Anritsu

MS2651B/2661B

Spectrum Analyzer

9 kHz to 3 GHz

For various applications

Portable at Only 11 kg

In the latest radio communications systems, the development of improved frequency efficiency and sophisticated digital functions are emphasized. The MS2651B/2661B portable spectrum analyzers are ideal for analyzing the signals of above systems, device and related equipment. They are fully synthesized spectrum analyzers covering a wide frequency range from 9 kHz to 3 GHz. They have superior basic performance such as high C/N ratio, low distortion, and high frequency/level accuracies and are easy to operate. In addition, they use resolution bandwidth filters with a much better selectivity than previously possible. The large selection of options is available to handle a wide range of applications at reasonable cost.
The MS2661B is designed for manufacture and installation of radio equipment and devices, while the MS2651B is meant for maintenance applications.

Compact and lightweight (11 kg in standard configuration)

- Easy portability for installation and maintenance

High C/N and superior distortion characteristics

- Measurement speed improved by using 100 dB log dynamic range

Easy-to-use, simple operation

- Built-in “Measure” function for evaluation of radio equipment (Frequency counter, C/N, channel power, adjacent channel power, occupied frequency bandwidth, burst average power and template pass/fail function)
- User-defined function
- Zone marker/zone sweep
- Two-screen display
- FM demodulation waveform display
- Memory card interface (for saving/recalling trace data and parameter and for saving screen image in bitmap format)

Options support wide range of applications

- High stability crystal oscillator
- Narrow resolution bandwidth (MS2661B only)
- High-speed time domain sweep
- Trigger/gate circuit
- AM/FM demodulator
- Pre-amplifier
- Centronics interface (can not be installed with GPIB simultaneously)
- QP detector
- Television monitor
- DC coupled input (MS2661B only)
- Tracking generator
- 75 Ω input
- 75 Ω tracking generator

Easy to set up automatic measurements

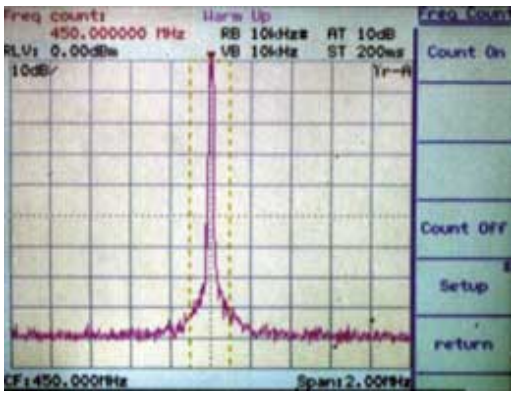
- Controller function built-in (PTA)
- Built-in RS-232C and GPIB (standard)
- Various application software

Compact, Lightweight, and Powerful

●Small and weighing only 11 kg
The MS2651B/2661B are compact and lightweight, measuring 320 (W) × 177 (H) × 351 (D) mm and weighing only 11 kg. In addition to benchtop use, they can be carried easily for field use, making them the ideal choice for manufacturing and maintenance of radio equipment.

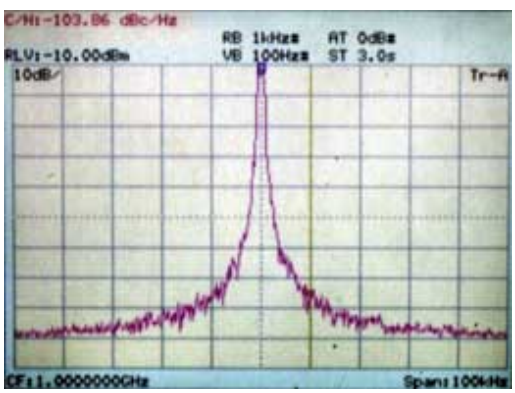
●Synthesized local oscillator
The synthesized local oscillator design permits stable measurement without disturbance due to frequency drift of the spectrum analyzer itself. The level stabilizes in 30 minutes after power-on, making these units especially suitable for on-site maintenance and adjustment where work must be completed quickly.

●Counter with 1 Hz resolution
A full complement of frequency counter functions are provided. Resolution is a high ±1 Hz even at full span, and high-speed frequency measurements can be performed. The high sensitivity compared with ordinary counters makes it easy to select one signal from many and to determine its frequency.



Frequency measurement (1 Hz resolution)

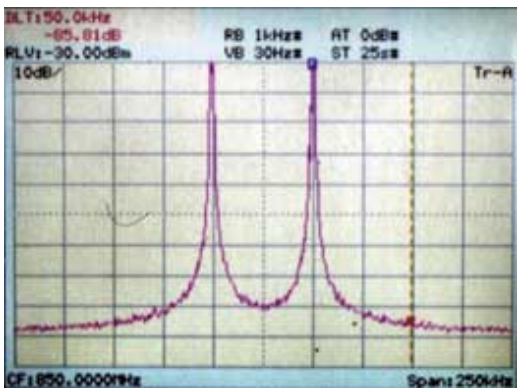
●High C/N ratio
Excellent noise sideband characteristics are required for analysis of weak signals adjacent to strong signals. The MS2661B has low noise sidebands of below –100 dBc/Hz (10 kHz offset), making it suitable for measurement of adjacent channel power of both analog and digital radio communication equipment.



Noise sidebands measurement (10 kHz offset)

●Superior distortion characteristics
The MS2661B boasts extremely low harmonic distortion levels, including a second harmonic distortion of –75 dBc*[1] and a two-signal third order intermodulation distortion of –80 dBc*[2] making it suitable for measuring harmonic components and for evaluating the non-linearity of high-power amplifiers.

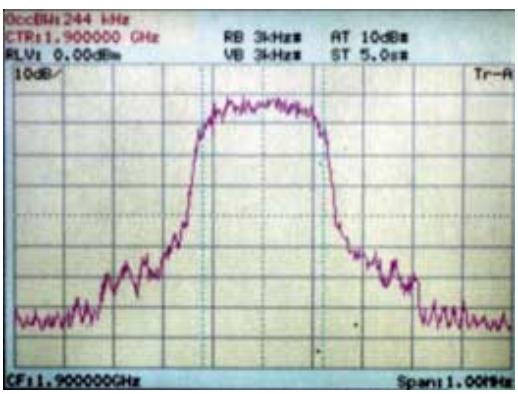
*[1]200 MHz to 1.5 GHz, mixer input: –30 dBm
*[2]100 MHz to 3 GHz, frequency difference between signals: ≥50 kHz, mixer input: –30 dBm



Two-signal third order intermodulation

●100 dB display dynamic range
In measurements requiring a wide dynamic range such as adjacent channel power measurements, the MS2651B/2661B can display more than 80 dB on a single screen.

●Highly-accurate measurement
Auto-calibration ensures an overall level accuracy of within ±1.3 dB.
A span accuracy of 2.5% and 501 sampling points ensure accurate occupied frequency bandwidth and adjacent channel power measurements.



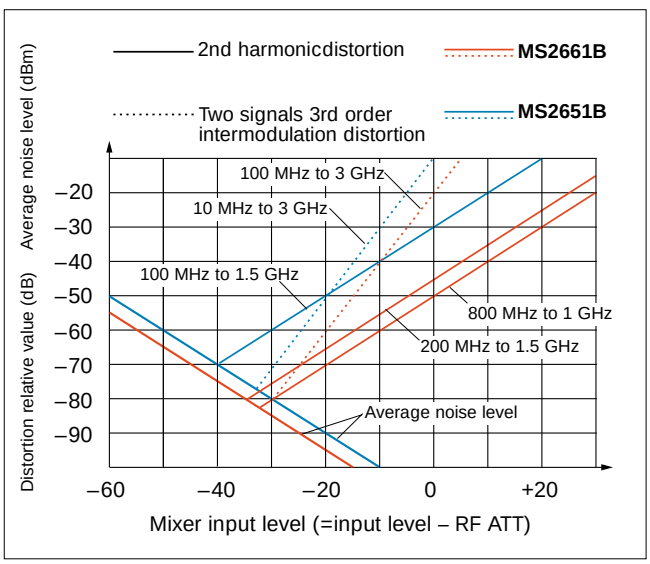
Occupied bandwidth measurement

●MS2651B for maintenance, MS2661B for manufacturing

The optimum applications for the MS2651B and MS2661B are maintenance and manufacturing, respectively, owing to their basic performance such as noise sidebands, average noise level and distortion free dynamic range. The MS2651B is a good choice where there is no need to measure parameters such as adjacent channel power or harmonic distortions. High frequency/level accuracy and 1 Hz-readout-resolution counter which are required especially for maintenance are common features to the MS2651B and MS2661B. The MS2661B is best for manufacturing. It is capable of highly-accurate measurement of adjacent channel power, harmonic spurious components, and in-band spurious components, and can also be used for development.

Model	MS2651B	MS2661B
Noise sideband*1	≤–90 dBc/Hz	≤–100 dBc/Hz
Average noise level*2	≤–110 dBm	≤–115 dBm
Maximum distortion free dynamic range (RBW: 1 kHz)	2nd harmonic: **>**70 dB (100 to 500 MHz) 3rd intermodulation distortion: >76.6 dB (10 to 1000 MHz)	2nd harmonic: **>**80 dB (200 to 500 MHz) 3rd intermodulation distortion: >83.3 dB (100 to 1000 MHz)

*1 1 GHz, 10 kHz offset
*2 1 MHz to 1 GHz, RBW: 1 kHz, VBW: 1 Hz, RF ATT: 0 dB



Distortion characteristics

Convenient Easy-to-Use Functions

●Simple operation

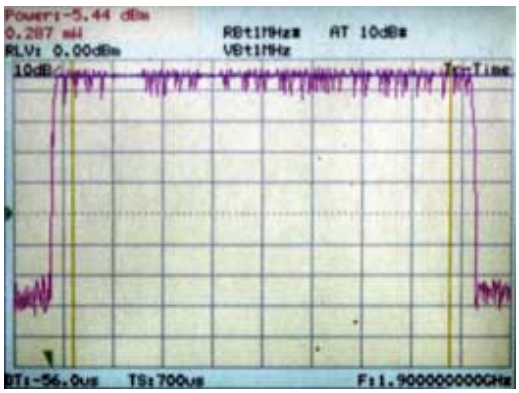
Users require ease of operation in a wide variety of contexts. For greater ease, in addition to simplifying the panel keys and key layout, also menu page configuration is well organized and “page-learning” as well as “user-defined” functions have been added to minimize the steps required for a given procedure.

●Bright color screen

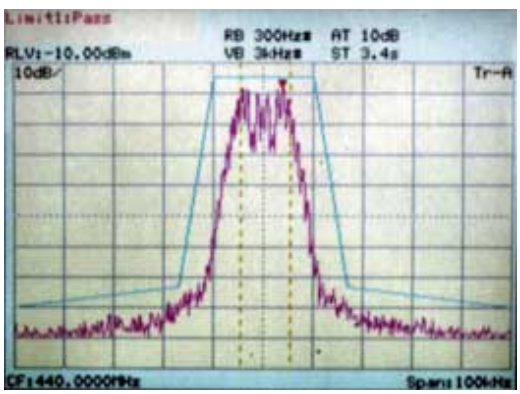
A 5.5" bright color TFT LCD is used to display scales, measured waveform data, settings and other information in different easy-to-read colors. Each color can be changed if required. When the soft key display is turned off, the scale area enlarges to 180 (W) × 80 (H) mm, comparable to an 8" CRT.

