

Signal Analyzers

Spectrum Analyzers, Portable



HP 8591E

HP 8591E, 8593E, 8594E, 8595E, 8596E

Specifications

Specifications apply to any of these analyzers unless otherwise noted.

Frequency

Frequency Range

HP 8591E:

50 Ω: 9 kHz to 1.8 GHz

75 Ω: 1 MHz to 1.8 GHz

HP 8594E: 9 kHz to 2.9 GHz, dc-coupled; 100 kHz to 2.9 GHz, ac-coupled

HP 8595E: 9 kHz to 6.5 GHz, dc-coupled; 100 kHz to 6.5 GHz, ac-coupled

	Band	LO harmonic = N	Center frequency
HP 8596E	0	1	9 kHz to 2.9 GHz (dc-coupled)
	0	1	100 kHz to 2.9 GHz (ac-coupled)
	1	1	2.75 to 6.5 GHz
HP 8593E	2	2	6.0 to 12.8 GHz
	0	1	9 kHz to 2.9 GHz
	1	1	2.75 to 6.5 GHz
	2	2	6.0 to 12.8 GHz
	3	3	12.4 to 19.4 GHz
	4	4	19.1 to 22 GHz
	4	4 (Option 026/027)	19.1 to 26.5 GHz

Frequency Reference

Aging: $\pm 2 \times 10^{-9}$ /year; $\pm 1 \times 10^{-7}$ /year (Option 004)

Temperature Stability: $\pm 5 \times 10^{-6}$; $\pm 1 \times 10^{-8}$ (Option 004)

Initial Achievable Accuracy: $\pm 0.5 \times 10^{-6}$; $\pm 2.2 \times 10^{-8}$ (Option 004)

Frequency Readout Accuracy (start, stop, center, marker):

\pm (freq. readout x freq. ref error + span accuracy + 1% of span + 20% of RBW + 100 Hz x N)

Marker Count Accuracy

Span ≤ 10 MHz x N: \pm (marker freq. x freq. ref error + counter resolution + 100 Hz x N)

Span > 10 MHz x N: \pm (marker freq. x freq. ref error + counter resolution + 1 kHz x N)

Counter Resolution

Span ≤ 10 MHz x N: Selectable from 10 Hz to 100 kHz

Span > 10 MHz x N: Selectable from 100 Hz to 100 kHz

Frequency Span

Range: 0 Hz (zero span) and

HP 8591E: 10 kHz to 1.8 GHz; 1 kHz min (Option 130)

HP 8594E: 10 kHz to 2.9 GHz; 1 kHz min (Option 130)

HP 8595E: 10 kHz to 6.5 GHz; 1 kHz min (Option 130)

HP 8596E: $[10 \times N]$ kHz to 12.8 GHz; $[1 \times N]$ kHz min (Option 130)

HP 8593E: $[10 \times N]$ kHz to 19.25 GHz; $[1 \times N]$ kHz min (Option 130)

Resolution: Four digits or 20 Hz x N, whichever is greater

Accuracy

Span ≤ 10 MHz x N: $\pm 2\%$ of span

Span > 10 MHz x N: $\pm 3\%$ of span

Sweep Time

Range

Span = 0 Hz or > 1 kHz: 20 ms to 100 s

Span = 0 Hz (Option 101): 20 μ s to 100 s

Accuracy

20 ms to 100 s: $\pm 3\%$

20 μ s to < 20 ms (Option 101): $\pm 2\%$

Sweep Trigger: Free run, single, line, video, external

Resolution Bandwidth: 1 kHz to 3 MHz (3 dB) in 1, 3, 10 sequence; 9 kHz and 120 kHz (6 dB) EMI bandwidths. Option 130 adds 30, 100, and 300 Hz (3 dB) bandwidths and 200 Hz (6 dB) EMI bandwidth.

