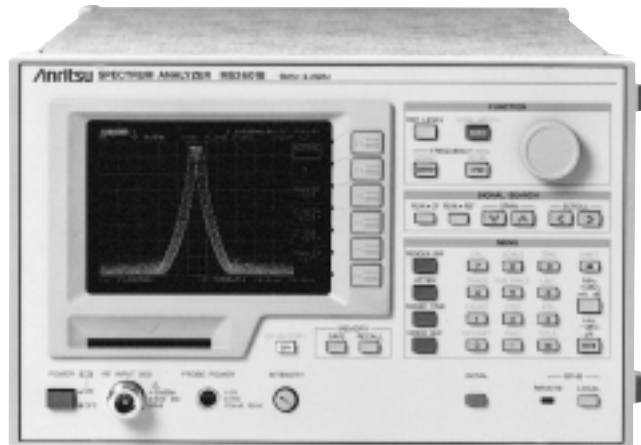


SPECTRUM ANALYZER MS2601B/K

9 kHz to 2.2 GHz

High-Speed Measurement of Various Devices



The MS2601B/K is a wide-band spectrum analyzer which covers the video to VHF/UHF bands. The synthesized local oscillator and automatic calibration, which uses a highly accurate signal source, enable accurate frequency and level measurement. In addition, the MS2601B/K has new and original functions such as the zone marker and scroll function, that shorten measurement time. Furthermore, plug-in memory cards (PMCs) for storing measurement conditions and waveform data offer excellent operability.

Advanced functions

• High-level built-in automatic calibration

The MS2601B/K automatically calibrates itself using the calibration signal from the built-in signal source each time the CAL key is pressed. The calibration data is processed at high speed by a 16-bit micro-processor and the compensation value is added to the displayed measured value. The reliability of measurements has been greatly improved and the measurement error has been reduced to about one-third of conventional models, resulting in a general level measurement accuracy of 1 dB.

Furthermore, when the working temperature changes drastically, an accurate measurement can be made just by pressing the CAL key.

• Digital technology supports high-accuracy measurement

Digital technology, including a synthesized local signal, has been used to greatly improve the level measurement accuracy. Also, the signal peak-level frequency can be measured with 1 Hz resolution even at a 2.2 GHz full sweep. Furthermore, in addition to having a QP detector, three resolution bandwidths, and time constants based on CIS-PR standards, the antenna calibration coefficients are automatically calculated to facilitate the best EMI measurement.

• IC cards for spectrum analyzers

The age of spectrum analyzers operated by IC cards has now arrived. The MS2601B/K uses IC memory cards called PMCs to store measurement conditions and waveform data. For example, once the test procedures are stored in the PMCs, measurements can be made under the same conditions at any time. You can keep your hard-earned measurement conditions as your personal know-how. Also, if these PMCs are used with the Personal Test Automation (PTA) program memory, automatic measurement can be packaged in a card.

• PTA widens realm of automatic measurements

The PTA function is a high-level language for measurement and a computer integrated in a spectrum analyzer. Programs for measurements, operation, and display, etc. can be input to the MS2601B/K via the keyboard or a personal computer. Thus, the spectrum analyzer can be configured quickly into automatic test equipment. PTA supports complicated measurements as well as preparation of final test results. The MS2601B/K can be used as a frequency counter, power meter, and real-time computer for measurement operations, or as ATE combining these functions, as well as a spectrum analyzer. Also, various support software is available to enable connection to factory automation LANs (local area networks).