●Radio equipment evaluation functions (“Measure” functions)

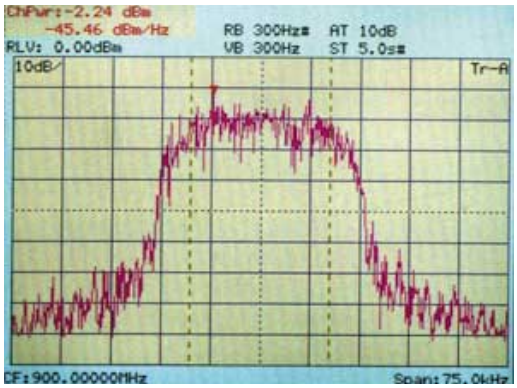
A full range of functions including measurement of power levels, frequencies, adjacent channel power, and mask and time template measurements are provided for performance evaluation of radio equipment. Key operation is simple and high-speed calculations make the measurement fast and efficient.



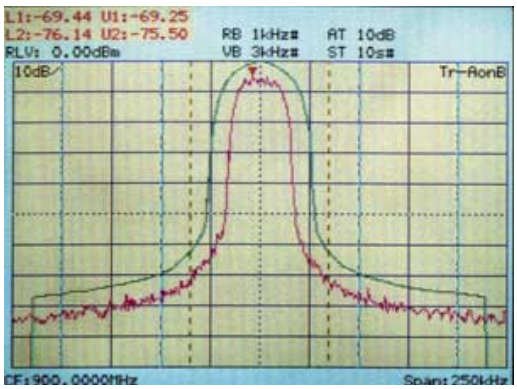
Burst average power measurement



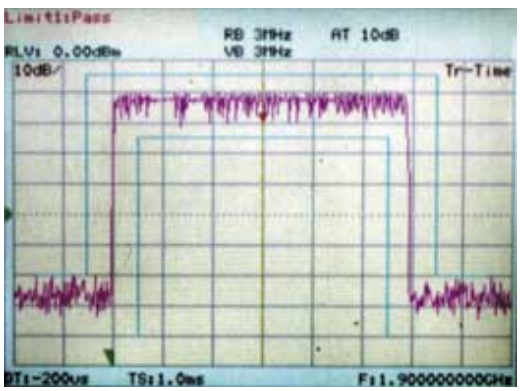
Mask measurement



Channel power measurement



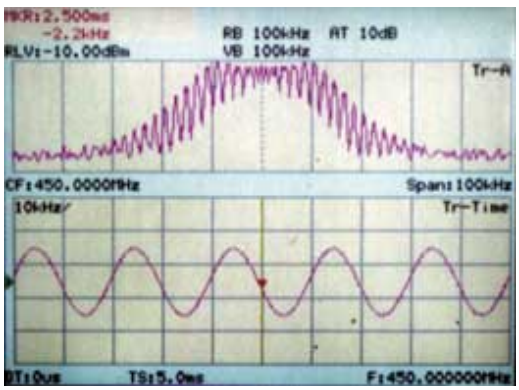
Adjacent channel power measurement



Time template measurement

●FM-demodulated waveform display function

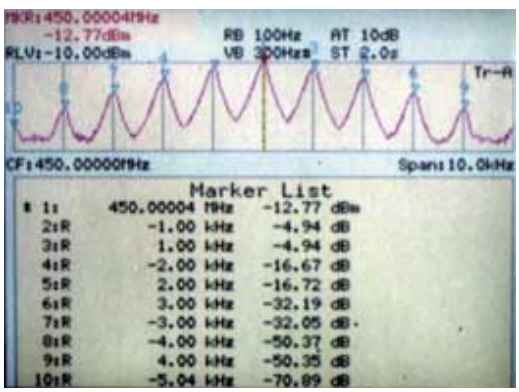
This function displays FM-demodulated waveforms with an accuracy of 5% over the range ±10 kHz to ±1 MHz. When used with high-speed time domain sweep (Option 04) and trigger/gate circuit (Option 06), frequency deviation of the modulated signal, and frequency switching times of radio equipment and VCOs, can be measured.



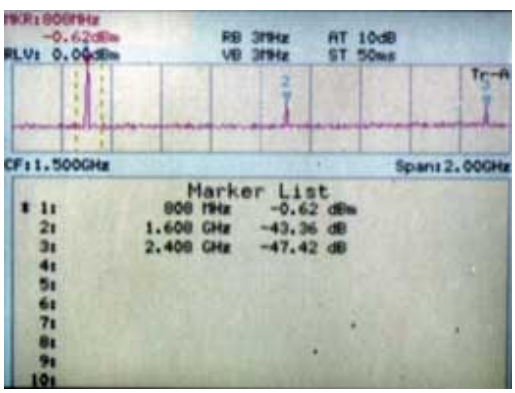
Spectrum and FM-demodulation waveform

●Zone markers and multimarkers

Zone markers can be set automatically at the peak signal within a given marker range, enabling quick measurement. By using the multimarker function, automatic measurements can be performed at up to ten marker points, and the results displayed in a table. Multimarkers have functions for harmonic measurements, highest 10 points and manual setting.



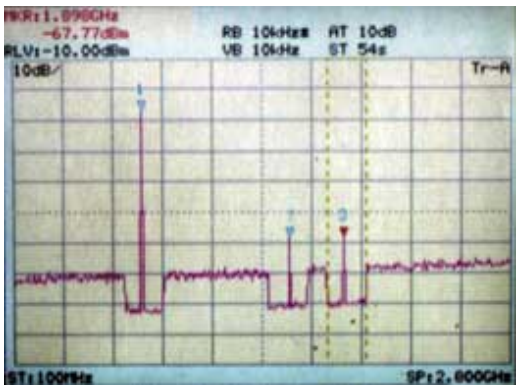
Multimarker (highest 10 points)



Multimarker (harmonics measurement)

●Zone sweep and multi-zone sweep functions

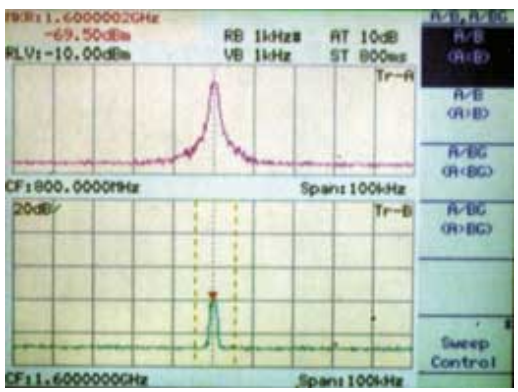
Sweeps can be limited to zones defined by zone markers reducing sweep time. This zone sweep function can be combined with “measure” functions such as “noise measure” which can direct readout the total noise power within the zone, and reduces measurement time greatly. The multi-zone sweep function enables up to ten zones to be swept.



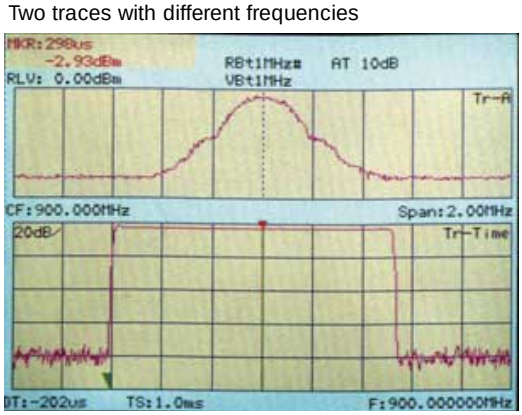
Multi-zone sweep

●Multi-screen display

The Trace A and Trace B waveforms are superimposed on the same screen, and two spectra with different frequencies are displayed simultaneously. In addition, it is possible to simultaneously display spectrum and time domain screens for the same signal. The multi-screen display permits efficient signal level adjustment and harmonic distortion measurement, too. Furthermore, in addition to being able to display amplitude in the time domain, it is also possible to display the FM demodulation waveform.



Two traces with different frequencies



Spectrum and time domain measurement

●User-defined functions

Measurement programs downloaded to the spectrum analyzers from a personal computer or memory card can be executed by defining menu keys. The measurement program is executed simply by pressing the predefined key, with no further operation. Other panel and function keys can also be predefined in the same way.

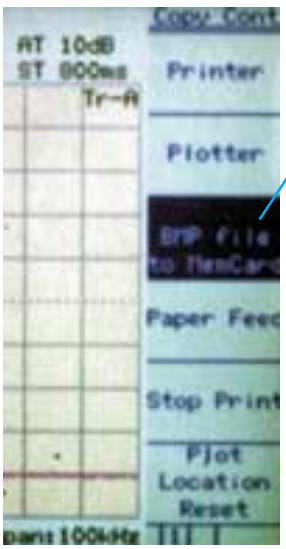
Measurement programs definition (downloaded from personal computer)

Panel and function keys definition

User-defined menu

●Screen image bitmap saved to memory card

Instead of printing a hard copy of the screen, it is also possible to save the screen image data to a memory card in bitmap format. Editing the saved bitmap data using a PC, makes report writing easy.



When the mode to save the screen image in the bitmap format to the memory card is selected as a copy method at the hard copy function, just one press of the copy key saves the screen image as a bitmap format to the memory card. And the file number of each saved file is incremented automatically.

The screen image data can also be saved to the memory card using the save function. In this case, the file number of the saved file can be specified.

Full Range of Options

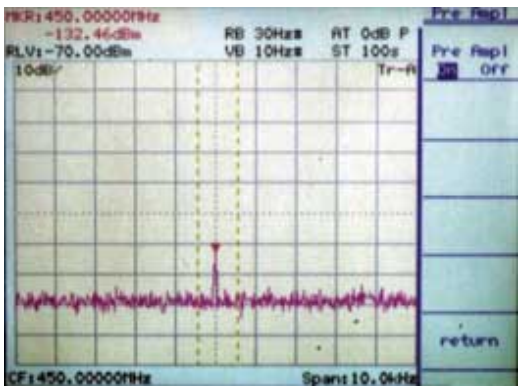
Full lineup of options to select required performance and functions with minimum capital investment

To boost basic performance

Reference crystal oscillator (Option 01)
Adding the optional reference oscillator with a stability of 2 × 10^{-8}/day and 1 × 10^{-7}/year, increases the accuracy of frequency measurements even further.

Narrow resolution bandwidth (MS2661B only, Option 02)
Adding the option for a resolution bandwidth of 30 Hz, 100 Hz and 300 Hz greatly improves frequency resolution.

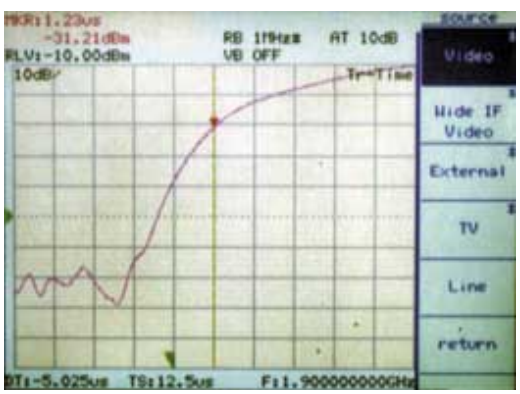
Pre-amplifier (Option 08)
The pre-amplifier improves the sensitivity (noise figure) of the spectrum analyzer, and is best used when studying interference signals and other low-power signals. It covers a frequency range from 100 kHz to 3 GHz.



