

Specifications

Model		MS2651A	MS2661A			
Frequency	Frequency range	9 kHz to 3 GHz	9 kHz to 3 GHz. Option19:500 Hz to 3 GHz			
	Center frequency display accuracy	\pm (display frequency \times reference frequency accuracy + span \times span accuracy + 100 Hz) Span \geq 10 kHz, after calibration				
	Marker frequency display accuracy	Normal: Same as center frequency display accuracy. Delta: Same as frequency span accuracy				
	Frequency span	Setting range: 0 Hz, 1 kHz to 3.1 GHz Accuracy: \pm 2.5% (span: \geq 10 kHz), \pm 5% (span: < 10 kHz with option 02)				
	Resolution bandwidth (3 dB BW)	Setting range: 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 5 MHz (manually or automatically settable according to frequency span) * Option 02 (MS2661A only): 30 Hz, 100 Hz and 300 Hz are added. Measurements of such as noise, C/N, adjacent channel leakage power by measure function are executed with the calculated equivalent noise bandwidth of the resolution bandwidth.				
	Selectivity (60 dB: 3 dB)	\leq 10: 1 (RBW: 1 to 300 kHz) \leq 15: 1 (RBW: 1 MHz, 5 MHz)				
	Video bandwidth	1 Hz to 3 MHz (1-3 sequence), automatically settable for through, manual or span)				
	Signal purity and stability	Noise sidebands: \leq - 90 dBc/Hz (1 GHz, 10 kHz offset)	Noise sidebands: \leq - 100 dBc/Hz (1 GHz, 10 kHz offset)			
		Residual FM: \leq 20 Hzp-p/0.1 s (1 GHz, span: 0 Hz) Frequency drift: \leq 200 Hz/min (span: \leq 10 kHz, sweep time: \leq 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: $\pm 5 \times 10^{-6}$ (0° to 50°C)					
Amplitude	Level measurement	Measurement range	Average noise level to +30 dBm			
		Maximum input level	+30 dBm (CW average power, input attenuator \geq 10 dB), \pm 50 Vdc			
		Average noise level	MS2651A	\leq - 110 dBm (1 MHz to 1 GHz), \leq - 110 dBm + f [GHz] dB (> 1 GHz) * Resolution bandwidth 1 kHz, video bandwidth 1 Hz, input attenuator 0 dB	MS2661A	\leq - 115 dBm (1 MHz to 1 GHz), \leq - 115 dBm + f [GHz] dB (> 1 GHz) * Resolution bandwidth 1 kHz, video bandwidth 1 Hz, input attenuator 0 dB When Option-08 Pre-amplifier installed: \leq - 114 dBm(1 MHz to 1 GHz) \leq - 114 dBm + 1.5f[GHz] dB(>1 GHz)
			Residual response	\leq - 100 dBm (input attenuator: 0 dB)		
	Total level accuracy	\pm 1.1 dB Total level accuracy: reference level accuracy (0 to - 50 dBm) + frequency response + log linearity (0 to - 20 dB) + calibration signal accuracy				
	Reference level	Setting range Log scale: - 100 to +30 dBm, or equivalent level Linear scale: 224 μ V to 7.07 V Unit Log scale: dBm, dB μ V, dBmV, V, dB μ Vemf, W, dB μ V/m Linear scale: V Reference level accuracy: \pm 0.3 dB (- 49.9 to 0 dBm), \pm 0.75 dB (- 69.9 to - 50 dBm, 0.1 to +30 dBm), \pm 1.5 dB (- 80 to - 70 dBm) .. *After calibration at 100 MHz frequency, span 2 MHz (when input attenuator, resolution bandwidth, video bandwidth, and sweep time set to AUTO) Resolution bandwidth switching deviation: \pm 0.3 dB Input attenuator Setting range: 0 to 70 dB (10 dB steps) *Manual settable, or automatically settable according to reference level Switching deviation: \pm 0.3 dB (0 to 50 dB), \pm 1 dB (0 to 70 dB) *After calibration, frequency 100 MHz, input attenuator 10 dB				

