

NETWORK/SPECTRUM ANALYZER

MS560J

100Hz to 300MHz



The MS560J is a sophisticated network analyzer that has combined functions of a spectrum analyzer, and, when connected with a reflection bridge or probe, an impedance analyzer, all in one completely self-contained unit. No longer do you need many separate instruments to measure transmission and impedance characteristics, distortion, spurious emission, noise, compression/expansion characteristics, and many more. Whether you are testing components, checking a PCM system operating at peak efficiency, you will appreciate this remarkably flexible and easy-to-use instrument.

Although the MS560J was designed for measurement of networks with a 50-ohm characteristic impedance, 75-ohm networks measurement is also possible using the Impedance Converter MA518A.

Features

- Wide measurement range: 100Hz to 300MHz
- Measurement with high frequency resolution of 0.1Hz. Thanks to the employment of a frequency synthesizer, the MS560J can perform the digital sweep of high precision.
- Wide variety of signal search and marker functions that are easy to use: MKR → CF (marker to center frequency), peak search, zero marker, delta marker.
- Automatic calibration and error correction functions enable highly accurate measurement.
- Excellent automation capability: GP-IB interface (standard feature) and internal controller (PTA) option.
- Electro-luminescent screen display that is clear to see.

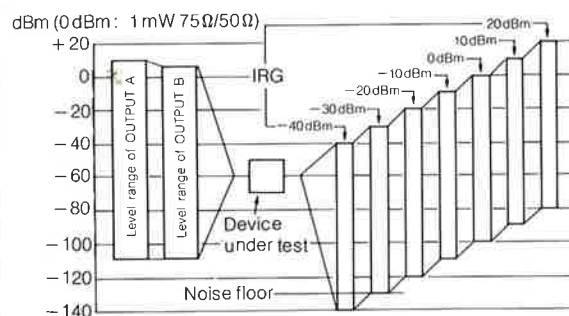
Functions and advantages

Measurements at actual operational levels

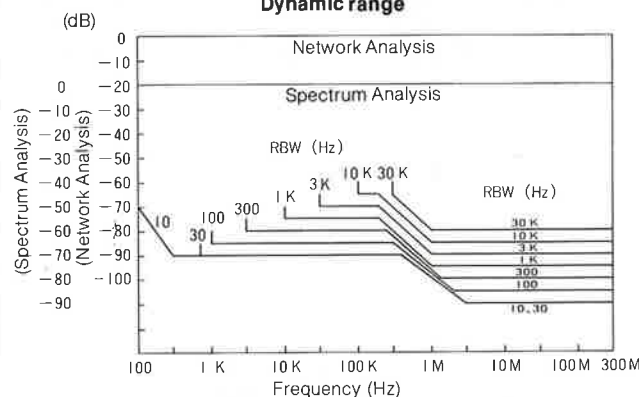
Output from the MS560J is variable from -110 to $+10$ dBm, while input to the analyzer can vary from -130 to $+20$ dBm. Hence measurements can be performed at levels close to those actually found in operational circuitry—from LC resonant circuits to telephone and power amplifiers. The output level can be stepped, at the same time the frequency is

swept. With the step resolution of 0.01 dB, this performance makes the MS560J ideal for testing the characteristics of input sensitive devices such as crystal filters or AGC circuits.