Accuracy: $\pm 20\%$

Selectivity (characteristic)

-60 dB/-3 dB: 3 kHz to 10 kHz, 15:1

100 kHz to 3 MHz, 15:1

1 kHz, 30 kHz, 16:1

-40 dB/-3 dB: 30 Hz to 300 Hz, 10:1

Video Bandwidth Range: 30 Hz to 1 MHz in 1, 3 sequence

(1 Hz to 1 MHz with Option 130)

Stability

Noise Sidebands (1 kHz RBW, 30 Hz VBW, sample detector)

> 10 kHz offset from CW signal: ≤ -90 dBc/Hz + 20 log N

> 20 kHz offset from CW signal: ≤ -100 dBc/Hz + 20 log N

> 30 kHz offset from CW signal: ≤ -105 dBc/Hz + 20 log N

Residual FM

HP 8591E:

1 kHz RBW, 1 kHz VBW: ≤ 250 Hz pk-pk in 100 ms

30 Hz RBW, 30 Hz VBW: ≤ 30 Hz pk-pk in 300 ms

HP 8593E, 8594E, 8595E, 8596E:

1 kHz RBW, 1 kHz VBW: $\leq (250 \times N)$ Hz pk-pk in 100 ms

30 Hz RBW, 30 Hz VBW: $\leq (30 \times N)$ Hz pk-pk in 300 ms

System Related Sidebands (> 30 kHz offset from CW signal):

≤ -65 dBc + 20 log N

Comb Generator Frequency (HP 8593E, 8596E): 100 MHz fundamental

frequency; $\pm 0.007\%$ frequency accuracy

Amplitude

Amplitude Range: Displayed average noise level to + 30 dBm

HP 8591 Option 001: Displayed average noise level to + 72 dBmV

Maximum Safe Input Level (input attenuator ≥ 10 dB)

Average Continuous Power: + 30 dBm (1 W)

HP 8591E Option 001: + 72 dBmV (0.2 W)

Peak Pulse Power

HP 8591E: ± 30 dBm (1 W)

HP 8591E Option 001: + 72 dBmV (0.2 W)

HP 8593E, 8594E, 8595E, 8596E: +50 dBm (100 W) for < 10 μ s pulse width and $< 1\%$ duty cycle, input atten. ≥ 30 dB

DC

HP 8591E: 25 Vdc

HP 8591E Option 001: 100 Vdc

HP 8593E: 0 Vdc

HP 8594E, 8595E, 8596E: 0 V (dc-coupled); 50 V (ac-coupled)

Gain Compression (> 10 MHz): ≤ 0.5 dB (total power at

input mixer = -10 dBm)

Displayed Average Noise Level (input terminated, 0 dB atten.,

30 Hz VBW or 1 Hz VBW with Option 130, sample detector)

	30 Hz RBW	1 kHz RBW
HP 8591E		
400 kHz to 1 MHz	≤ -130 dBm	≤ -115 dBm
1 MHz to 1.5 GHz	≤ -130 dBm	≤ -115 dBm
1.5 GHz to 1.8 GHz	≤ -128 dBm	≤ -113 dBm
HP 8591E Option 001		
1 MHz to 1.5 GHz	≤ -78 dBmV	≤ -63 dBmV
1.5 GHz to 1.8 GHz	≤ -76 dBmV	≤ -61 dBmV
HP 8594E		
400 kHz to 5 MHz	≤ -122 dBm	≤ -107 dBm
5 MHz to 2.9 GHz	≤ -127 dBm	≤ -112 dBm
HP 8595E		
400 kHz to 2.9 GHz	≤ -125 dBm	≤ -110 dBm
2.75 to 6.5 GHz	≤ -127 dBm	≤ -112 dBm
HP 8596E		
400 kHz to 2.9 GHz	≤ -125 dBm	≤ -110 dBm
2.75 to 6.5 GHz	≤ -127 dBm	≤ -112 dBm
6.0 to 12.8 GHz	≤ -115 dBm	≤ -100 dBm
HP 8593E		
400 kHz to 2.9 GHz	≤ -127 dBm	≤ -112 dBm
2.75 to 6.5 GHz	≤ -129 dBm	≤ -114 dBm
6.0 to 12.8 GHz	≤ -117 dBm	≤ -102 dBm
12.4 to 19.4 GHz	≤ -113 dBm	≤ -98 dBm
19.1 to 22 GHz	≤ -107 dBm	≤ -92 dBm
HP 8593E Option 026/027		
19.1 to 26.5 GHz	≤ -102 dBm	≤ -87 dBm