Low-power signal measurement using RF pre-amplifier

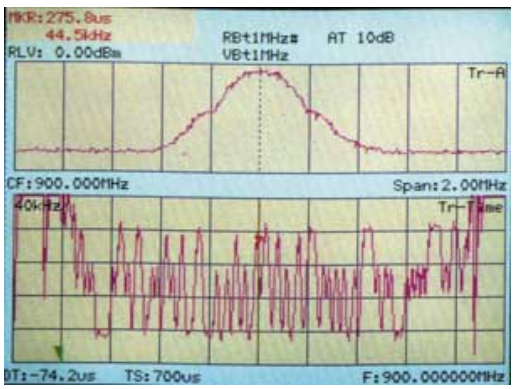
For testing digital mobile communication equipment

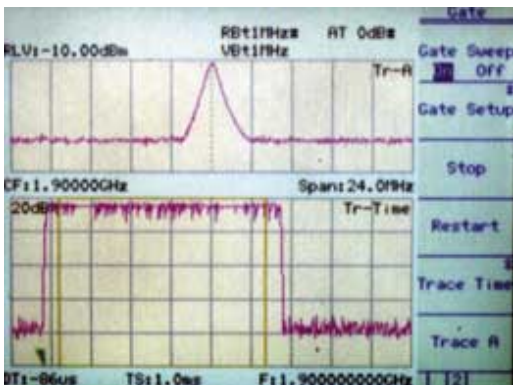
High-speed time domain sweep (Option 04)
Testing of TDMA-type radio equipment includes time domain (zero-span) measurements of antenna power, transient response characteristics of burst transmissions, transmission timing, and other quantities. The high-speed time domain sweep option boosts sweep time to 12.5 µs and resolution to 0.025 µs. This option must be used with the trigger/gate circuit (Option 06).



High-speed time-domain measurement (TS=12.5 µs)

Trigger/gate circuit (Option 06)
Burst signal and TV signals etc. can be stably measured using the trigger function in time-domain measurements. One of the external, video wide IF video, line or TV is selectable. This makes a variety of TDMA radio equipment tests possible, including template comparison using pre-trigger and post-trigger delay functions, and gate spectrum analysis using the gate sweep function. Previously, the trigger output from an external detector was required in gate spectrum analysis. However, this option for the MS2651B/2661B has a 20 MHz wide IF video trigger function, eliminating the need for trigger output from an external detector.


Wide IF video trigger function



Wide IF video trigger and gate functions

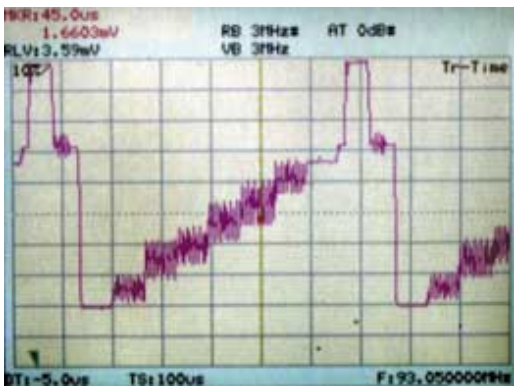
For CATV maintenance

75 Ω input (Option 22)
Converts RF input impedance to 75 Ω (100 kHz to 2.5 GHz)

75 Ω tracking generator (Option 23)
For 75 Ω output

AM/FM demodulator (Option 07)
Demodulates AM/FM signals, enabling audio monitoring using internal speaker or earphones.
This is useful for distinguishing between signals and interfering spurious.

Television monitor (Option 16)
This option displays TV (NTSC or PAL) signals. When used with the AM/FM demodulator (Option 07), audio signals can be monitored simultaneously. With addition of high-speed time domain sweep (Option 04) and the trigger/gate circuit (Option 06), measurement of CATV parameters such as carrier level/frequency, C/N, modulation, distortion, hum and low-frequency interference etc. becomes possible.



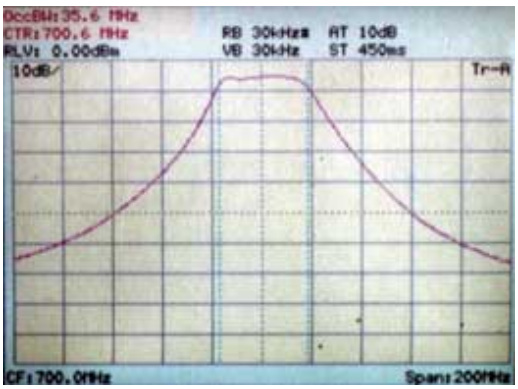
NTSC TV waveform

For measurement of filter frequency response and antenna impedance response

Tracking generator (Option 20) covers a frequency range of 9 kHz to 3 GHz at levels of 0 to –60 dBm while tracking generator (Option 23) covers 100 kHz to 2.5 GHz at levels of +44 to +104 dBµV.

Superior frequency/level stability

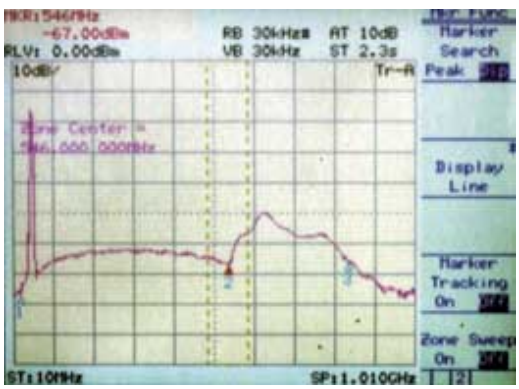
The synthesized local oscillator permits stable measurement of narrow-band crystal filters without disturbance by drift. Moreover, the bandwidth of bandpass filters can be measured accurately by using the occupied bandwidth measurement function after sweeping.



Bandpass filter measurement

Multimarkers

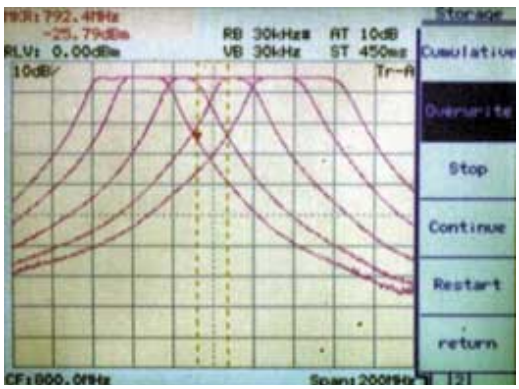
Markers can be displayed at up to 10 points by using the multimarker function even while the tracking generator is in use. Furthermore, by setting the zone marker width other than spot, fine adjustment of the marker position is unnecessary because the peak or dip within the zone is located automatically.



Example of dip marker

●Overwrite display

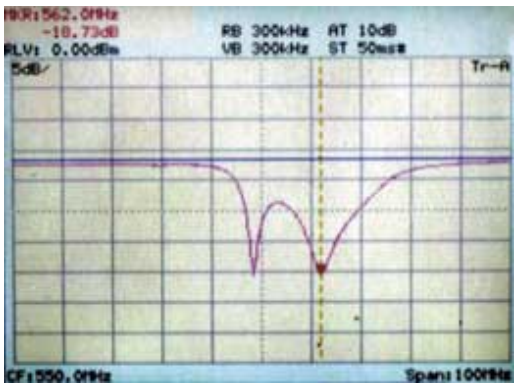
The overwrite display function is convenient for operations such as tuning multistage filters and amplifier gain characteristics. Fine adjustment is simplified by simultaneous observation of the trimming changes in the characteristics.



Bandpass filter adjustment

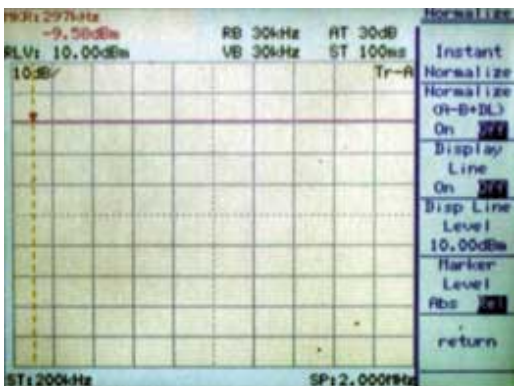
●Return loss measurement

When the Tracking Generator is combined with the separately-available reflection bridge (60N50-1 etc.), return loss can be measured with very high accuracy. In addition, the instant normalize function provides one-touch calibration permitting almost instantaneous measurement start.

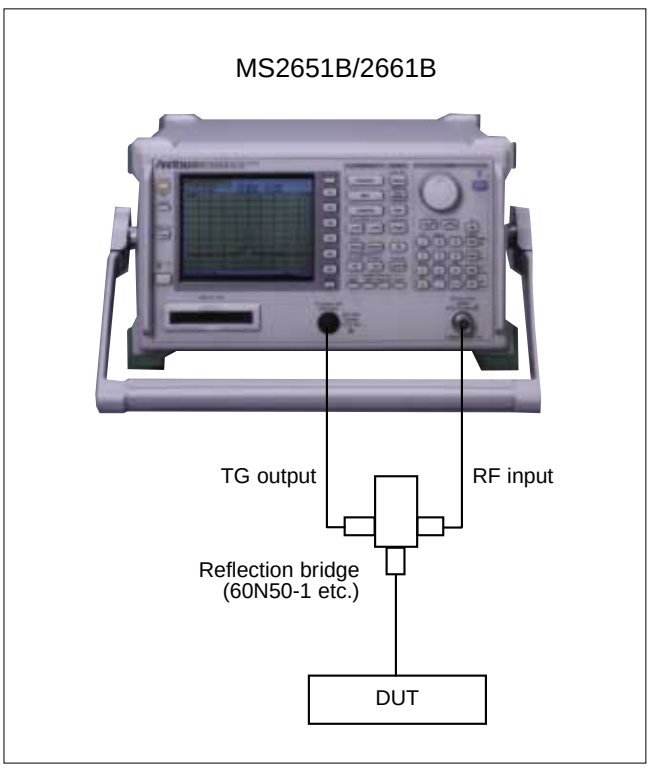


Return loss measurement

●Instant normalize function



One-touch calibration is performed using this key.



