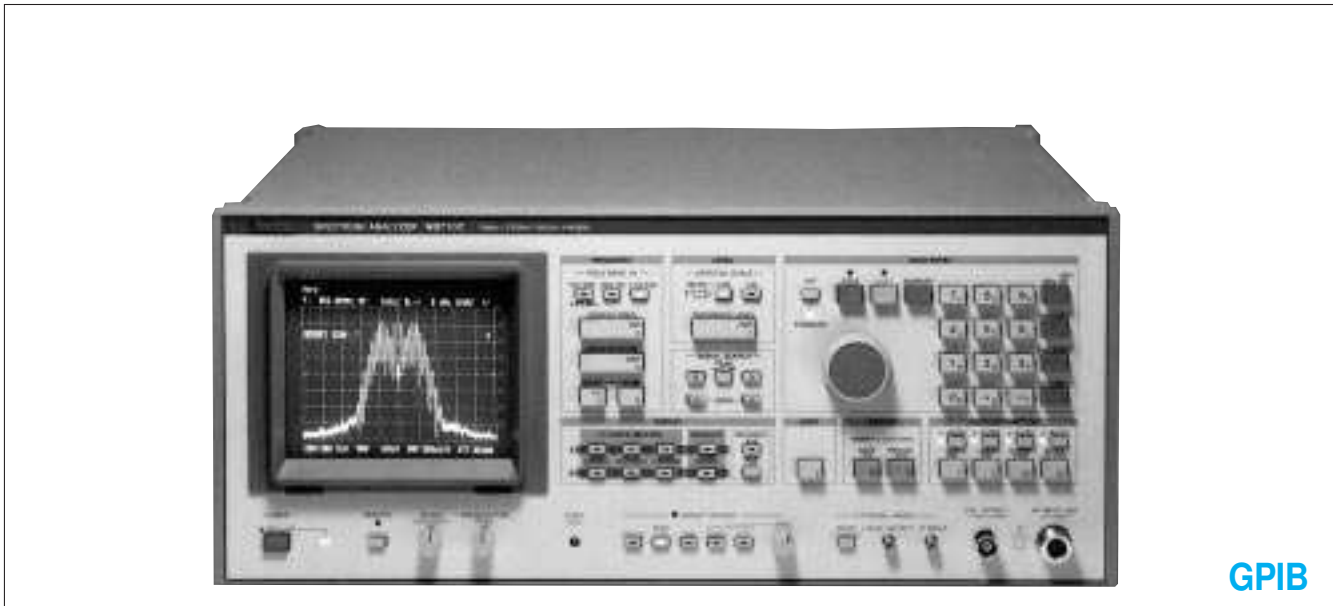


SPECTRUM ANALYZER
MS710C/D/E/F
 10 kHz to 23 GHz (18 to 140 GHz)

2



GPIB

The MS710C/D/E/F has been designed as a high-performance microwave spectrum analyzer with wide user applications. The MS710C/D/ E/F is easy-to-use and has a variety of functions suited to users' requirements. Use of a simplified PLL synthesizer local oscillator gives a high accuracy of 30 kHz/6.5 GHz (MS710C/E) and a high resolution of 100 Hz/6 dB (=70 dB/3 dB). Other features include wide dynamic range (second harmonics ≤ 100 dB) and an optional, wide measurement frequency range of up to 140 GHz by using external mixers. This fundamental performance is required by most users. In addition, a two-channel digital memory enables simultaneous display of two measured data, display of subtraction results and processing functions such as MAX HOLD and AVERAGING. By using these functions, the MS710C/D/E/F can provide many display/record-related functions such as signal search, and marker point data readout for numeric display and direct plotting. A new function which enables store/recall of up to 9 sets of measured data and measurement conditions has also been added. The MS710C/D/E/F has been designed for both easy manual operation and completely automatic operation via GPIB. The design includes:

(1) a grouped key layout with different key sizes depending on their functional importance, (2) an operation guide display for complicated operations such as SHIFT and MARKER functions, and (3) a preset memory which can memorize up to 10 sets of measurement conditions.

