-48	Rack Mount (JIS) without Handles
	Measurement software
MX268101B	W-CDMA Measurement Software
MX268102A	GSM Measurement Software
MX268103A	cdma Measurement Software
MX268104A	1xEV-DO Measurement Software
MX268105A	$\pi/4$ DQPSK Measurement Software
MX268130A	WIRELESS LAN Measurement Software
MX268151A	W-CDMA Release5 Uplink Measurement Software
MX268160A	TD-SCDMA Measurement Software
MX268301B	W-CDMA Measurement Software
MX268302A	GSM Measurement Software
MX268303A	cdma Measurement Software
MX268304A	1xEV-DO Measurement Software
MX268305A	$\pi/4$ DQPSK Measurement Software
MX268330A	WIRELESS LAN Measurement Software
MX268351A	W-CDMA Release5 Uplink Measurement Software
MX268360A	TD-SCDMA Measurement Software

Model/Order No.	Name
	Application parts
W1746AE	W-CDMA Measurement Software Operation Manual
W1854AE	GSM Measurement Software Operation Manual
W1865AE	cdma Measurement Software Operation Manual
W2090AE	1xEV-DO Measurement Software Operation Manual
W1866AE	$\pi/4$ DQPSK Measurement Software Operation Manual
W2080AE	WIRELESS LAN Measurement Software Operation Manual
W2617AE	W-CDMA Release5 Uplink Measurement Software Operation Manual
W2593AE	TD-SCDMA Measurement Software Operation Manual
J0576D	Coaxial Cord (N-P, 5D-2W, N-P), 2 m
J0561	Coaxial Cord (N-P, 5D-2W, N-P), 1 m
J0104A	Coaxial Cord (BNC-P, RG-55/U, N-P), 1 m
J0127C	Coaxial Cord (BNC-P, RG-58A/U, BNC-P), 0.5 m
J0127A	Coaxial Cord (BNC-P, RG-58A/U, BNC-P), 1 m
0007	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
J1047	Ethernet Cross Cable
MA1612A	Four-port Junction Pad (5 MHz to 3000 MHz)
MA1621A	50 Ω \rightarrow 75 Ω Impedance Transformer (75 Ω , 9 kHz to 3 GHz, ± 100 V, NC-type)
MP614B	50 \rightarrow 70 Ω Impedance Converter (50 to 1200 MHz, 1.5 dB or lower)
J0395	Fixed Attenuator for High-power (30 dB, 30 W, DC to 9 GHz)
B0472	Fixed Attenuator for High-power (30 dB, 100 W, DC to 18 GHz)
J0078	High Power Attenuator (N type, 20 dB, 10 W, DC to 18 GHz)
MA2507A	DC Block Adaptor (50 Ω , 9 kHz to 3 GHz, ± 50 V)
J0805	DC Block, N type (10 kHz to 18 GHz, made by Wineshell)
B0452A	Hard Carrying Case (with casters)
B0452B	Hard Carrying Case (without casters)
B0488	Rear Panel Protective Pad
W1888AE	Assembling Guide Drawing for Rear Protective Pad (supplied with B0488 as standard)
B0481B	Carrybone
B0479	Soft Carrying Case (rucksack type)
	Warranty
MS2681A-90	Extended Three Year Warranty Service
MS2681A-91	Extended Five Year Warranty Service
MS2683A-90	Extended Three Year Warranty Service
MS2683A-91	Extended Five Year Warranty Service

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