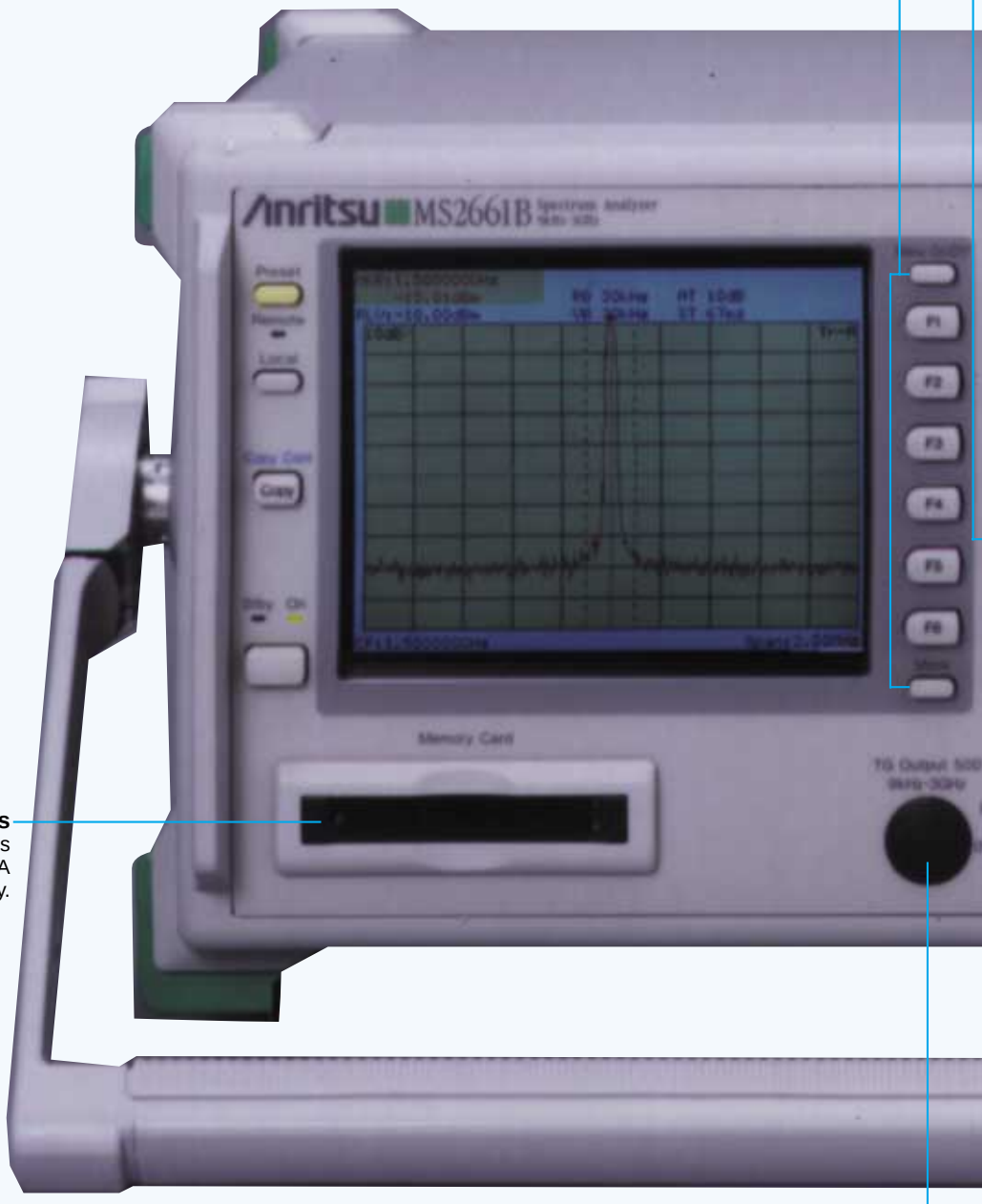
●EMI measurement

EMI of electronic devices can be measured using the QP detector (Option 12/13).

Easy-to-Use Key Layout

Save/recall
Saves and recalls measurement settings and measured waveforms
Data can be saved either to internal memory or to a memory card
(In internal memory, up to 12 data sets can be saved.)

Function keys F1 to F6
Select on-screen menu items
Menu on/off keys turn menus on and off,
and [more] key turns menu pages.



Memory card slots
Support memory cards up to 2 Mbytes
Two type-1 memory cards conforming to PCMCIA
ver. 2.0 standards can be used simultaneously.

Tracking generator output (Option 20/23)

Display
Can be switched between frequency and time
domains, and has two-screen display modes

Coupled-function keys
Set parameters other than those set using main function keys
Normally set “Auto” for optimum values.

Main functions
Set frequency, span, amplitude and other parameters

Markers
Normal markers, multimarkers (maximum 10 numbers), zone markers and zone sweeping are provided.

Entry keys
Input numeric values, units, and alphabetic characters

User keys
Register any panel and menu key functions, as well as application software functions to user keys.

User define key
Define functions of user-defined keys Up to 3-pages can be predefined.

Tracking generator (Option 20/23)

Calibration
The built-in high-precision calibration signal source provides accurate measurements.

RF connector
For input of signals at levels up to +30 dBm (maximum DC input: ±50 V without Option 19 installed)

Measure key
Executes various operations based on waveform data High-speed measurements and computations are performed without the need for an external computer.

Trigger/gate, TV monitor
The trigger can be set in the time domain mode, and analog TV video signals can be monitored.

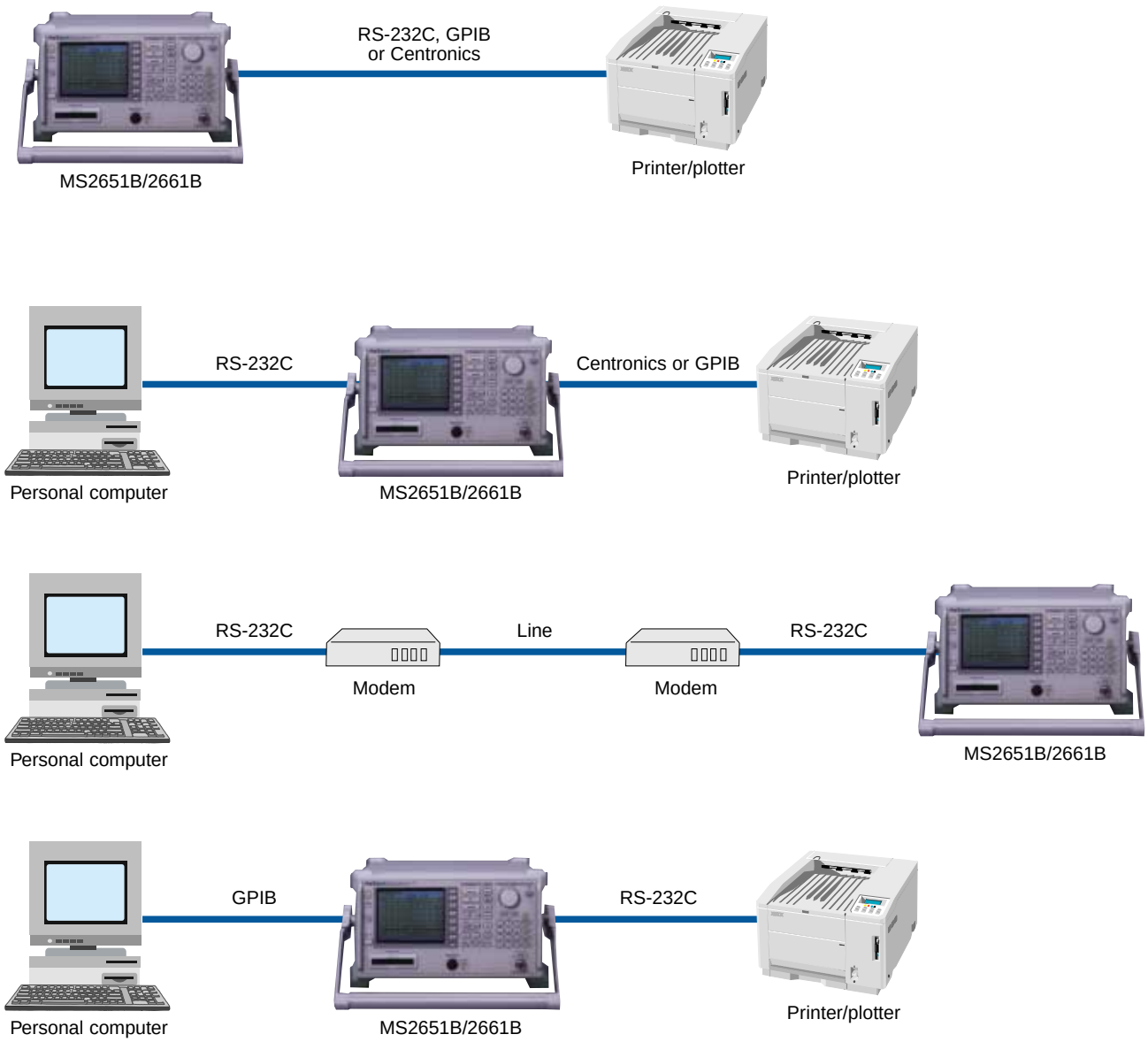
Configuring Automated Measurement System

●RS-232C interface (standard)
The RS-232C interface can be used to output hard copy data to a printer or plotter and for remote control of the analyzer. A notebook computer can be used for automated control and data collection in the field. In addition, a modem can be used for easy remote operation.

●GPIB interface (standard)
In addition to remote control, the GPIB interface can also be used to output data to a printer/plotter. (GPIB and Option 10 can not be installed simultaneously.)

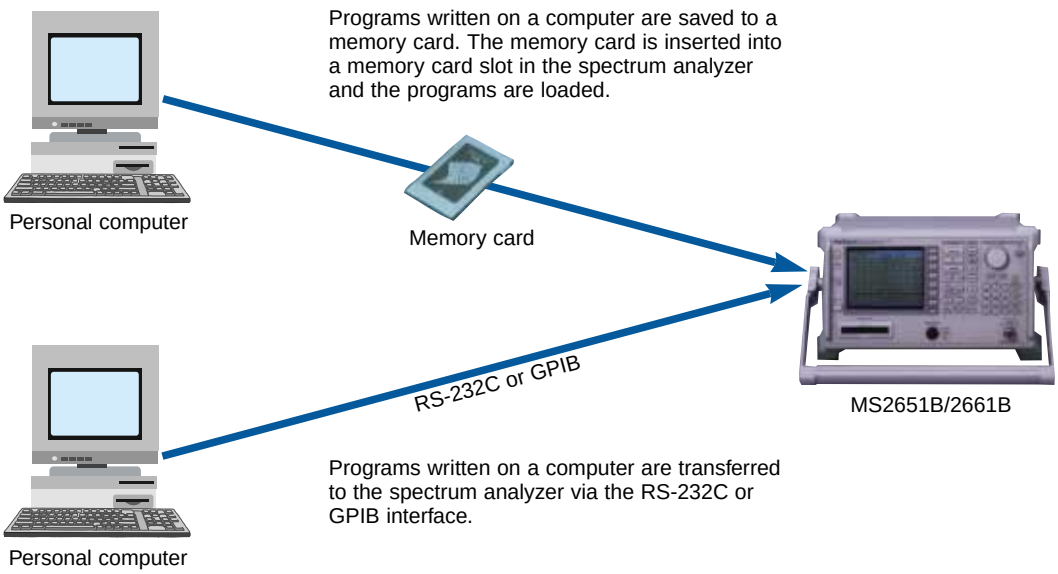
●Centronics interface (Option 10)
This Centronics interface is used to output data to a printer. (GPIB and Option 10 can not be installed simultaneously.)