Main applications

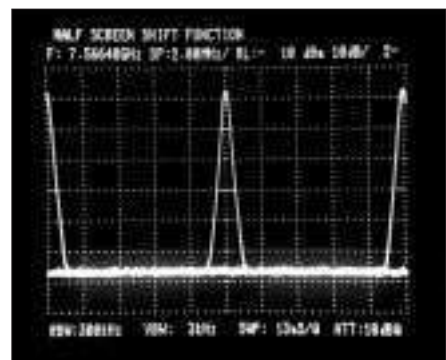
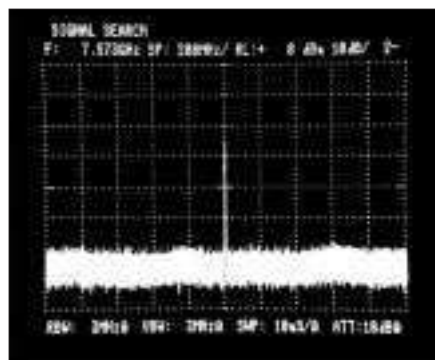
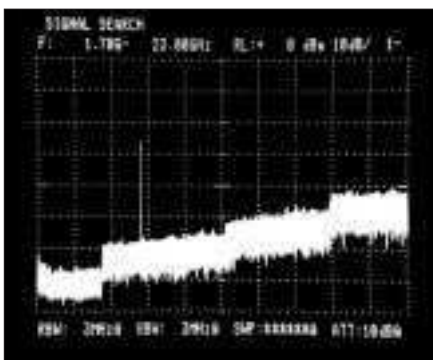
- Spectrum analysis of microwave devices and components
- Spurious emission and spectral distribution measurements of analog and digital communications transmitters
- Interference measurements for radio stations, satellite each stations, etc.
- Spectrum analysis in basic research such as nuclear physics and radio-astronomy
- Spurious measurements for home-use satellite broadcast receivers and related equipment

Functions

- **Wide variety of signal search functions**
 The special-purpose PEAK→CENTER SPAN UP/DOWN and HALF SCREEN SHIFT keys enable rapid location of the desired signal.

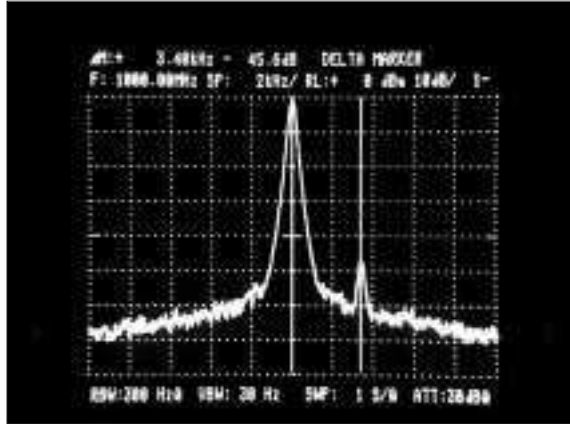
PEAK→CENTER

HALF SCREEN SHIFT



• **Marker**

Five marker functions (Normal, Delta, Peak, Marker → CF and Signal Track) are provided. In Signal Track, during successive sweeps the marker continuously tracks the peak signal, and at the start of each sweep, the marker frequency is moved automatically to the center frequency to hold the signal around the center of the screen. For the convenience of users, Signal Track is automatically stopped when the signal is lost. The photo shows the delta marker which enables reading of the frequency and level differences between two markers.