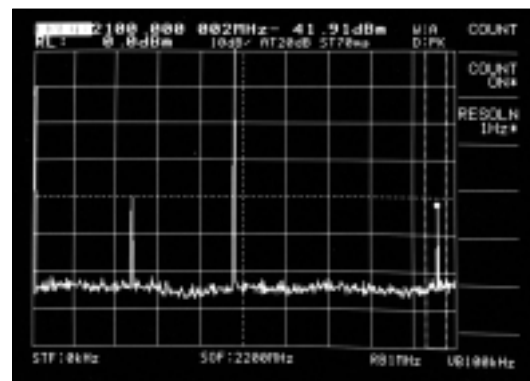
Main applications

- Measuring transmission quality such as spurious emissions from radio communication equipment
- Measuring electromagnetic interference (EMI)
- Testing high-frequency parts such as RF converters and tuners
- Measuring various devices such as filters and ICs

Measurement examples

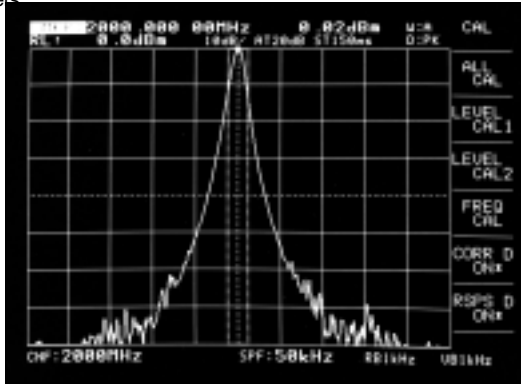
Correct frequency count even at 2.2 GHz-span sweep

The zone markers can be aligned with the desired signal even while observing the entire signal at full span sweep. A 2.2 GHz signal frequency can be measured at 1 Hz resolution (see below).



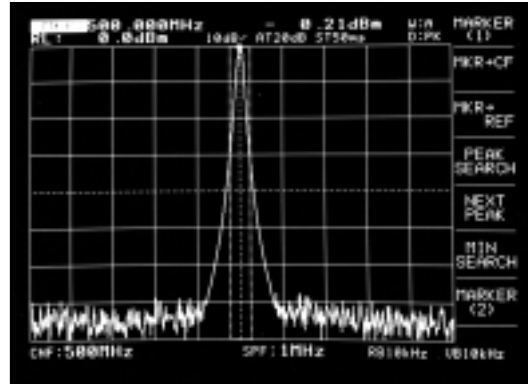
Overall level accuracy of ±1 dB

Reproducible high-accuracy level measurements are ensured through internal signal calibration, initiated simply by pressing the CAL key on the MS2601B/K (see below). In addition, there is little cumulative LOG linearity error so that measurements of transmission characteristics are carried out with the same high accuracy achieved by network analyzers.



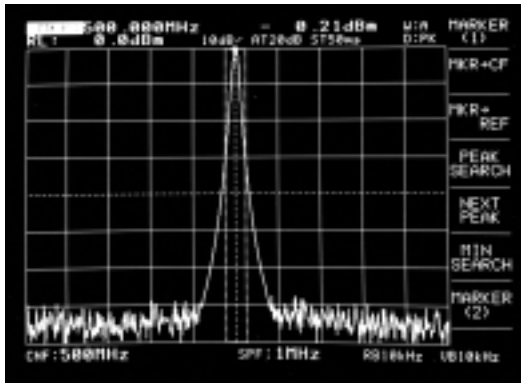
Frequency axis scroll function

Sometimes the signal on the left or right of the displayed portion must be examined in detail during a slow sweep (see below). Just press the scroll key to move the display two divisions left or right on the screen. This permits areas beyond the edge of the screen to be displayed without waiting for a new sweep to display the entire waveform.



Zone marker easily locates signals.

This zone marker function (patent pending) has been developed to reduce the measurement time. Simply enter zone markers around the signal frequency and the peak value within that zone will be measured with 0.03 dB resolution and displayed, even if the exact frequency varies. This eliminates troublesome marker adjustment to the signal peak each time you want to read the frequency and level (see below). The frequency-adjustment capability for an oscillator under test has been increased remarkably, and the frequency display remains visible during adjustment.



EMI measurement

In addition to providing a QP detector and three resolution bandwidths and time constants based on CISPR standards, antenna calibration coefficients are automatically calculated to facilitate easy EMI measurement.

Application software

MX4102B Transmitter Test System Software

The MX4102B software can be used for efficient testing of mobile transmitter equipment that uses PTA (optional). This software can be used to measure frequency, high-order harmonic spurious components (second to fifth order harmonics), occupied bandwidths, and the adjacent channel power.