●Memory card interface (standard)
Memory cards are used to save and recall measurement settings and waveform data, as well as to upload and download PTA programs. Cards up to 2 Mbytes are supported (PCMCIA ver. 2.0, type-I, 2-slots).



●Automated measurement without external controller

The built-in microcomputer (PTA) functions which utilize the spectrum analyzer as a controller, make an external controller unnecessary. An automated measurement system including control of other instruments is easily configured. The two methods for loading programs are shown below.



●Application software

The following items can be measured automatically using a combination of application software, peripheral equipment and options.

MX260002A CDMA Cellular System Measurement Software

Channel power, occupied frequency bandwidth, adjacent channel power, time response for open-loop power control, spurious

MX260003A PDC Measurement Software (for base station)

Channel power, frequency, occupied frequency bandwidth, adjacent channel power, spurious

MX260004A GSM Measurement Software

Power, time response, adjacent channel power, spurious, intermodulation characteristics

MX261001A Low-Power Data Communication System Measurement Software conforming to issue of Direct Spread Spectrum System

MX261002A Low-Power Data Communication System Measurement Software conforming to issue of Frequency Hopping System

Frequency, power, occupied frequency bandwidth, adjacent channel power, spurious

MX262001A CATV Measurement Software

Video power, C/N, frequency, cross modulation, CTB, modulation factor, hum

MX264001A EMI Measurement Software

Radiated emission, conducted emission

Specifications

Except where noted otherwise, specified values are obtained after warming up the equipment for 30 minutes at a constant ambient temperature and then performing calibration. The typical values are given for reference, and are not guaranteed.

Model		MS2651B	MS2661B
Frequency	**Frequency range**	9 kHz to 3 GHz	
	Display frequency accuracy	± (display frequency × reference frequency accuracy + span × span accuracy + 100 Hz) ∗Span: ≥10 kHz, after calibration	
	Marker frequency display accuracy	Normal: Same as display frequency accuracy, Delta: Same as frequency span accuracy	
	Frequency counter	Resolution: 1 Hz, 10 Hz, 100 Hz, 1 kHz Accuracy: Display frequency × reference frequency accuracy ±1 LSD (at S/N: ≥20 dB)	
	Frequency span	Setting range: 0 Hz, 1 kHz to 3.1 GHz Accuracy: ±2.5% (span: ≥10 kHz)	Setting range: 0 Hz, 1 kHz to 3.1 GHz Accuracy: ±2.5% (span: ≥10 kHz) ±5% (span: <10 kHz with option 02)
	Resolution bandwidth (RBW) (3 dB bandwidth)	Setting range: 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 5 MHz (manually settable, or automatically settable according to frequency span) ∗Option 02 (MS2661B only): 30 Hz, 100 Hz, and 300 Hz are added. Measurements of noise, C/N, adjacent channel power and channel power by measure function are executed with the calculated equivalent noise bandwidth of the RBW. Selectivity (60 dB : 3 dB): ≤10:1 (RBW: 1 to 300 kHz), ≤15:1 (RBW: 1, 5 MHz)	
	Video bandwidth (VBW)	1 Hz to 3 MHz (1-3 sequence), OFF (manually settable, or automatically settable according to RBW)	
	Noise sideband, stability	Noise sideband: ≤–90 dBc/Hz (1 GHz, 10 kHz offset)	Noise sideband: ≤–100 dBc/Hz (1 GHz, 10 kHz offset)
		Residual FM: ≤20 Hzp-p/0.1 s (1 GHz, span: 0 Hz) Frequency drift: ≤200 Hz/min (span: ≤10 kHzxn, sweep time: ≤100 s) ∗After 1-hour warm-up at constant ambient temperature	
	Reference oscillator	Frequency: 10 MHz Aging rate: 2×10^{-6}/year (typical); Option 01: 1×10^{-7}/year, 2×10^{-8}/day Temperature characteristics: 1×10^{-5} (typical, 0° to 50°C); Option 01: $\pm 5 \times 10^{-8}$ (0° to 50°C, referenced to 25°C)	
Amplitude	**Level measurement**	Measurement range: Average noise level to +30 dBm Maximum input level: +30 dBm (CW average power, RF ATT: ≥10 dB), ± 50 Vdc	
		Average noise level: ≤–110 dBm (1 MHz to 1 GHz), ≤–110 dBm + f [GHz] dB (>1 GHz) ∗RBW: 1 kHz, VBW: 1 Hz, RF ATT: 0 dB Residual response: ≤–95 dBm (RF ATT: 0 dB, input: 50 Ω termination, 1 MHz to 3 GHz)	Average noise level: ≤–115 dBm (1 MHz to 1 GHz), ≤–115 dBm + f [GHz] dB (>1 GHz), ≤–114 dBm (1 MHz to 1 GHz, at Option 08 pre-amplifier installed), ≤–114 dBm + 1.5f [GHz] dB (>1 MHz, at Option 08 pre-amplifier installed) ∗RBW: 1 kHz, VBW: 1 Hz, RF ATT: 0 dB Residual response: ≤–100 dBm (RF ATT: 0 dB, input: 50 Ω termination, 1 MHz to 3 GHz)
	Total level accuracy	±1.3 dB (100 kHz to 3 GHz) ∗Level measurement accuracy after calibration using internal calibration signal Total level accuracy: Reference level accuracy (0 to –49.9 dBm) + frequency response + log linearity (0 to –20 dB) + calibration signal source accuracy	
	Reference level	Setting range Log scale: –100 to +30 dBm, Linear scale: 224 µV to 7.07 V Unit Log scale: dBm, dBµV, dBmV, V, dBµVemf, W, dBµV/m Linear scale: V Reference level accuracy: ±0.4 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm, 0.1 to +30 dBm), ±1.5 dB (–80 to –70 dBm) ∗After calibration, at 100 MHz, 1 MHz span (when RF ATT, RBW, VBW, and sweep time set to AUTO) RBW switching uncertainty: ±0.3 dB (1 kHz to 1 MHz), ±0.4 dB (5 MHz) ∗After calibration, referenced to RBW 3 kHz Input attenuator (RF ATT) Setting range: 0 to 70 dB (10 dB steps) ∗Manually settable, or automatically settable according to reference level Switching uncertainty: ±0.3 dB (0 to 50 dB), ±1.0 dB (0 to 70 dB) ∗After calibration, frequency: 100 MHz, referenced to RF ATT: 10 dB	
	Frequency response	±0.5 dB (100 kHz to 3 GHz, referenced to 100 MHz, RF ATT: 10 dB, 18° to 28°C) ±1.5 dB (9 to 100 kHz, referenced to 100 MHz, RF ATT: 10 dB, 18° to 28°C) ±1.0 dB (100 kHz to 3 GHz, referenced to 100 MHz, RF ATT: 10 to 50 dB)	
	Waveform display	Scale (10 div) Log scale: 10, 5, 2, 1 dB/div Linear scale: 10, 5, 2, 1%/div Linearity (after calibration) Log scale: ±0.4 dB (0 to –20 dB, RBW: ≤1 MHz), ±1.0 dB (0 to –70 dB, RBW: ≤100 kHz), ±1.5 dB (0 to –85 dB, RBW: ≤3 kHz), ±2.5 dB (0 to –90 dB, RBW: ≤3 kHz) Linear scale: ±4% (compared to reference level) Marker level resolution Log scale: 0.01 dB, Linear scale: 0.02% of reference level	
	Spurious response	2nd harmonic distortion: ≤–55 dBc (10 to 100 MHz), ≤–60 dBc (0.1 to 1.5 GHz) ∗Mixer input: –30 dBm Two signals 3rd order intermodulation distortion: ≤–70 dBc (10 MHz to 3 GHz) ∗Frequency difference of two signals: ≥50 kHz, mixer input: –30 dBm)	2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz), ≤–75 dBc (0.2 to 1.5 GHz), ≤–80 dBc (0.8 to 1 GHz) ∗Mixer input: –30 dBm Two signals 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), ≤–80 dBc (0.1 to 3 GHz) ∗Frequency difference of two signals: ≥50 kHz, mixer input: –30 dBm

Model		MS2651B	MS2661B
Amplitude	**1 dB gain compression**	≥–5 dBm (≥100 MHz, at mixer input)	
	Maximum dynamic range	1 dB gain compression level to average noise level: >105 dB (0.1 to 1 GHz), >105 dB – f [GHz] dB (>1 GHz) Distortion characteristics (RBW: 1 kHz) 2nd harmonic: >67.5 dB (10 to 100 MHz), >70 dB (100 to 500 MHz), >70 – f [GHz] dB (0.5 to 1 GHz) 3rd order intermodulation: >76.6 dB (10 MHz to 1 GHz), >76.6 – (2/3)f [GHz] dB (1 to 3 GHz)	1 dB gain compression level to average noise level: >110 dB (0.1 to 1 GHz), >110 dB – f [GHz] dB (>1 GHz), >109 dB (0.1 to 1 GHz, at Option 08 pre-amplifier installed), >109 dB – 1.5f [GHz] (>1 GHz, at Option 08 pre-amplifier installed) Distortion characteristics (RBW: 1 kHz) 2nd harmonic: >72.5 dB (10 to 200 MHz), >80 dB (200 to 500 MHz), >80 – f [GHz] dB (0.5 to 1.5 GHz), >82.5 – f [GHz] dB (0.8 to 1 GHz) 3rd order intermodulation: >80 dB (10 to 100 MHz), >83.3 dB (0.1 to 1 GHz), >83.3 – (2/3)f [GHz] dB (1 to 3 GHz)
Sweep	**Sweep time**	Setting range: 20 ms to 1000 s (Manually settable, or automatically settable according to span, RBW, and VBW) Accuracy: ±15% (20 ms to 100 s), ±45% (110 to 1000 s), ±1% (time domain sweep: digital zero span mode)	
	Sweep mode	Continuous, single	
	Time domain sweep mode	Analog zero span, digital zero span	
	Zone sweep	Sweeps only in frequency range indicated by zone marker	
	Tracking sweep	Sweeps while tracing peak points within zone marker (zone sweep also possible)	
Functions	**Number of data points**	501	
	Detection mode	NORMAL: Simultaneously displays max. and min. points between sample points POS PEAK: Displays max. point between sample points NEG PEAK: Displays min. point between sample points SAMPLE: Displays momentary value at sample points Detection mode switching uncertainty: ±0.5 dB (at reference level)	
	Display	Color TFT-LCD, Size: 5.5“, Number of colors: 17 (RGB, each 64-scale settable), intensity adjustment: 5 steps settable	
	Display functions	Trace A: Displays frequency spectrum Trace B: Displays frequency spectrum Trace Time: Displays time domain waveform at center frequency Trace A/B: Displays Trace A and Trace B simultaneously. Simultaneous sweep of same frequency, alternate sweep of independent frequencies Trace A/BG: Displays frequency region to be observed (background) and object band (foreground) selected from background with zone marker simultaneously at alternate sweep Trace A/Time: Displays frequency spectrum, and time domain waveform at center frequency simultaneously at alternate sweep Trace move/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	
	FM demodulation waveform display function	Demodulation range: 2, 5, 10, 20, 50, 100, 200 kHz/div Marker display accuracy: ±5% of full scale (referenced to center frequency, DC-coupled, RBW: 5 MHz, VBW: 1 Hz, CW) Demodulation frequency response: DC (50 Hz at AC-coupled) to 100 kHz ∗Range: ≤20 kHz/div, VBW: OFF, at 3 dB bandwidth DC (50 Hz at AC-coupled) to 500 kHz ∗Range: ≥50 kHz/div, VBW: OFF, at 3 dB bandwidth ∗RBW: ≥100 kHz usable	
	Input connector	N-J, 50 Ω	
	Auxiliary signal input and output	IF OUTPUT: 455 kHz (RBW: ≤30 kHz), 10.695 MHz (RBW: ≥100 kHz), BNC connector VIDEO OUTPUT (Y): 0 to 0.5 V ±0.1 V (100 MHz, from lower edge to upper edge at 10 dB/div or 10%/div, 75 Ω terminated, BNC connector) COMPOSITE OUTPUT: For NTSC, 1 Vp-p (75 Ω terminated), BNC connector EXT REF INPUT: 10 MHz ±10 Hz, ≥0 dBm (50 Ω terminated), BNC connector	
	Signal search	AUTO TUNE, PEAK→CF, PEAK→REF, SCROLL	
	Zone marker	NORMAL, DELTA	
	Marker →	MARKER→CF, MARKER→REF, MARKER→CF STEP SIZE, ΔMARKER→SPAN, ZONE→SPAN	
	Peak search	PEAK, NEXT PEAK, NEXT RIGHT PEAK, NEXT LEFT PEAK, MIN DIP, NEXT DIP	
	Multimarker	Number of markers: 10 max. (HIGHEST 10, HARMONICS, MANUAL SET)	
	Measure	Noise power (dBm/Hz, dBm/ch), C/N (dBc/Hz, dBc/ch), occupied bandwidth (power N% method, X-dB down method), adjacent channel power (REF: total power/reference level/in-band level method, channel designate display: 2 channels × 2 graphic display), average power of burst signal (average power in designated time range of time domain waveform), channel power (dBm, dBm/Hz), template comparison (upper/lower limits × each 2, time domain), MASK (upper/lower × each 2, frequency domain)	
	Save/recall	Saves and recalls setting conditions and waveform data to internal memory (max. 12) or memory card	
	Hard copy	Printer (HP dotmatrix, EPSON dotmatrix or compatible models): Display data can be hard-copied via RS-232C, GPIB and Centronics (Option 10) interface Plotter (HP-GL, GP-GL compatible models): Display can be output via RS-232C and GPIB interface	