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Amplitude	Frequency response	± 0.5 dB (100 kHz to 3 GHz, referenced to 100 MHz, input attenuator 10 dB, temperature 18° to 28°C) ± 1.0 dB (100 kHz to 3 GHz, referenced to 100 MHz, input attenuator 0 to 50 dB) ± 1.5 dB (9 kHz to 100 kHz, referenced to 100 MHz, input attenuator 10 dB, temperature 18° to 28°C)	
	Screen display	Scale: 10 div (at single scale) Log scale: 10, 5, 2, 1 dB/div Linear scale: 10, 5, 2, 1% Linearity (after calibration): Log scale: ± 0.3 dB (0 to -20 dB, RBW \leq 1 MHz), ± 1 dB (0 to -70 dB, RBW \leq 100 kHz), ± 1.5 dB (0 to -80 dB, RBW \leq 10 kHz), ± 2.5 dB (0 to -90 dB, RBW \leq 10 kHz). Linear scale: $\pm 3\%$ (compared to reference level) Marker level resolution: Log scale: 0.01 dB Linear scale: 0.01% of reference level	
	Spurious response	2nd harmonic distortion: - 55 dBc (10 to 100 MHz, mixer level - 30 dBm) - 60 dBc (100 to 1500 MHz, mixer level - 30 dBm) Two signal 3rd intermodulation distortion: - 70 dBc (10 MHz to 3 GHz, frequency difference of two signals >50 kHz, mixer input level - 30 dBm)	2nd harmonic distortion: - 60 dBc (10 to 200 MHz, mixer level - 30 dBm) - 75 dBc (200 to 1500 MHz, mixer level - 30 dBm) - 80 dBc (800 to 1000 MHz, mixer level - 30 dBm) Two signal 3rd intermodulation distortion: - 70 dBc (10 to 100 MHz), - 80 dBc (100 to 3 GHz) *Frequency difference of two signals >50 kHz, mixer input level - 30 dBm
	1 dB gain compression	≥ -5 dBm (\geq 100 MHz, at mixer input level)	
	Maximum dynamic range	1-dB gain compression level vs. average noise level: >105 dB, >105 dB - f [GHz] dB Distortion characteristics (1 kHz RBW): 2nd harmonic: >67.5 dB (10 to 100 MHz), >70 dB (100 to 500 MHz), >70 - f [GHz] dB (500 to 1000 MHz) 3rd intermodulation: >76.7 dB (10 to 1000 MHz), >76.7 - 2/3f [dB] (1 to 3 GHz)	1-dB gain compression level vs. average noise level: >110 dB (100 MHz to 1 GHz), >110 dB - f [GHz] dB (>1 GHz) When Option-08 Pre-amplifier installed: ≥ -109 dB (1 MHz to 1 GHz) ≥ -109 dB + 1.5f (GHz) dB (>1 GHz) Distortion characteristics (1 kHz RBW): 2nd harmonic: >72.5 dB (10 to 200 MHz), >80 dB (200 to 500 MHz), >80 - f [GHz] dB (500 to 1500 MHz) 3rd intermodulation: >80 dB (10 to 1000 MHz), >83.3 dB (100 to 1000 MHz), >83.3 - 2/3f [GHz] dB (1 to 3 GHz)
	Sweep	Sweep time	Setting range: 20 ms to 1000 s (automatically for manual set, span, resolution bandwidth, and video bandwidth) Accuracy: $\pm 15\%$ (20 ms to 100 s), $\pm 45\%$ (110 to 1100 s), $\pm 1\%$ (time domain sweep)
	Sweep mode	Continuous, single	
	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 error: ± 0.5 dB (at reference level)	
	Display	Color TFT-LCD Size: 5.7" Number of colors: 17 (RGB, each 64-scale settable)	

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Model		MS2651A	MS2661A
Functions	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 Trace A/Time: Displays frequency spectrum, and time domain waveform at center frequency simultaneously 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	
	Input connector	N-J, 50 Ω	
	Auxiliary signal input and output	IF OUTPUT: 455 kHz (RBW ≤ 30 kHz), 10.695 MHz (RBW ≥ 100 kHz), - 10 dBm ± 2 dB (100 MHz, at upper edge of display, 50 Ω), BNC connector VIDEO OUTPUT (Y): 0 to 0.5 V ± 0.1 V (100 MHz input, 75 Ω termination, LOG: 10 dB/div, from lower edge to upper edge, BNC connector) COMPOSITE OUTPUT: For NTSC, 1 Vp-p (75 Ω terminated), BNC connector EXT REF INPUT: 10 MHz ± 10 Hz, 2 to 5 Vp-p, ≥ 200 Ω, BNC connector	
	Signal search	AUTO TUNE, PEAK → CF, PEAK → REF, SCROLL	
	Zone marker	NORMAL, DELTA	
	Marker	MARKER → CF, MARKER → REF, MARKER → CF STEP SIZE, Δ MARKER → SPAN, ZONE → SPAN	
	Peak search	PEAK, NEXT PEAK, NEXT RIGHT PEAK, NEXT LEFT PEAK, MIN DIP, NEXT DIP	
	Multi-marker	Number of markers: 10 max. (HIGHEST 10, HARMONICS, MANUAL SET)	
	Measure	Noise power (dBm/Hz, dBm/ch), C/N (dBc/Hz, dBc/ch) channel power (dBm/Hz, dBm), occupied bandwidth (power N% method, X-dB down method), adjacent channel leakage power (REF: total power method, reference level method, inband channel power method, channel designate display: 2 channels × 2, graphic display), average power of burst signal (average power in designated time range of time domain waveform), template comparison (upper/lower limits × each 2, time domain), MASK (upper/lower × each 2, frequency domain)	
	Save/recall	Save and recall setting conditions and waveform data to internal memory (max. 12) or memory card (Option 11)	
	Hard copy	Printer (HP dotmatrix, EPSON dotmatrix or compatible models): Display data can be hard-copied via the RS-232C, GPIB (Option 09), or parallel (Option 10) interface Plotter (HP-GL, GP-GL or compatible models): Display data can be output via the RS-232C, and GPIB (Option 09) interface	
	PTA	Language: PTL (interpreter based on BASIC) Programming: Using editor of external computer Program memory: Memory card (Option 11), upload/download to/from external computer Programming capacity: 192 Kbyte Data processing: Directly accesses measurement data according to system variables, system subroutines, and system functions	
	Others	RS-232C	Outputs data to printer and plotter. Control from external computer (excluding power switch)
Others	Power	85 to 132 Vac/170 to 250 Vac (automatic voltage switching), 47.5 to 63 Hz, ≤ 200 VA (100 Vac), ≤ 220 VA (200 Vac)	
	Dimensions and mass	177 (H) × 320 (W) × 351 (D) mm, <10.4 kg (without option, <9.8 kg when handle is removed)	
	Ambient temperature	0° to 50°C (operate), - 30° to +75°C (storage)	