Level diagram of the MS560J measuring system



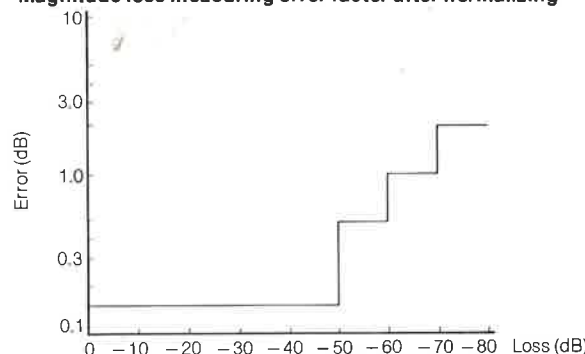
Dynamic range



High accuracy of measurements

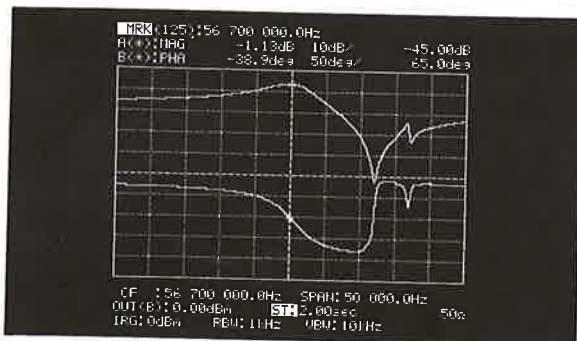
Usually, measured values include an error factor determined by the frequency response characteristics, gain shift, etc. The MS560J provides the function of frequency response and gain shift normalization, and with the network analyzer utilizing a through circuit as a standard, the error factor is corrected to a value of almost zero. The spectrum analyzer employs the synthesizer output level as a standard, thereby correcting the error to within ± 0.4 dB, exclusive of any detuning error in the IF band-pass filter.

Magnitude loss measuring error factor after normalizing



Frequency synthesizer for accurate network analysis

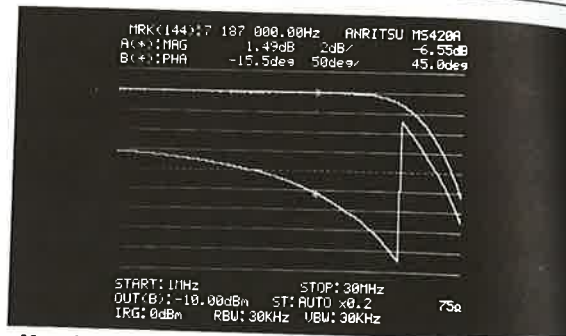
The MS560J is a complete network analyzer system for measuring magnitude, phase, delay time, magnitude/phase and magnitude/delay time. A highly accurate frequency synthesizer produces an output over the entire audio and low RF ranges 100Hz to 300MHz. The synthesizer is extremely stable, and provides precise control at 0.1 Hz resolution, allowing analysis to be performed on even high-Q resonant circuits or narrow-bandwidth filters.



Measuring of 56.7 MHz crystal resonator with a π network

Full sweep control

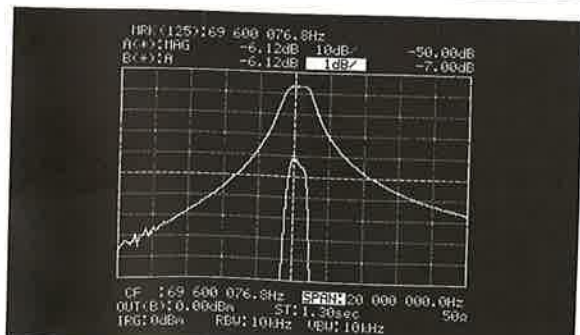
You can select automatic sweeping over the entire range or you can sweep between markers. The sweep can be linear or logarithmic. Since a high-speed sweep makes filter adjustment more efficient or automatic measurement faster, the entire span can be swept in as little as 500 milliseconds. And you can switch between two different sweep widths by the touch of a button.



Magnitude and phase measurement of a video amplifier by means of logarithmic sweeping

100dB dynamic range at 0.01 dB resolution

The analyzer has the ability to offer a 100dB dynamic range at 0.01dB resolution in its function as a network analyzer. It can simultaneously display dual traces at different SCALE and OFFSET settings. This means the passband ripple can be adjusted while the entire characteristic is being observed.