Model		MS2651B	MS2661B
Functions	PTA	Language: PTL (interpreter based on BASIC) Programming: Using editor of external computer Program memory: Memory card, upload/download to/from external computer Programming capacity: 192 KB Data processing: Directly accesses measurement data according to system variables, system subroutines, and system functions	
	RS-232C	Outputs data to printer and plotter. Control from external computer (excluding power switch)	
	GPIB	Meets IEEE488.2. Controlled by external computer (excluding power switch). Or controls external equipment with PTA Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C4, C28	
	Correction	Automatic correction of insertion loss of MA1621A Impedance Transformer Correction accuracy (RF ATT: ≥10 dB): ±2.5 dB (9 to 100 kHz), ±1.5 dB (100 kHz to 2 GHz), ±2.0 dB (2 to 3 GHz) ∗Typical value Antenna correction coefficients: Correct display and measurement of field strengths (dBμV/m) for specified antennas, Internal antenna correction coefficients (MP534A/651A Dipole Antenna, MP635A/666A Log-Periodic Antenna, MP414B Loop Antenna, and four antennas user-defined; writes via GPIB or RS-232C interface, saves/loads to/from memory card)	
	Memory card interface	Functions: Saving/recalling measurement parameters/waveform data, uploading/downloading PTA programs; Applicable cards: SRAM, EPROM, Flash EPROM ∗Only SRAM writable; Card capacity: 2 MB max. Connector: PCMCIA Rel. 2.0, 2 slots	
Others	Conducted emission	Meets the EN55011 (Group 1, Class A)	
	Radiated emission	Meets the EN55011 (Group 1, Class A)	
	Static discharge	Meets the EN50082-1	
	Radiation field	Meets the EN50082-1	
	Conducted susceptibility	Meets the IEC801-4 (Level II)	
	Vibration	Meets the MIL-STD-810D	
	Power (operating range)	85 to 132/170 to 250 Vac (automatic voltage switching), 47.5 to 63 Hz, 380 to 420 Hz (85 to 132 Vac only), ≤320 VA	
	Dimensions and mass	320 (W) × 177 (H) × 351 (D) mm, ≤10.8 kg (without option)	
	Ambient temperature	0° to +50°C (operate), –40° to +75°C (storage)	

●Option 01: Reference crystal oscillator

Frequency	10 MHz
Aging rate	$\leq 1 \times 10^{-7}$/year, $\leq 2 \times 10^{-8}$/day (after power on, with reference to frequency after 24 h)
Temperature characteristics	$\pm 5 \times 10^{-8}$ (0° to 50°C, with reference to 25°C)
Buffer output	BNC connector, 10 MHz, >2 Vp-p (200 Ω terminated)

●Option 02: Narrow resolution bandwidth (MS2661B only)

Resolution bandwidth (3 dB)	30 Hz, 100 Hz, 300 Hz
Resolution bandwidth switching uncertainty	±0.4 dB (RBW 3 kHz referenced)
Selectivity (60 dB:3 dB)	≤15:1 (RBW: 100, 300 Hz), ≤20:1 (RBW: 30 Hz)

●Option 04: High-speed time domain sweep

Sweep time	12.5 μs, 25 μs, 50 μs, 100 to 900 μs (one most significant digit settable) 1.0 to 19 ms (two upper significant digits settable)
Accuracy	±1%
Marker level resolution	0.1 dB (log scale), 0.2% (linear scale, relative to reference level)

●Option 06: Trigger/gate circuit

Trigger switch		FREERUN, TRIGGERED
Trigger source	EXT	Trigger level: ±10 V (resolution: 0.1 V), TTL level Trigger slope: Rise/Fall Connector: BNC
	VIDEO	Trigger level (at log scale): –100 to 0 dB (resolution: 1 dB) Trigger slope: Rise/Fall
	WIDE IF VIDEO	Trigger level: High, middle, or low selectable Bandwidth: ≥20 MHz Trigger slope: Rise/Fall
	LINE	Frequency: 47.5 to 63 Hz (line lock)
	TV	Method: M-NTSC, B/G/H PAL Sync: V-SYNC, H-SYNC Sync line (NTSC) H-SYNC (ODD): 7 to 262 line, H-SYNC (EVEN): 1 to 263 line Sync line (PAL) H-SYNC (ODD): 1 to 312 line, H-SYNC (EVEN): 317 to 625 line ∗Option 16 required

Trigger delay	Pre-trigger (displays waveform from previous max. 1 screen at trigger occurrence point) Range: –time span to 0 s Resolution: time span/500 Post trigger (displays waveform from after max. 65.5 ms at trigger occurrence point) Range: 0 to 65.5 ms Resolution: 1 µs
Gate sweep	In frequency domain, displays spectrum of input signal in specified gate interval Gate delay: 0 to 65.5 ms (from trigger point, resolution: 1 µs) Gate width: 2 µs to 65.5 ms (from gate delay, resolution: 1 µs)

●Option 07: AM/FM demodulator

Voice output	With internal loudspeaker and earphone connector (ϕ3.5 jack), adjustable volume

●Option 08: Pre-amplifier*1

Frequency range		100 kHz to 3 GHz, 100 kHz to 2.5 GHz (with Option 22)
Noise figure		≤7 dB (typical, <2 GHz), ≤12 dB (typical, ≥2 GHz), ≤9 dB (typical, <2 GHz, with Option 22), ≤14 dB (typical, ≥2 GHz, with Option 22)
Amplitude	**Measurement range**	Average noise level to +10 dBm
	Max. input level	CW average power: +10 dBm, ±50 Vdc
	Average noise level	MS2651B: ≤–130 dBm (1 MHz to 1 GHz), ≤–130 dBm + 1.5f [GHz] dB (>1 GHz) MS2661B: ≤–134 dBm (1 MHz to 1 GHz), ≤–134 dBm + 2f [GHz] dB (>1 GHz), ≤–132 dBm (1 MHz to 1 GHz, with Option 22), ≤–132 dBm + 2f [GHz] dB (≥1 GHz, with Option 22) ∗RBW: 1 kHz, VBW: 1 Hz, RF ATT: 0 dB
	Reference level	Setting range Log scale: –120 to +10 dBm, or equivalent level Linear scale: 22.4 µV to 707 mV, 27.4 µV to 487 mV with Option 22 Reference level accuracy: ±0.5 dB (–69.9 to –20 dBm), ±0.75 dB (–89.9 to –70 dBm, –19.9 to +10 dBm) ∗After calibration, referenced to 100 MHz, 1 MHz span (RF ATT, RBW, VBW, and sweep time set to AUTO) RBW switching uncertainty: ±0.5 dB (after calibration, referenced to 3 kHz RBW) RF ATT switching uncertainty: ±0.5 dB (0 to 50 dB), ±1.0 dB (0 to 70 dB) ∗After calibration, referenced to 100 MHz, RF ATT: 10 dB
	Frequency response	±2.0 dB (100 kHz to 3 GHz, referenced to 100 MHz, RF ATT: 10 to 50 dB) ±2.0 dB (with Option 22, 100 kHz to 2.5 GHz, referenced to 100 MHz, RF ATT: 10 dB, 18° to 28°C)
	Linearity of waveform display	Log scale (after calibration): ±0.5 dB (0 to –20 dB), ±1.0 dB (0 to –60 dB), ±1.5 dB (0 to –75 dB) Linear scale (after calibration): ±5% (according to reference level)
	Spurious response	Two signals 3rd order intermodulation distortion: ≤–70 dBc (10 MHz to 3 GHz, 10 MHz to 2.5 GHz with Opton 22) ∗Frequency difference of two signals: ≥50 kHz, Pre-amplifier input*2: –55 dBm
	1 dB gain compression	≥–35 dBm (≥100 MHz, at pre-amplifier input*2)

*1 Overall specification with pre-amplifier on (Noise figure is the simple performance.)
*2 Pre-amplifier input level = RF input level – RF ATT setting level

●Option 10: Centronics interface

Function	Outputs data to printer (Centronics standard). GPIB interface can not be installed simultaneously
Connector	D-sub 25-pin (jack)

●Option 12: QP detector (MS2661B only)

Functions	QP detection ∗Requires Option 02. When Option 12 installed, Option 02 RBW 100 Hz 3 dB bandwidth changed to 150 Hz (typical)
6 dB bandwidth	200 Hz, 9 kHz, 120 kHz Accuracy: ±30% (18° to 28°C)
Display	LOG scale, 5 dB/div (10 divisions) Linearity: ≤±2.0 dB (0 to –40 dB, CW signal, reference level: 60 dBµV, RF ATT: 0 dB, 18° to 28°C)