Specifications

Model	MS2601B	MS2601K
Measurement frequency range	9 kHz to 2.2 GHz	
Frequency setting	0 to 2210 MHz (stop frequency: ≥1 kHz)	
Display resolution	20 Hz	
Setting mode	CENTER/SPAN, START/SPAN, START/STOP Set frequency span (stop freq.– start freq.) to 2 digit value (10 to 98)	
Frequency display accuracy	±(100 Hz + freq. span × 2% + display freq. × reference freq. accuracy) For CENTER/SPAN or START/SPAN mode, after auto-calibration, provided that freq. span is ≥10 kHz and sweep time is ≤100 s	
Frequency span	Setting range: 1 kHz to 2200 MHz for horizontal 10 divisions, 2-digit (10 to 98) variable, and 0 Hz (fixed tuning) 1 kHz to 2000 MHz, 1-2-5 sequence at step keys Readout accuracy: ±2% (sweep time ≤100 s)	
Resolution	Resolution bandwidth: 30 Hz to 1 MHz (3 dB bandwidth), variable in 1-3 sequence, can be selected manually or automatically coupled to frequency span Resolution bandwidth accuracy: ±20% Selectivity: ≤15 : 1 (ratio of 60 dB and 3 dB bandwidth)	
Stability	Residual FM: ≤20 Hz p-p/0.1 s (frequency span; ≤500 kHz) Drift: ≤300 Hz/min (frequency span; ≤500 kHz, sweep time; ≤100 s, after 1-hour warm-up at constant ambient temperature)	
Sideband noise	≤-80 dBc (at 100 Hz resolution bandwidth, 1 Hz video bandwidth, 10 kHz from signal)	