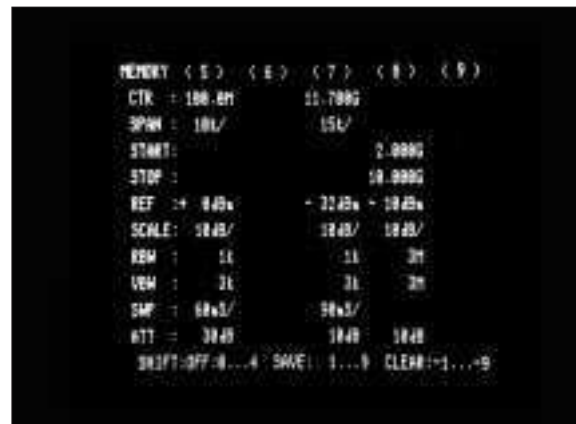


• **List display based on operability research**

Five list displays enable effective use of the many functions. The displays are classified into two types: operation procedures and memory contents. As an example of each type (1) the marker function list and (2) measurement condition list are shown below.



Marker function list



Measurement condition list

MS710C/D/E/F selection guide

Model	10 kHz to 30 MHz	100 kHz to 2 GHz, 1.7 to 23 GHz	18 to 140 GHz (with external mixer)	High frequency accuracy
MS710C	√	√	√	√
MS710D		√	√	
MS710E		√		√
MS710F		√		

Specifications

• 100 kHz to 2 GHz and 1.7 to 23 GHz band

Model		MS710C/E	MS710D/F	
Frequency	Measuring range	100 Hz to 2 GHz, 1.7 to 23 GHz		
	Center frequency	Setting range	0 MHz to 2 GHz, 1.7 to 23 GHz	
		Readout resolution	10 kHz (10 MHz to 2 GHz) 10 kHz (1.7 to 23 GHz)	100 kHz (0 MHz to 2 GHz) 1 MHz (1.7 to 23 GHz)
		Readout accuracy	± (the following accuracy +2% of frequency span +10% of resolution bandwidth)	
			30 kHz (0 MHz to 2 GHz, 1.7 to 6.5 GHz) 60 kHz (6.5 to 12.5 GHz) 90 kHz (12.5 to 18.5 GHz) 120 kHz (18.5 to 23 GHz)	1 MHz (0 MHz to 2 GHz, 1.7 to 6.5 GHz) 2 MHz (6.5 to 12.5 GHz) 3 MHz (12.5 to 18.5 GHz) 4 MHz (18.5 to 23 GHz)
			Setting	Number/unit keys, data knob, peak center key, or half-screen shift key
	Frequency span	Setting range and resolution: The following and 0 Hz (fixed tuning) in number/unit keys and in data knob 1 kHz/div to 200 kHz/div in 1 kHz increments 210 kHz/div to 2 MHz/div in 10 kHz increments 2.1 to 20 MHz/div in 100 kHz increments 21 to 200 MHz/div in 1 MHz increments For span up/down keys: 1 kHz/div to 200 MHz/div in 1-2-5-10 sequence Readout accuracy: ±5% (6 kHz/div to 200 MHz/div), ±10% (1 to 5 kHz/div) Setting: Number/unit keys, data knob, or span up/down keys		
	Start/stop frequency	Setting range	In each band (span ≥10 kHz)	In each band (span ≥1 MHz)
		Readout resolution	Min. 10 kHz (various with span settings) (span = stop frequency – start frequency)	1 MHz (span ≤200 MHz) 10 MHz (span ≤210 MHz) (span = stop frequency – start frequency)
		Readout accuracy	±(center frequency accuracy) +2.5% of span	
Setting		Number/unit keys or data knob		
Resolution	Resolution bandwidth (6 dB bandwidth) Setting range: 100 Hz to 3 MHz in 1-3-10 sequence Setting: Selectable manually or automatically coupled to frequency span Selectivity (60 dB/3 dB): ≤10 : 1 (resolution bandwidth ≥1 kHz)			
Stability	Residual FM: ≤200 Hzp-p/0.1 s (center frequency; ≤6.5 GHz, span; ≤100 kHz/div) Noise sidebands: ≤-75 dB (1 kHz resolution bandwidth, 10 Hz video bandwidth, 30 kHz from signal, center frequency ≤6.5 GHz)			
Amplitude	Measuring range	Average noised level to +30 dBm		
	Display	Graticule	Vertical 8 divisions, reference level is top line of graticule	
		LOG	10 dB/div: 0 to -70 dB from reference level 5 dB/div: 0 to -40 dB from reference level 2 dB/div: 0 to -16 dB from reference level 1 dB/div: 0 to -8 dB from reference level	
		LIN	12.5%/div	
		Linearity	±0.2 dB/1 dB, ±1.5 dB/70 dB	
	Reference level	Setting range: -109 to +30 dBm Calibration output accuracy: -10 dBm ±0.3 dB (100 MHz ±10 kHz) Reference level accuracy: ±2.0 dB (reference level; -99 to -10 dBm, frequency; 100 MHz, 0 dB input attenuator, and after calibrated using CAL OUTPUT) Input attenuator accuracy Setting range: 0 to 70 dB, 10 dB steps, selected manually or automatically coupled to reference level Error between steps: ±1 dB (0 to 60 dB, 100 kHz to 2 GHz), ±2 dB (0 to 40 dB, 100 kHz to 23 GHz) Maximum accumulation error: ±2.2 dB (0 to 60 dB, 100 kHz to 2 GHz), ±3 dB (0 to 40 dB, 100 kHz to 23 GHz) Frequency response: 10 dB input attenuator after preselector peak adjustment to obtain maximum response ±2.5 dB (100 kHz start frequency, 10 MHz stop frequency) ±1.5 dB (10 MHz start frequency, 2 GHz stop frequency) ±2.5 dB (1.7 GHz start frequency, 5.48 GHz stop frequency) ±3 dB (5.48 GHz start frequency, 12.52 GHz stop frequency) ±4 dB (12.52 GHz start frequency, 23 GHz stop frequency)		