<table>
<tr><td>Pulse response characteristics</td><td>Response to CISPR pulse (DET mode: QP, 18° to 28°C)
<table>
<tr><td rowspan="2">Repetition frequency</td><td colspan="3">Bandwidth</td></tr>
<tr><td>120 kHz</td><td>9 kHz</td><td>200 Hz</td></tr>
<tr><td>1 kHz</td><td>≤–8.0 ±1.0 dB</td><td>≤–4.5 ±1.0 dB</td><td>–</td></tr>
<tr><td>100 Hz</td><td>Referenced</td><td>Referenced</td><td>≤–4.0 ±1.0 dB</td></tr>
<tr><td>60 Hz</td><td>–</td><td>–</td><td>≤–3.0 ±1.0 dB</td></tr>
<tr><td>25 Hz</td><td>–</td><td>–</td><td>Referenced</td></tr>
<tr><td>20 Hz</td><td>≤+9.0 ±1.0 dB</td><td>≤+6.5 ±1.0 dB</td><td>–</td></tr>
<tr><td>10 Hz</td><td>≤+14.0 ±1.5 dB</td><td>≤+10.0 ±1.5 dB</td><td>≤+4.0 ±1.0 dB</td></tr>
<tr><td>2 Hz</td><td>≤+26.0 ±2.0 dB</td><td>≤+20.5 ±2.0 dB</td><td>≤+13.0 ±2.0 dB</td></tr>
<tr><td>1 Hz</td><td>≤+28.5 ±2.0 dB</td><td>≤+22.5 ±2.0 dB</td><td>≤+17.0 ±2.0 dB</td></tr>
</table></td></tr>
<tr><td>QP on/off switching uncertainty (PEAK, QP)</td><td>≤±1.0 dB (CW signal, reference level – 40 dB, after auto-calibration, 18° to 28°C)</td></tr>
<tr><td>Detection mode</td><td>QP, AVERAGE</td></tr>
<tr><td>Field strength measurement</td><td>Waveform data compensation data display for specified antenna factor, field strength (dBµV/m)
Built-in antenna factors:
MP534A/651A Dipole Antenna, MP635A/666A Log-Periodic Antenna, MP414B Loop Antenna, user-defined (four types writable via GPIB or RS-232C, can be saved/loaded to/from memory card)</td></tr>
</table>

●Option 13: QP detector (MS2651B only)

<table>
<tr><td>6 dB bandwidth</td><td>9, 120 kHz
Accuracy: ±30% (18° to 28°C)</td></tr>
<tr><td>Display</td><td>LOG scale, 5 dB/div (10 divisions)
Linearity: ≤±2.0 dB (0 to –40 dB, CW signal, reference level: 60 dBµV, RF ATT: 0 dB, 18° to 28°C)</td></tr>
<tr><td>Pulse response characteristics</td><td>Response to CISPR pulse (DET mode: QP, 18° to 28°C)
<table>
<tr><td rowspan="2">Repetition frequency</td><td colspan="2">Bandwidth</td></tr>
<tr><td>120 kHz</td><td>9 kHz</td></tr>
<tr><td>1 kHz</td><td>≤–8.0 ±1.0 dB</td><td>≤–4.5 ±1.0 dB</td></tr>
<tr><td>100 Hz</td><td>Referenced</td><td>Referenced</td></tr>
<tr><td>20 Hz</td><td>≤+9.0 ±1.0 dB</td><td>≤+6.5 ±1.0 dB</td></tr>
<tr><td>10 Hz</td><td>≤+14.0 ±1.5 dB</td><td>≤+10.0 ±1.5 dB</td></tr>
<tr><td>2 Hz</td><td>≤+26.0 ±2.0 dB</td><td>≤+20.5 ±2.0 dB</td></tr>
<tr><td>1 Hz</td><td>≤+28.5 ±2.0 dB</td><td>≤+22.5 ±2.0 dB</td></tr>
</table></td></tr>
<tr><td>QP ON/OFF Switching uncertainty (PEAK, QP)</td><td>≤±1.0 dB (CW signal, reference level – 40 dB, after auto-calibration, 18° to 28°C)</td></tr>
<tr><td>Detection mode</td><td>QP, AVERAGE</td></tr>
<tr><td>Field strength measurement</td><td>Waveform data compensation data display for specified antenna factor, field strength (dBµV/m)
Built-in antenna factors:
MP534A/651A Dipole Antenna, MP635A/666A Log-Periodic Antenna, MP414B Loop Antenna, user-defined (four types writable via GPIB or RS-232C, can be saved/loaded to/from memory card)</td></tr>
</table>

●Option 14: PTA parallel I/O

<table>
<tr><td>Functions</td><td>Controls external devices from PTA, cannot be installed when Option 10 installed</td></tr>
<tr><td>System variables</td><td>As follows using PTA system variables
IOA: Controls 8-bit parallel output port A
IOB: Controls 8-bit parallel output port B
IOC: Controls 4-bit parallel input/output port C
IOD: Controls 4-bit parallel input/output port D
EIO: Controls I/O switching of ports C/D
EXO: Controls I/O trigger</td></tr>
<tr><td>PTL statements</td><td>External interrupt control of input to I/O ports using PTA-PTL statements
IOEN statement: Enables interrupt input
IODI statement: Disables interrupt input
IOMA statement: Masks interrupt input
ON TO GOTO statement: Changes program flow at interrupt generation
ON TO GOSUB statement: Changes program flow at interrupt generation</td></tr>
<tr><td>Write strobe signal</td><td>Write strobe signal (negative pulse) output externally at control of output ports C/D</td></tr>
<tr><td>Power supply</td><td>External +5 ±0.5 Vdc (max. 100 mA) supply</td></tr>
<tr><td>Signal logic levels</td><td>Negative logic, TTL level
Specified current:
Output ports A/B (max. output current Hi: 2.6 mA, Lo: 24 mA)
Output ports C/D (max. output current Hi: 15 mA, Lo: 24 mA)
Other control output lines (max. output current Hi: 0.4 mA, Lo: 8 mA)</td></tr>
<tr><td>Connection cable connectors</td><td>Amphenol 36 pins</td></tr>
</table>

Connector pin layout	

No.	Item	No.	Item
1	GND	19	Output port B (6)
2	Trigger input	20	Output port B (7) MSB
3	Trigger output 1	21	I/O port C (0) LSB
4	Trigger output 2	22	I/O port C (1)
5	Output port A (0) LSB	23	I/O port C (2)
6	Output port A (1)	24	I/O port C (3) MSB
7	Output port A (2)	25	I/O port D (0) LSB
8	Output port A (3)	26	I/O port D (1)
9	Output port A (4)	27	I/O port D (2)
10	Output port A (5)	28	I/O port D (3) MSB
11	Output port A (6)	29	Port C status 0/1: I/O
12	Output port A (7) MSB	30	Port D status 0/1: I/O
13	Output port B (0) LSB	31	Write strobe signal
14	Output port B (1)	32	Interruption signal
15	Output port B (2)	33	Not used
16	Output port B (3)	34	+5 V power supply
17	Output port B (4)	35	Not used
18	Output port B (5)	36	Not used

●Option 15: Sweep signal output

Sweep output (X)	0 to 10 V ±1 V (≥100 kΩ termination, from left side to right side of display scale), BNC connector
Sweep status output (Z)	TTL level (low level with sweeping), BNC connector

●Option 19: DC coupled input (MS2661B only)

Functions	DC-couples input circuit of main unit and expands lower limit of receiver frequency range to 500 Hz ∗Can only be installed with narrow RBW (Option 02)
Electrical characteristics	The standard specifications of the main unit are supplemented and changed as follows: Frequency range: 500 Hz to 3 GHz Max. input level: +30 dBm (CW, RF ATT: ≥ 10 dB), ±0 Vdc Average noise level: ≤–80 dBm (500 Hz to 10 kHz), ≤–90 dBm (10 kHz to 200 kHz), ≤–110 dBm (200 kHz to 1 MHz) ∗RBW: 30 Hz, VBW: 1 Hz, RF ATT: 0 dB Frequency response: ±1.2 dB (500 Hz to 100 kHz), ±0.5 dB (100 kHz to 3 GHz) ∗Referenced to 100 MHz frequency, RF ATT: 10 dB, ambient temperature: 18° to 28°C

●Option 20: Tracking generator

Frequency range	9 kHz to 3 GHz
Output level range	0 to –60 dBm
Setting resolution	0.1 dB
Output level accuracy	≤±1.0 dB (at 100 MHz, 0 dBm)
Output level flatness	≤±1.5 dB (100 kHz to 3 GHz, output level: 0 dBm, referenced to 100 MHz frequency)
Output level linearity	≤±1.0 dB (0 to –30 dBm), ≤±2.0 (–30 to –60 dBm) ∗100 kHz to 3 GHz, 0 dBm output level reference
Spurious	Harmonic: ≤–20 dBc (100 kHz to 3 GHz) Non-harmonic: ≤–35 dBc (100 kHz to 3 GHz)
Tracking generator feed through	≤–95 dBm (spectrum analyzer input and tracking generator output connectors terminated at 50 Ω)
Output connector	N-J, 50 Ω

●Option 21: Television monitor (Multi)

Video	M-NTSC, B/G/H/I/D PAL, color
Audio	Simultaneous monitoring of video and audio ∗Needs Option 07
Functions	Channel: Automatic setting to broadcast wave of CCIR, Japan, USA, Italy, UK and China; automatic setting to CATV of CCIR, Japan and USA Trigger: Triggerd sweep by V-SYNC, H-SYNC ∗Needs trigger/gate ciruit (Option 06) Aux. output: Composite video signal, Connector: BNC

●Option 22: 75 Ω input (Option 12, 13, 19 and 20 can not be installed simultaneously.)