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Model		MS2601B	MS2601K
Frequency	Reference oscillator	Frequency: 10 MHz Stability Starting characteristic: Within $\pm 5 \times 10^{-6}$ (after 20-minute warm-up, referred to frequency after 1-hour warm-up) Aging rate: Within $\pm 2 \times 10^{-6}$ /day, $\leq 1 \times 10^{-7}$ /year (referred to frequency after 24-hour warm-up) Temperature characteristic: Within $\pm 5 \times 10^{-6}$ (referred to frequency at 25°C) External reference input Frequency: 10 MHz, Level: 2 to 5 Vp-p	
	Markers	NORMAL	Function: Displays frequency at tunable marker Display accuracy: Same as center frequency display accuracy
		Delta	Function: Displays frequency difference between reference marker and tunable marker Display accuracy: Same as frequency span display accuracy
COUNT	Function: Displays received signal frequency at marker Resolution: 1 Hz, 10 Hz, 100 Hz selectable Accuracy: Display frequency x reference frequency accuracy $\pm(2$ counts or 20 Hz, whichever is greater)		
Measurement range		-130 to +20 dBm	-124 to +20 dBm
Display		Divisions: 8 divisions on vertical axis when top line is reference level and scale is 10 dB/div 10 divisions on vertical axis for other scales LOG (referred to reference level): 0 to -70 dB (10 dB/div), 0 to -50 dB (5 dB/div), 0 to -20 dB (2 dB/div), 0 to -10 dB (1 dB/div) LIN: 10%/div of reference level (calibrated in voltage, unit: V) Linearity LOG: ± 0.2 dB/0 to -10 dB, ± 0.3 dB/0 to -20 dB, ± 0.5 dB/0 to -50 dB (resolution bandwidth of 100 Hz to 1 MHz), ± 1 dB/0 to -70 dB (resolution bandwidth of 100 Hz to 100 kHz), after automatic calibration LIN: $\pm 3\%$ of reference level (fullscale)	
Frequency response (20° to 30°C)		± 0.5 dB (100 kHz to 2.0 GHz), ± 1.5 dB (9 kHz to 2.2 GHz), input ATT at 20 dB	± 0.5 dB (100 kHz to 1.5 GHz), ± 1.5 dB (9 kHz to 2.2 GHz), input ATT at 20 dB
Reference level	Setting range	LOG: +20 to -100 dBm (setting resolution 0.1 dB), 2240 mV to 2.20 μ V LIN: 2240 mV to 70.8 μ V	LOG: +20 to -100 dBm (setting resolution 0.1 dB), 2750 mV to 2.70 μ V LIN: 2750 mV to 87.1 μ V
	Accuracy	± 0.3 dB (0 to -50 dBm), ± 0.75 dB (+20 to -70 dBm) after automatic calibration at frequency of 50 MHz and frequency span ≤ 2 MHz (resolution bandwidth, video bandwidth, sweep time, and input ATT settings at AUTO)	
Resolution bandwidth switching deviation		± 0.3 dB (after automatic calibration)	
Dynamic range	Average noise level	≤ -120 dBm (frequency 1 MHz to 2 GHz) with 0 dB input ATT, 300 Hz resolution bandwidth, 1 Hz video bandwidth	≤ -114 dBm (frequency 1 MHz to 2 GHz) with 0 dB input ATT, 300 Hz resolution bandwidth, 1 Hz video bandwidth
	2nd and 3rd harmonic distortion	≤ -75 dB (frequency 5 to 800 MHz) when 0 dB input ATT and -30 dBm input level	
	Residual response	≤ -100 dBm (frequency ≥ 500 kHz) when 0 dB input ATT and 50 Ω input termination	≤ -95 dBm (frequency ≥ 500 kHz) when 0 dB input ATT and 75 Ω input termination
Marker		Normal: Displays the level at settable marker Delta: Displays the difference in levels between the settable marker and the reference marker Noise measurement: Both the power of noise per 1 Hz bandwidth (dBm/Hz, dBc/Hz), and the adjacent channel power (dBm/ch, dBc/ch) can be measured.	
Video bandwidth		1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, OFF (selected manually or automatically coupled to resolution bandwidth)	
Level unit		dBm, dB μ V, dBmV, dB μ V (emf), dB μ V/m	
LOG/LIN switching loss		$\leq \pm 1$ dB (after calibration at room temperature)	
Quasi-peak detection		6 dB bandwidth: 200 Hz, 9 kHz 120 kHz $\pm 30\%$ (at room temperature) Time constants for quasi-peak detection Charge-time constant: 45 ms (for 6 dB bandwidth at 200 Hz), or 1 ms (for 6 dB bandwidth at 9 kHz and 120 kHz) Discharge-time constant: 500 ms (for 6 dB bandwidth at 200 Hz), 160 ms (for 6 dB bandwidth at 9 kHz), or 550 ms (for 6 dB bandwidth at 120 kHz) Display time constant: 160 ms (for 6 dB bandwidth at 200 Hz and 9 kHz), or 100 ms (for 6 dB bandwidth at 120 kHz) Display: LOG scale; 5 dB/div (10 div) Linearity: ± 1 dB (for -40 to 0 dB carrier wave signal, at room temperature)	
Field strength measurement		Antenna correction coefficients for correct display and measurement of field strengths (dB μ V/m) can be selected for certain antennas. Antenna correction coefficients have been stored in memory for the following antennas: MP534A/651A, MP635A/666A, MP414B The user may define and store antenna coefficients (for one antenna) via the GPIB interface.	Any set of user-defined antenna correction can be selected for correct display and measurement of field strengths (dB μ m). The user may define and store antenna coefficients (for one antenna) via the GPIB interface.
RF input	Impedance	50 Ω , VSWR ≤ 1.5 (input ATT; ≥ 10 dB, frequency; ≥ 30 kHz), N-type connector	75 Ω , VSWR ≤ 1.5 (input ATT; ≥ 10 dB, frequency; 30 kHz to 2 GHz), NC-type connector
	Maximum input level	+25 dBm (input ATT; ≥ 10 dB), DC: ± 50 V	+25 dBm (input ATT; ≥ 10 dB), DC: ± 100 V
Input ATT		Attenuation: 0 to 50 dB, in 10 dB steps (selected manually or automatically coupled to reference level) Switching accuracy: ± 1 dB (100 kHz to 1.5 GHz), ± 2.0 dB (9 kHz to 2.2 GHz)	
Sweep	Sweep time	Setting range: 50 ms to 1000 s variable in 1-1.5-2-3-5-7 sequence. Range can be selected manually or automatically according to frequency span, resolution bandwidth, and video bandwidth. It can also be set from 50 ms to 1000 s (according to the most significant 2-digits) via the GPIB interface. Accuracy: $\leq \pm 15\%$ (for 50 ms to 100 s range) or $\leq \pm 30\%$ (for 100 to 1000 s range) at room temperature	
	Trigger	FREE RUN, LINE, VIDEO, SINGLE, EXT TRIGGER	
	Sweep range	Normal: Sweeps entire range, Zone marker width setting range: 1 to 501 points (odd numbers) Zone sweep: Sweeps range between zone markers, Zone marker width setting range: 25 to 501 points (odd numbers)	