Continued on next page

Model		MS710C/E	MS710D/F
Amplitude	Dynamic range	2nd harmonic distortion: ≤-60 dB (input frequency 100 kHz to 10 MHz, value obtained by subtracting input attenuator value from input level -40 dBm) ≤-70 dB (input frequency 10 to 200 MHz, value obtained by subtracting input attenuator value from input level -30 dBm) ≤-80 dB (input frequency 200 to 850 MHz, value obtained by subtracting input attenuator value from input level -30 dBm) ≤-100 dB*1(input frequency 850 MHz to 11.5 GHz [1.7 to 23 GHz band], value obtained by subtracting input attenuator value from input level -10 dBm) Two signal 3rd intermodulation distortion: ≤-80 dB (input frequency; 100 kHz to 2 GHz, frequency difference of two signal input; ≥2.5 MHz, value obtained by subtracting input attenuator value from input total level; -30 dBm) ≤-100 dB*1(input frequency; 1.7 to 12.5 GHz, frequency difference of two signal input; ≥70 MHz, value obtained by subtracting input attenuator value from input total level; -10 dBm) ≤-100 dB*1(input frequency; 12.5 to 23 GHz, frequency difference of two signal input; ≥100 MHz, value obtained by subtracting input attenuator value from input total level; -10 dBm) Residual response: ≤-90 dBm (0 dB input attenuator, 10 MHz to 6.5 GHz fundamental mixing, and 50 Ω termination) Average noise level: ≤-95 dBm (100 kHz to 1 MHz), ≤-115 dBm (1 MHz to 2 GHz), ≤-110 dBm (1.7 to 6.5 GHz), ≤-100 dBm (6.5 to 12.5 GHz), ≤-95 dBm (12.5 to 18.5 GHz), ≤-88 dBm (18.5 to 23 GHz) At 1 kHz resolution bandwidth, 0 dB input attenuator, and 3 Hz bandwidth Video bandwidth: 1 Hz to 3 MHz, 1-3-10 sequence Selected manually or automatically coupled to frequency span	
	Input	Connector: N-type (nominal 50 Ω) Maximum input level: +30 dBm, ±0 Vdc	
Marker	Normal	Frequency and level at marker displayed	
	Frequency readout resolution	1/50 of span/div or 1 kHz whichever greater	1/50 of span/div or 10 kHz whichever greater
	Level readout resolution	1/100 of span/div	
	Δ (delta)	Frequency and level difference at two markers displayed	
	Frequency readout resolution	1/50 of span/div	
	Level readout resolution	1/100 of scale/div	
	Peak	Marker always tracks peak position and shows frequency and level (readout resolution same as Normal Marker resolution)	
MKR→CF	Marker frequency set to center frequency		
CRT display	CRT Display area: 80 mm x 100 mm Display item: Graticule, signal traces, function setting value, error message, title, frequency band list, shift function list, and memory list Signal traces Memory capacity: Horizontal 501 points, vertical 801 points, A and B traces, backed-up by battery Display: NORMAL, MAX HOLD, AVERAGE, A→B, A↔B		
Function setting memory	Up to 10 sets of each function setting can be saved or recalled. The memory list can be displayed on the CRT, backed-up by battery.		
Display memory	Up to 9 sets of display (title, function settings, signal trace) can be saved or recalled.		
Sweep	Sweep time: 2 ms/div to 10 s/div. May be selected manually or automatically coupled to frequency span, resolution bandwidth, and video bandwidth. For 0 Hz frequency span, 2 μs/div to 10 s/div with manual setting. When (stop frequency - start frequency) >2 GHz, the previous time is set and time cannot be set manually. Trigger: Signal, free run, line, video, and external trigger		
Remote-control	GPIB (IEEE488, IEC625-1, 24 pins), all front panel functions (except power switch, CRT intensity, level calibration, and trigger level adjustment knob) can be remote-controlled.		
Direct plotting	CRT information can be plotted by the specified plotter or printer		
Power	AC 100 V ^{+10%} _{-15%} , 50/60 Hz, ≤200 VA		
Dimensions and mass	426 (W) x 177 (H) x 451 (D) mm, ≤27 kg		