Frequency range		100 kHz to 2.5 GHz
Amplitude	**Level measurement**	Measurement range: Average noise level to +25 dBm (+133.8 dBμV) Max. input level: +25 dBm (+133.8 dBμV, CW average power, RF ATT: ≥10 dB), ±100 Vdc Residual response: ≤–95 dBm (+13.8 dBμV, RF ATT: 0 dB, input: 75 Ω terminated, 1 MHz to 2.5 GHz)
	Total level accuracy	±1.8 dB (100 kHz to 2.5 GHz, level measurement accuracy after calibration using internal calibration signal) Total level accuracy: Reference level accuracy (0 to –49.9 dBm) + frequency response + log linearity (0 to –20 dBm) + calibration signal source accuracy
	Reference level	Setting range Log scale: +8.8 to +133.8 dBμV, Linear scale: 274 μV to 4.87 V
	Frequency response	±1.0 dB (100 kHz to 2.5 GHz, referenced to 100 MHz, RF ATT: 10 dB, 18° to 28°C)
	Waveform display	Linearity (after calibration) Log scale: ±0.4 dB (0 to –20 dB, RBW: ≤1 MHz), ±1.0 dB (0 to –70 dB, RBW: ≤100 kHz), ±1.5 dB (0 to –85 dB, RBW: ≤3 kHz) Linear scale: ±4% (according to reference level) Marker level resolution Log scale: 0.01 dB Linear scale: 0.02% (according to reference level)
	Spurious response	2nd harmonic distortion (MS2651B): ≤–55 dBc (10 to 100 MHz, mixer input: –30 dBm), ≤–60 dBc (0.1 to 1.25 GHz, mixer input: –30 dBm) 2nd harmonic distortion (MS2661B): ≤–60 dBc (10 to 200 MHz, mixer input: –30 dBm), ≤–75 dBc (0.2 to 1.25 GHz, band 0, mixer input: –30 dBm), ≤–80 dBc (0.8 to 1 GHz, mixer input: –30 dBm) Two signals 3rd order intermodulation distortion (MS2651B): ≤–70 dBc (10 to 2.5 GHz) ∗Frequency difference of two signals: ≥50 kHz, mixer input: –30 dBm Two signals 3rd order intermodulation distortion (MS2661B): ≤–70 dBc (10 to 100 MHz), ≤–80 dBc (0.1 to 2.5 GHz) ∗Frequency difference of two signals: ≥50 kHz, mixer input: –30 dBm
	Max. dynamic range	1 dB gain compression level to average noise level (MS2651B): >105 dB (0.1 to 1 GHz), >105 dB – f [GHz] dB (>1 GHz) 1 dB gain compression level to average noise level (MS2661B): >110 dB (0.1 to 1 GHz), >110 dB – f [GHz] dB (>1 GHz), >109 dB (0.1 to 1 GHz, with Option 08), >109 dB – 1.5f [GHz] dB (>1 GHz, with Option 08) Distortion characteristics (MS2651B, RBW: 1 kHz) 2nd harmonic: >67.5 dB (10 to 100 MHz), >70 dB (100 to 500 MHz), >70 – f [GHz] dB (0.5 to 1.25 GHz) 3rd order intermodulation: >76.6 dB (0.1 to 1 GHz), >76.6 dB – (2/3)f [GHz] dB (1 to 2.5 GHz) Distortion characteristics (MS2661B, RBW: 1 kHz) 2nd harmonic: >72.5 dB (10 to 200 MHz), >80 dB (200 to 500 MHz), >80 – f [GHz] dB (0.5 to 1.25 GHz), >82.5 – f [GHz] dB (0.8 to 1 GHz) 3rd order intermodulation: >80 dB (10 to 100 MHz), >83.3 dB (0.1 to 1 GHz), >83.3 dB – (2/3)f [GHz] dB (1 to 2.5 GHz)
Functions	**Input connector**	NC-J, 75 Ω
	Auxiliary I/O	VIDEO OUTPUT (Y): 0 to 0.5 V ±0.1 V (typical, from lower edge to upper edge at 10 dB/div, 100 MHz, 75 Ω terminated) 0 to 0.4 V ±0.1 V (typical, from lower edge to upper edge at 10%/div, 100 MHz, 75 Ω terminated), BNC connector

●Option 23: 75 Ω tracking generator (Option 12, 13, 19 and 20 can not be installed simultaneously.)

Frequency range	100 kHz to 2.5 GHz
Output level range	+44 to +104 dBμV (setting resolution: 0.1 dB)
Output level accuracy	≤±1.5 dB (100 MHz, output level: +104 dBμV)
Output level flatness	≤±1.75 dB (100 kHz to 2.5 GHz, output level: +104 dBμV, referenced to 100 MHz)
Output level linearity	≤±1.0 dB (+74 to +104 dBμV), ≤±2.0 dB (+44 to +74 dBμV) ∗100 kHz to 2.5 GHz, referenced to +104 dBμV
Spurious	Harmonics: ≤–20 dBc (100 kHz to 2.5 GHz) Non-harmonics: ≤–30 dBc (100 kHz to 2.5 GHz)
Tracking generator feed through	≤13.8 dBμV (spectrum analyzer input and tracking generator output connectors terminated at 75 Ω)
Output connector	NC-J, 75 Ω

●Option 24: Television monitor (Brazil)

Video	M-NTSC, M PAL, color
Audio	Simultaneous monitoring of video and audio ∗Needs Option 07
Functions	Channel: Automatic setting to broadcast wave of CCIR, Japan and USA Automatic setting to CATV of CCIR, Japan and USA Trigger: Triggered sweep by V-SYNC, H-SYNC ∗Needs trigger/gate circuit (Option 06) Aux. output: Composite video signal, Connector: BNC

Ordering Information

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

Model/order No.	Name	Remarks
	– Main frame –	
MS2651B	Spectrum Analyzer	
MS2661B	Spectrum Analyzer	
	– Standard accessories –	
	Power cord, 2.6 m: 1 pc	
F0013	Fuse, 5 A: 2 pcs	
W1251AE	MS2650B, MS2660B/C series operation manual: 1 copy	
B0329G	Protective cover	3/4MW4U
	– Options –	
MS2651B/2661B-01	Reference crystal oscillator	Stability: $\leq 2 \times 10^{-8}$/day
MS2661B-02	Narrow resolution bandwidth	30, 100, 300 Hz (MS2661B only)
MS2651B/2661B-04	High-speed time domain sweep	1.25 µs/div
MS2651B/2661B-06	Trigger/gate circuit	Pre-trigger and post trigger available
MS2651B/2661B-07	AM/FM demodulator	Outputs to loudspeaker or earphone connector
MS2651B/2661B-08	Pre-amplifier	100 kHz to 3 GHz, 20 dB
MS2651B/2661B-10	Centronics interface	GPIB cannot be installed simultaneously.
MS2661B-12	QP detector	Requires Option 02 (QP-BW: 0.2, 9, 120 kHz)
MS2651B-13	QP detector	QP-BW: 9, 120 kHz
MS2651B/2661B-14	PTA parallel I/O	Option 10 cannot be installed simultaneously.
MS2651B/2661B-15	Sweep signal output	X, Z
MS2661B-19	DC coupled input	MS2661B only, requires Option 02
MS2651B/2661B-20	Tracking generator	Built-in type
MS2651B/2661B-21	Television monitor (Multi)	M-NTSC, B/G/H/I/D PAL
MS2651B/2661B-22	75 Ω input	Option 12, 13, 19 and 20 can not be installed simultaneously.
MS2651B/2661B-23	75 Ω tracking generator	Option 12, 13, 19 and 20 can not be installed simultaneously.
MS2651B/2661B-24	Television monitor (Brazil)	M-NTSC, M PAL
	– Application parts –	
MX260002A	CDMA Cellular System Measurement Software	
MX260003A	PDC Measurement Software (for base station)	
MX260004A	GSM Measurement Software	
MX261001A	Low-Power Data Communication System Measurement Software conforming to issue of Direct Spread Spectrum System	
MX261002A	Low-Power Data Communication System Measurement Software conforming to issue of Frequency Hopping System	
MX262001A	CATV Measurement Software	
MX264001A	EMI Measurement Software	
J0561	Coaxial cord (N-P-5W · 5D-2W · N-P-5W), 1 m	
J0104A	Coaxial cord (BNC-P · RG-55/U · N-P), 1 m	
CSCJ-256K-SM	256 KB memory card	Meets PCMCIA Rel 2.0
CSCJ-512K-SM	512 KB memory card	Meets PCMCIA Rel 2.0
CSCJ-001M-SM	1024 KB memory card	Meets PCMCIA Rel 2.0
CSCJ-002M-SM	2048 KB memory card	Meets PCMCIA Rel 2.0
B0395A	Rack mount kit (IEC)	
B0395B	Rack mount kit (JIS)	
J0055	Coaxial adaptor (NC-P · BNC-J)	
J0076	Coaxial adaptor (NC-P · F-J)	
B0391A	Carrying case (hard type)	With casters
B0391B	Carrying case (hard type)	Without casters
MP612A	RF Fuse Holder	DC to 1000 MHz, 50 Ω (N)
MP613A	Fuse Element	For MP612A
J0805	DC block (Model 7003)	10 kHz to 18 GHz, ±50 V, N-type, Weinschel product
MA2507A	DC Block Adaptor	50 Ω, 9 kHz to 3 GHz, ±50 V, N-type
MA8601A	DC Block Adaptor	50 Ω, 30 kHz to 2 GHz, ±50 V, N-type
MA8601J	DC Block Adaptor	75 Ω, 10 kHz to 2.2 GHz, ±50 V, N-type
MA1621A	50 Ω→75 Ω Impedance Transformer	9 kHz to 3 GHz, ±100 V, NC-type
MP614A	50 Ω←→75 Ω Impedance Transformer	10 to 1200 MHz (transformer type), NC-type
J0121	Coaxial cord (NC-P-3W · 3C-2WS · NC-P-3W), 1 m	
J0308	Coaxial cord (BNC-P · 3C-2WS · NC-P-3W), 1 m	
J0063	Fixed attenuator for high power	30 dB, 10 W, DC to 12.4 GHz, N-type
J0395	Fixed attenuator for high power	30 dB, 30 W, DC to 9 GHz, N-type
MP640A	Branch	40 dB, DC to 1700 MHz
MP654A	Branch	30 dB, 0.8 to 3 GHz
MP520A	CM Directional Coupler	25 to 500 MHz, 75 Ω (NC)
MP520B	CM Directional Coupler	25 to 1000 MHz, 75 Ω (NC)
MP520C	CM Directional Coupler	25 to 500 MHz, 50 Ω (N)
MP520D	CM Directional Coupler	100 to 1700 MHz, 50 Ω (N)
MP526A	High Pass Filter	60 MHz band
MP526B	High Pass Filter	150 MHz band

Model/order No.	Name	Remarks
B0436A	Carrying case (soft type)	
MP526C	High Pass Filter	250 MHz band
MP526D	High Pass Filter	400 MHz band
MP526G	High Pass Filter	27 MHz band
MA1601A	High Pass Filter	800/900 MHz band, N-type
J0007	GPIB cable, 1 m	408JE-101
J0008	GPIB cable, 2 m	408JE-102
J0742A	RS-232C cable, 1 m	For PC-98 Personal Computer and VP-600, D-sub 25 pins (straight)
J0743A	RS-232C cable, 1 m	For AT compatible, D-sub 9-pins (cross)
60N50-1	Reflection bridge	50 Ω, N-P (measured-end) · N-J (I/O)
60NF50-1	Reflection bridge	50 Ω, N-J (measured-end) · N-J (I/O)
87A50	Reflection bridge	50 Ω, GPC-7 (measured-end) · N-J (I/O)
62N75	Reflection bridge	75 Ω, NC-P (measured-end) · NC-J (I/O)
62NF75	Reflection bridge	75 Ω, NC-J (measured-end) · NC-J (I/O)
MH648A	Pre-Amplifier	100 kHz to 1200 MHz
MP534A	Dipole Antenna	25 to 520 MHz
MP651A	Dipole Antenna	470 to 1700 MHz
BBA9106/VHA9103	Biconical Antenna	30 to 300 MHz
6502	Loop Antenna	10 kHz to 30 MHz
MP414B	Loop Antenna	9 kHz to 30 MHz
MP415B	Rod Antenna	9 kHz to 30 MHz
MP635A	Log-Periodic Antenna	80 to 1000 MHz
MP666A	Log-Periodic Antenna	200 to 2000 MHz
MB9A	Tripod	For MP534A/B, MP651A
MB19A	Tripod	For MP635A/666A
MA2601B	EMI Probe	
MA2601C	EMI Probe	
KT-10	EMI clamp	
KT-20	EMI clamp	

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Specifications are subject to change without notice.

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