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Model		MS2601B	MS2601K
CRT display	CRT	Six-inch electromagnetic deflection type (green display color)	
	Display items	Graticule (grid), waveform data, setting conditions, menu, title	
	Waveform data display method	The display screen uses digital storage, 501 points of data for horizontal-axis data, and 2 display channels (A and B): Either channel can be selected for NORMAL, AVERAGE, MAX-HOLD, or MIN-HOLD waveforms, but only channel A can be used for the CUMULATIVE and OVERWRITE mode of displaying stored data. Channels A and B can be displayed simultaneously.	
	Detection method	PEAK, SAMPLE and DIP can be selected.	
	Direct plotting	Screen data can be hard-copied to a plotter or printer via the GPIB interface (RS-232C interface for option 02) Plotter compatibility: HP-GL or GP-GL compatible Printers: EPSON's VP-870 (or compatible models), or Hewlett-Packard's 2225	
Automatic calibration	ALL CAL: Calibrates all LEVEL CAL 1, LEVEL CAL 2 and FREQ CAL functions LEVEL CAL 1: Calibrates total gain deflection and log linearity LEVEL CAL 2: Calibrates resolution bandwidth, reference level, and LOG/LIN switching deflection FREQ CAL: Calibrates local frequency errors, and the center frequency of the resolution bandwidth QP CAL: Calibrates the on/off switching error apparent in quasi-peak detection		
Function memory	Internal memory: Save/recall 6 setting conditions PMC: Save/recall 12 (32 KB) or 48 (128 KB) setting conditions and measurement data		
External control	GPIB (IEEE488, IEC625-1, 24 pins): All functions except power switch, CRT intensity, PMC control, GPIB address, AM/FM modulator (option 07) and direct plotting controlled. Interface: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0		
Auxiliary signal input and output	IF output Frequency: 3.6 MHz, Output level: 0 dBm \pm 3 dB (at the reference line on the CRT), Connector: BNC-type 50 MHz output Frequency: 50 MHz, Output level: -2 dBm \pm 3 dB, Connector: BNC-type X, Y and Z outputs X-axis output: From 0 V (left edge) to 10 \pm 1 V (right edge), terminated at \geq 100 k Ω , BNC-connector Y-axis output ^{*1} : From 0 V (lower edge) to 1 \pm 0.3 V (upper edge), terminated at \geq 100 k Ω , BNC-connector Z-axis output: TTL level (level is low while sweep is in progress), BNC-connector Video output Composite: 1 Vp-p \pm 0.3 V, BNC-connector Separate: 8 pins, DIN-connector Probe power supply: +5 V \pm 10%, +15 V \pm 10%, -15 V \pm 10% (each 110 mA max.), 4-pole connector External trigger input: TTL level (rising edge active), BNC-connector External reference signal input: Use 10 MHz, 2 to 5 Vp-p reference input signal (input impedance: \geq 2 k Ω), BNC-connector		
Power	*2Vac \pm 5%, 50/60 Hz, \leq 145 VA (DC operation with MZ144A Battery Pack or MZ145B DC/DC Converter)		
Dimensions and mass	284 (W) x 177 (H) x 451 (D) mm, \leq 18.5 kg (without options)		
Operating temperature range	0° to 50°C		
EMC ^{*3}	EN55011: 1991, Group 1, Class A EN50082-1: 1992		