*1: Less than specified level or average noise level

• 10 kHz to 30 MHz band (MS710C)

Frequency	Measuring frequency	10 kHz to 30 MHz
	Center frequency	Setting range: 0 kHz to 30 MHz Readout resolution: 1 kHz Readout accuracy: $\pm(3 \text{ kHz} + 2\% \text{ of frequency span} + 10\% \text{ of resolution bandwidth})$
	Frequency span setting range and resolution	The following and 0 Hz (fixed tuning) in number/unit keys and in data knob 1 to 200 kHz/div in 1 kHz increments 210 kHz/div to 2 MHz/div in 10 kHz increments 2.1 to 3 MHz/div in 100 kHz increments For span up/down keys: 1 kHz/div to 2 MHz/div in 1-2-5-10 sequence and 3 MHz/div
Amplitude	Frequency response	$\pm 1.5 \text{ dB}$ (10 kHz start frequency, 30 MHz stop frequency, 10 dB input attenuator)
	Dynamic range	2nd harmonic distortion: $\leq -60 \text{ dB}$ (input frequency 10 to 300 kHz, value obtained by subtracting input attenuator value from input level -40 dBm) $\leq -70 \text{ dB}$ (input frequency 300 kHz to 15 MHz, value obtained by subtracting input attenuator value from input level -30 dBm) Two signal 3rd intermodulation distortion: $\leq -70 \text{ dB}$ (input frequency 10 to 100 kHz, frequency difference of two signal input $\geq -2.5 \text{ MHz}$, value obtained by subtracting input attenuator value from input total level -30 dBm) Residual response: $\leq -90 \text{ dBm}$ Average noise level: $\leq -95 \text{ dBm}$ (100 kHz to 1 MHz), $\leq -115 \text{ dBm}$ (1 to 30 MHz) 1 kHz resolution bandwidth, 0 dB input attenuator, and 3 Hz video bandwidth

*: Other specifications are the same as the 100 kHz to 2 GHz and 1.7 to 23 GHz band specifications.