Band-pass filter with dual trace

Applications

	Spectrum Analyzer	Network Analyzer	Impedance Analyzer
Active filter		•	•
AGC amplifier		•	•
Amplifier		•	•
AM modulator		•	•
Antenna		•	•
Cable	•	•	•
Comander		•	•
Delay line		•	•
Diode	•	•	•
Equalizer		•	•
Feedback loop		•	•
Isolator		•	•
L. C. R.	•	•	•
Magnetic head	•	•	•
Mixer		•	•
Modem		•	•
Optical device		•	•
Oscillator		•	•
Passive filter		•	•
Resonator		•	•
Semiconductor switch	•	•	•
Transformer		•	•
Transistor, FET	•	•	•
Ultrasonic device	•	•	•

Specifications

Frequency range		100Hz to 300MHz
Measurement items		Magnitude, phase, delay, level, spectrum, frequency and envelope display
Sampling points		251 points
Sweep time		500ms to 24 hours (Depends on the measurement item and measurement conditions)
Impedance		50 Ω (Measurement in 75 Ω impedance are available when using MA518A 75 Ω Impedance Converter)
Synthesizer	Frequency	100Hz to 300MHz, 0.1Hz step
	Frequency accuracy	$\pm 5 \times 10^{-8}$ /day after a 15 minutes warm up, at 23 $\pm 5^{\circ}$ $\pm 1 \times 10^{-7}$ /year after a 24 hours warm up, at 23 $\pm 5^{\circ}$ $\pm 1 \times 10^{-7}$ /0 to 50 $^{\circ}$ C after a 15-minute warm up
	Level	-110dBm to +10dBm (Output-A), 0.01dB steps -110dBm to 4dBm (Output-B), 0.01dB steps
	Level accuracy	± 0.4 dB: -40 to +10dBm (at Output-A) ± 1 dB: -80 to -40dBm
	Sideband phase noise	-85dBc/Hz at 10kHz offset
	Harmonic distortion	-30dB
	Spurious	-55dB or -100dBm
	Connector	BNC
	Impedance	Return loss: 20dB (Output level less than 0dBm at Output-A terminal)
	Frequency	100Hz to 300MHz
Receiver	Input terminal	R and T (2 channels)
	Input range	-40 to +20dBm, 10dB steps
	Maximum input	+24dBm AC, +1.5V DC -3.5V DC
	Resolution bandwidth	3Hz to 30kHz, in 1-3 sequence Accuracy: $\pm 20\%$ at ≥ 30 Hz, Selectivity 20/1 Shape factor 60dB/3dB
	Average noise level	
	Residual response	-60dB or -100dBm
	Connector	BNC
	Impedance	Return loss: 25dB in greater than -10dBm range
	Cross talk	100dB: Between R and T channels
	Frequency	100Hz to 300MHz
Magnitude measurement	Range	± 100 dB
	Resolution	0.01dB
	Accuracy	± 0.15 dB: 0 to -50dB ± 0.5 dB: -50 to -60dB ± 1 dB: -60 to -70dB ± 2 dB: -70 to -80dB [At 30Hz of RBW, and 3MHz to 300MHz frequency range]

Continued on next page.