- *1: Since Y-axis outputs are not automatically calibrated, their amplitude specifications are not guaranteed.
- *2: Specify one nominal line voltage between 100 and 240 V when ordering. Maximum operational voltage is 250 V.
- *3: Electromagnetic Compatibility

Options

● Option 01: PTA (with external keyboard), Option 04: PTA (without keyboard)

PTA model	PTA-S201
Display	Number of display characters: 57 characters x 25 lines (small), 48 characters x 25 lines (medium), 41 characters x 25 lines (large) Displayable characters: Upper-case and lower-case characters, numerals, special symbols, and cursor Character font: 7 x 11 dot matrix (small), 9 x 13 dot matrix (medium), 10 x 13 dot matrix (large) Graphic: 4 screens, 400 x 575 dots
Keyboard	Character keys: Upper-case and lower-case characters, numerals, and special symbols Editing keys: DEL, INS, <, >, v, ^ Command keys: RUN, STEP, RETURN, RES
PTL	Program area: 200 KB Commands: Basic commands (18 types) and GPIB statements (2 types) Functions: Arithmetic functions, logical functions, and system functions System subroutines: Display subroutines and GPIB subroutines Variables: Numeric, string, and system variable Interfaces: GPIB and I/O ports, RS-232C and I/O port (Option 02)

● Option 02: RS-232C interface

Communication mode	Start-stop, full-duplex
Baud rate	300, 600, 1200, 2400, 4800 bps
Data bit	7, 8
Parity bit	Odd, even, none
Start bit	1 bit
Stop bit	1, 1.5, 2 bits
Control items	All items except power on/off, CRT intensity, PMC management, AM/FM modulator (Option 02), direct plotting and RS-232C parameters
Connector	DB-25P or equivalent

● **Option 05: Following changes to specifications**

Option		MS2601B option 05	MS2601K option 05
Frequency measurement range		100 Hz to 2.2 GHz	
Amplitude	Frequency response	±0.5 dB (100 Hz to 2.0 GHz), input ATT at 20 dB, temperature range 20° to 30°C	±0.5 dB (100 Hz to 1.5 GHz), input ATT at 20 dB, temperature range 20° to 30°C
	Dynamic range	Average noise level: Following added to standard model ≤-80 dBm (1 to 10 kHz) ≤-100 dBm (10 to 100 kHz) ≤-110 dBm (100 kHz to 1 MHz) At 0 dB input ATT, 30 Hz RBW, 1 Hz VBW	Average noise level: Following added to standard model ≤-74 dBm (1 to 10 kHz) ≤-94 dBm (10 to 100 kHz) ≤-104 dBm (100 kHz to 1 MHz) At 0 dB input ATT, 30 Hz RBW, 1 Hz VBW
	RF input	Impedance: 50 Ω, VSWR ≤1.5 At ≥10 dB input ATT, ≥100 Hz frequency	Impedance: 75 Ω, VSWR ≤1.5 At ≥10 dB input ATT, 100 Hz to 2 GHz frequency
	Input ATT switching accuracy	Maximum input level: +25 dBm (≥10 dB input ATT), DC ±0 V ±1.0 dB (1 kHz to 1.5 GHz), ±2.0 dB (1.5 to 2.0 GHz)	