• 18 to 140 GHz band (with external mixer)

Model		MS710C	MS710D	
Frequency	Frequency band and harmonic number	18.0 to 26.5 GHz: 6, 22.0 to 33.0 GHz: 6, 26.5 to 40.0 GHz: 8, 40.0 to 60.0 GHz: 10, 60.0 to 90.0 GHz: 16, 90.0 to 140.0 GHz: 26		
	Center frequency	Setting range	In each band	
		Readout resolution	100 kHz (18 to 60 GHz), 1 MHz (60 to 140 GHz)	1 MHz
		Readout accuracy	30 kHz x harmonic number	1 MHz x harmonic number
		Setting	Number/unit keys, data knob, peak center key, or half-screen shift key	
	Frequency span	Setting range and resolution: The following and 0 Hz (fixed tuning) in number/unit keys and in data knob 1 kHz x n/div to 200 kHz x n/div in 1 kHz x n increments 210 kHz x n/div to 2 MHz x n/div in 10 kHz x n increments 2.1 MHz x n/div to 20 MHz x n/div in 100 kHz x n increments 21 MHz x n/div to 200 MHz x n/div in 1 MHz x n increments For span up/down keys: 1 kHz x n/div to 200 MHz x n/div in 1 x n, 2 x n, 5 x n, 10 x n sequence (n: harmonic number) Readout accuracy: $\pm 5\%$ (6 kHz x n/div to 200 MHz x n/div), $\pm 10\%$ (1 kHz x n/div to 5 kHz x n/div) Setting: Number/unit keys, data knob, or span up/down keys		
	Start/stop frequency	Setting range	In each band (span $\geq 10 \text{ kHz} \times n$)	In each band (span $\leq 1 \text{ MHz} \times n$)
		Readout resolution	Min. 10 kHz x n (varies with span settings) Span = stop frequency – start frequency	1 MHz (span $\leq 200 \text{ MHz} \times n$) 10 MHz (span $\leq 210 \text{ MHz} \times n$) Span = stop frequency – start frequency
		Readout accuracy	$\pm(\text{center frequency accuracy} + 2.5\% \text{ of span})$	
		Setting	Number/unit keys or data knob	
Resolution	Resolution bandwidth (6 dB bandwidth)	Setting range: 100 Hz to 3 MHz in 1-3-10 sequence Setting: Selected manually or automatically coupled to frequency span		
	Selectivity (60 dB/6 dB)	$\leq 10 : 1$ (resolution bandwidth $\leq 1 \text{ kHz}$)		
Amplitude	Measuring range	Average noise level to +30 dBm		
	Display	Graticule	Vertical 8 division, reference level is top line of graticule	
		LOG	10 dB/div: 0 to -70 dB from reference level 5 dB/div: 0 to -40 dB from reference level 2 dB/div: 0 to -16 dB from reference level 1 dB/div: 0 to -8 dB from reference level	
		LIN	12.5%/div	
		Linearity	$\pm 0.2 \text{ dB/1 dB}$, $\pm 1.5 \text{ dB/70 dB}$	
	Reference level	Setting range	-105 to +30 dBm (LOG), -9.5 to +30 dBm (LIN)	
		Calibration output accuracy	$-10 \text{ dBm} \pm 0.3 \text{ dB}$ (100 MHz $\pm 10 \text{ kHz}$)	
		Reference level accuracy	$\pm 2.0 \text{ dB}$ (reference level -99 to -10 dBm , frequency 100 MHz, 0 dB input attenuator, and after calibration using CAL OUTPUT)	
		Frequency response	Depends on external mixer	
	Average noise level	Depends on external mixer (-100 dBm typical with 30 dB external mixer conversion loss, 1 kHz resolution bandwidth)		
Video bandwidth	1 Hz to 3 MHz, 1-3-10 sequence Selected manually or automatically coupled to frequency span			

Continued on next page

Model		MS710C	MS710D
Marker	Normal	Frequency and level at markers displayed	
	Frequency readout resolution	1/50 of span/div or 1 kHz x n whichever greater	1/50 of span/div or 10 kHz x n whichever greater
	Level readout resolution	1/100 of scale/div	
	Δ(delta)	Frequency and level difference at two markers displayed	
	Frequency readout resolution	1/50 of span/div	
	Level readout resolution	1/100 of scale/div	
	Peak	Marker always tracks peak position and shows frequency and level (readout resolution same as normal marker resolution)	
	MKR→CF	Marker frequency set to center frequency	
Local output for external mixer		3 to 6 GHz, ≥+7 dBm	
IF input for external mixer		521.4 MHz	

* Other specifications are the same as the 100 kHz to 2 GHz and 1.7 to 23 GHz band specifications.