NETWORK ANALYZERS

Phase measurement	Frequency	100Hz to 300MHz
	Range	±180 deg
	Resolution	0.1 deg
	Accuracy	±1 deg at the same input level
	Level characteristics	±1.5 deg: 0 to -50dB ±3 deg: -50 to -70dB [At 30Hz of RBW, and 3MHz to 300MHz frequency range]
Delay measurement	Frequency	100Hz to 300MHz
	Range	100 ns to 40 ms, 17 ranges in 1, 2, 4 sequence
	Resolution	NORMAL: 1/1000 of range EXPAND: 1/10000 of range
	Accuracy	±0.5%: 0 to -50dB ±2%: -50 to -70dB [At 30Hz of RBW, and 3MHz to 300MHz frequency range]
Level measurement	Frequency	100Hz to 300MHz
	Range	-130 to +20dBm
	Resolution	0.01dB
	Accuracy	±0.5dB: +20 to -90dBm ±1.0dB: -90 to -100dBm ±3dB: -100 to -120dBm [At 30Hz of RBW, and 3MHz to 300MHz frequency range]
	Linearity	±0.15dB: 0 to -50dB ±1.0dB: -50 to -60dB ±3.0dB: -60 to -70dB [At 30Hz of RBW, and 3MHz to 300MHz frequency range]
Spectrum analysis	Image rejection	70dB
	IF rejection	70dB
	Internal distortion	-50dB at 100Hz to 3MHz and RBW ≤300Hz -60dB at 3 to 150 MHz
	Spurious	-60dB
Frequency count	Frequency	100Hz to 300MHz
	Resolution	1Hz
	Accuracy	± (5 × 10 ⁻⁸ + 2Hz)/day after a 15 minutes warm up, at 23 ±5°C ± (1 × 10 ⁻⁷ + 2Hz)/year after a 24 hours warm up, at 23 ±5°C ± (1 × 10 ⁻⁷ + 2Hz)/0 to 50°C after a 15-minute warm up [At a signal 20dB greater than other signals and noise in the filter skirts, and marker set at the maximum value of object signals]
Envelope display	Carrier frequency	100Hz to 300MHz
	Sweep time	100 ms to at least 100 s
	Envelope frequency	DC to 200Hz (depends on RBW and VBW)
Sweep mode	Frequency	LIN: START/STOP, CENTER/SPAN LOG: START/STOP
	Level	START/STOP/STEP
Sweep control		RESET, STOP, REPEAT START, SINGLE START
Automatic setting		SIGNAL TRACK: Ganged to maximum received signal automatically.
		BW, ST: COUPLED TO FREQ Resolution bandwidth, video bandwidth and sweep time are automatically set to the optimum value by ganging with the span width.
		BW, ST: COUPLED TO SPAN Resolution bandwidth, video bandwidth and sweep time are automatically set to the optimum value by ganging with the span width.
Calculation	INT	Non-linearity
	X→S	Offset error correction
	X-S	Automatic correction of offset error
	A-B	Arithmetic processing between A and B
	Δ	Deviation between MAIN marker and the Δ marker
	ZERO	Deviations from the reference value

Continued on next page.

Display	Display	6.5-inch FPD
	Trace	Same as the measuring items (rectangular coordinates)
	Sub trace	Same as the measuring items (rectangular coordinates)
	Markers	B, A, A-B. It is not performed for Magnitude/Phase and Magnitude/Delay.
	Characters	2 (MAIN marker, Δ marker)
Function memory		Marker point data, trace conditions, measurement conditions
Rear panel INPUT/OUTPUT	3	(Trace conditions, measurement conditions)
	Video output	75 Ω load, Approx. 1Vp-p (BNC)
	10MHz reference output	TTL level (BNC)
	10MHz signal input	TTL level (BNC)
	56.7MHz IF output 450kHz IF output Det output	Provided
	S \rightarrow X switching signal	Open collector (36 pins)
	GP-IB	Compatible with IEEE 488 (24 pins)
Remote control		GP-IB (IEEE 488, IEC625-1, 24 pins) SH1, AH1, T6, L4, SR1, RL1, PP0, DC0, DT0, C28 All functions (except power and intensity) of front panel can be remotely controlled.
Power		AC 100V \pm 10%, 50/60Hz, <450VA
Ambient temperature, rated range of use		0°C to 50°C
Dimensions and weight		221.5H, 426W, 451D mm, <35kg
Accessories supplied		Four coaxial cables BNC-P \rightarrow •BNC-P: 0.5m Two coaxial cables BNC-P \rightarrow •BNC-P: 1m One 75 Ω Impedance Converter MA518A One band pass filter One AC power cord Two set of keys for power switch One fuse One MS560J Operation Manual One MS560J GP-IB Operation Manual One MS560J PTA1 Operation Manual One MS560J Service Manual

Options

- PBMI Option
The same as that of MS420B/K (See p.100 for further details)
- PTA 1 Option
A dedicated option for MS560J. Functions are similar to that of MS420B/K

Optional accessories

See pages 98 to 106.