Ordering information

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

Model/Order No.	Name
MS2601B	Main frame Spectrum Analyzer (RF input: 50 Ω)
MS2601K	Spectrum Analyzer (RF input: 75 Ω)
	MS2601B standard accessories
J0025A	Coaxial cord, N-P-5W • 5D-2W • N-P-5W, 1 m: 1 pc
J0104	Coaxial cord, UG-88U • RG55/U • N-P-55U, 1 m: 1 pc
J0017	Power cord, 2.5 m: 1 pc
F0012	Fuse, 3.15 A: 2 pcs
P0005	Memory card, 32 KB: 1 pc MS2601B/K operation manual: 1 copy MS2601B/K service manual: 1 copy
	MS2601K standard accessories
J0308	Coaxial cord, BNC-P • 3C-2WS • NCP-3W, 1 m: 1 pc
J0121	Coaxial cord, NCP-3W • 3C-2WS • NCP-3W, 1 m: 1 pc
J0017	Power cord, 2.5 m: 1 pc
F0012	Fuse, 3.15 A: 2 pcs
P0005	Memory card, 32 KB: 1 pc MS2601B/K operation manual: 1 copy MS2601B/K service manual: 1 copy
	Options
MS2601-01	PTA (with external JIS type PTA keyboard)
MS2601-02	RS232C interface (used in exchange for GPIB interface)
MS2601-04	PTA (without PTA keyboard)
MS2601-05	Frequency range: 100 Hz to 2.2 GHz (MS2601B: with MA8601A, MS2601K: with MA8601J)
MS2601-07	AM/FM Modulator (cannot be installed simultaneously with Option 09)
MS2601-08	Protector (cannot be installed simultaneously with B0025 protective front cover)
MS2601-09	Tilt Handle (cannot be installed simultaneously with Option 07)
	Optional instruments and parts
MC3305A	JIS Type PTA Keyboard
MC3306A	ASCII Type PTA Keyboard
MX4102B	Transmitter Test System Software
P0007	Memory card, 128 KB
P0008	Memory card, 256 KB
MA8601A	DC Block Adapter (50 Ω)
MA8601J	DC Block Adapter (75 Ω)
MH680A1	Tracking Generator
MA8610A	Pre-amplifier (9 kHz to 2.2 GHz)
MH648A	Pre-amplifier
MZ144A	Battery Pack
MZ145B	DC/DC Converter
MP534A	Dipole Antenna
MP651A	Dipole Antenna

Model/Order No.	Name
BBA9106	Biconical antenna (30 to 300 MHz, 50 Ω)
6502	Loop antenna (10 kHz to 30 MHz, 50 Ω)
MP635A	Log-periodic Antenna
MP666A	Log-periodic Antenna
MB18B	Pole (for MP666A)
MB9A	Tripod
MB19A	Tripod (with a pole, for MP635A/666A)
MP414B	Loop Antenna (9 kHz to 30 MHz, 3 bands)
MP415B	Rod Antenna (9 kHz to 30 MHz, 3 bands)
MZ126A	Band Selector (for MP414B/MP415B)
MP612A	RF Fuse Holder (DC to 1000 MHz, 50 Ω)
MP613A	Fuse Element (5 pcs/set, for MP612A)
MP640A	Branch
MP654A	Coupler
J0063	Fixed attenuator for high power measurement (10 W, DC to 12.4 GHz, 30 dB)
J0395	Fixed attenuator for high power measurement (30 W, DC to 9 GHz, 30 dB)
MP526A	High-Pass Filter (for 60 MHz band)
MP526B	High-Pass Filter (for 150 MHz band)
MP526C	High-Pass Filter (for 250 MHz band)
MP526D	High-Pass Filter (for 400 MHz band)
MP526G	High-Pass Filter (for 27 MHz band)
B0215	Rack mount
B0213	Carrying case (with casters)
B0214	Carrying case (without casters)
B0225	Carrying bag (with casters)
B0226	Carrying bag (without casters)
B0025	Protective front cover (cannot be installed simultaneously with option 08)
B0029	Stacking feet
B0038	Front handle kit
B0231	CRT hood
MP520A	CM Directional Coupler
MP520B	CM Directional Coupler
MP520C	CM Directional Coupler
MP520D	CM Directional Coupler
MP614A	50/75 Ω Impedance Transformer
MB009	50/75 Ω Impedance Transformer
MA2601B	EMI Probe
MA2601C	EMI Probe
KT-10	EMI clamp
P6201	FET probe (Tektronix product)
MA8611A	EMI Probe Kit (case, MA2601B, MA2601C, MA8610A, cable) Case for MA8611A