Peripherals and optional accessories

• Plotters and printers

Typical plotters that can be used for direct plotting are classified into three groups according to their types of command. The interfaces are GPIB or Centronics-style 8-bit parallel.

Manufacture	Country	Model
GRAPHTEC	Japan	PD9411
GRAPHTEC	Japan	FP6302
Hewlett Packard	USA	7475A
Hewlett Packard	USA	7470A

• Recommended external waveguide mixer

Tektronix: WM780 series (18 to 140 GHz, 2 port type)

Hewlett Packard: 11970 series (18 to 110 GHz, 3 port type)

Note: An additional amplifier (such as MP11975A) is required when using the HP11970 series mixer for local signal amplification.

• Measuring cable

Recommended measuring cables are as follows: (product of JUNKOSHA Co., Ltd.)

(1) JUNFLON microwave coaxial cable assembly

(2) DGM010-02000EE (general type, 2 m, N-P, 3.1 dB loss at 10 GHz)

(3) DGM024-02000EE (low loss type, 2 m, N-P, 2.5 dB loss at 10 GHz)

Ordering information

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

Model/Order No.	Name
MS710C	Main frame Spectrum Analyzer (10 kHz to 23 GHz/18 to 140 GHz)
MS710D	Spectrum Analyzer (100 kHz to 23 GHz/18 to 140 GHz)
MS710E	Spectrum Analyzer (100 kHz to 23 GHz)
MS710F	Spectrum Analyzer (100 kHz to 23 GHz)
	Standard accessories
J0104A	Coaxial cord, 1 m (BNC-P • RG-55/U • N-P): 1 pc
J0017	Power cord, 1 m (plug type must be specified.): 1 pc
F0013 (F0011)	Fuse, 5 A or 2 A: 2 pcs
F0010	Fuse, 1.6 A: 1 pcs
F0011	Fuse, 2 A: 1 pcs
F0012	Fuse, 3.15 A: 1 pcs
W0087AE	MS710[] operation manual: 1 copy
W0087BE	MS710[] service manual: 1 copy
	Option
MS710[]-01	Occupied frequency bandwidth calculation function
	Optional accessories
MP614A	50 Ω ↔ 75 Ω Impedance Transformer
J0078	20 dB high power attenuator (N-type connector, 10 W, DC to 18 GHz)
J0064A	Coaxial to 7 GHz band waveguide adaptor (5.8 to 8.6 GHz, BRJ-7 • N-J)
J0064C	Coaxial to 10 GHz band waveguide adaptor (8.2 to 12.4 GHz, BRJ-10 • N-J)
MP59B	Coaxial Switch (DC to 3 GHz)
J0114A	Coaxial cord, 1 m (N-P • RG-9A/U • N-P, general use)
DGM010-02000EE	Coaxial cord, 2 m (N-type connector, general use)
DGM024-02000EE	Coaxial cord, 2 m (N-type connector, low-loss type)
J0309	Mixer cable, 1 m (HRM-202B • RG58A/U • HRM-202B)
J0004	Coaxial adaptor (N-P • SMA-J)
J0007	GPIB cable, 1 m
J0008	GPIB cable, 2 m
J0409	Centronics cable, 1 m (for printer)
J0410	Centronics cable, 2 m (for printer)
B0115C	CRT hood
B0063	Carrying case (for standard type)
B0020	Front/rear cover (4U)
B0029	Stacking foot
B0038	Front handle kit (4U)
B0043	Rack mount kit (4U)
	Application equipment
MH680A1	Tracking Generator
MH648A	Pre-amplifier
MB23A	Portable Test Rack
MB24A	Portable Test Rack