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Signal Analyzers

Spectrum Analyzers, Portable

HP 8590
E-Series
HP 8591E
HP 8593E
HP 8594E
HP 8595E
HP 8596E

Specifications (cont'd)

Spurious Responses

Second Harmonic Distortion

HP 8591E (5 MHz to 1.8 GHz): < -70 dBc for -45 dBm tone at input mixer

HP 8593E (10 MHz to 2.9 GHz): < -70 dBc for -40 dBm tone at input mixer

HP 8594E, 8595E, 8596E (> 10 MHz): < -70 dBc for -40 dBm tone at input mixer

HP 8593E, 8595E, 8596E (> 2.75 GHz): < -100 dBc for -10 dBm tone at input mixer (or below DANL)

Third-Order Intermodulation

HP 8591E (5 MHz to 1.8 GHz): < -70 dBc for two -30 dBm tones at input and > 50 kHz separation

HP 8593E, 8594E, 8595E, 8596E (> 10 MHz): < -70 dBc for two -30 dBm tones at input and > 50 kHz separation

Other Input-Related Spurious (≥ 30 kHz offset, -20 dBm tone at input mixer)

HP 8591E, 8594E, 8595E, 8596E: < -65 dBc

HP 8593E: < -65 dBc (applied frequency ≤ 18 GHz); < -60 dBc (applied frequency ≤ 22 GHz)

Residual Responses (input terminated, 0 dB attenuation)

1 MHz to 1.8 GHz (HP 8591E Option 001): < -38 dBmV

150 kHz to 1.8 GHz (HP 8591E): < -90 dBm

150 kHz to 2.9 GHz (HP 8594E): < -90 dBm

150 kHz to 6.5 GHz (HP 8593E, 8595E, 8596E): < -90 dBm

Display Range

Log Scale: 0 to -70 dB from ref level is calibrated; 0.1, 0.2, 0.5 dB/div and 1 to 20 dB/div in 1 dB steps; 8 div displayed

Linear Scale: 8 divisions

Scale Units: dBm, dBmV, dB μ V, V, W

Marker Readout Resolution

Log Scale: 0.05 dB

Linear Scale: 0.05% of ref level

Fast Time Sweep for Zero Span (Option 101 or 301, 20 μ s to 20 ms)

≤ 1 GHz: 0.7% of ref level for linear scale

> 1 GHz: 1.0% of ref level for linear scale

Reference Level

Range: Same as amplitude range

Resolution: ± 0.01 dB for log scale; $\pm 0.12\%$ of ref level for linear scale

Accuracy: ± 0.3 dB at -20 dBm; 0 to -59.9 dBm: $\pm (0.3 \text{ dB} + 0.01 \times \text{dB from } -20 \text{ dBm})$

Frequency Response (10 dB input attenuation)

Absolute (referenced to 300 MHz CAL OUT)

HP 8591E, 8594E: ± 1.5 dB

HP 8595E: ± 1.5 to ± 2.0 dB

HP 8596E: ± 1.5 to ± 2.5 dB

HP 8593E: ± 1.5 to ± 5.0 dB (preselector peaked)

Relative Flatness (referenced to midpoint between highest and lowest frequency response deviations)

HP 8591E, 8594E: ± 1.0 dB

HP 8595E: ± 1.0 to ± 1.5 dB

HP 8596E: ± 1.0 to ± 2.0 dB

HP 8593E: ± 1.0 to ± 2.0 dB (preselector peaked)

Calibrator Output Amplitude: -20 dBm ± 0.4 dB; $+28.75$ dBmV ± 0.4 dB, HP 8591 Option 001

Resolution Bandwidth Switching Uncertainty (ref to 3 kHz RBW, at ref level)

3 kHz to 3 MHz RBW: ± 0.4 dB

1 kHz RBW: ± 0.5 dB

30 Hz to 300 Hz RBW: ± 0.6 dB

Log to Linear Switching: ± 0.25 dB at ref level

Display Scale Fidelity

Log Incremental Accuracy (0 to -60 dB from ref level): ± 0.4 dB/4 dB

Log Maximum Cumulative (0 to -70 dB from ref level)

3 kHz to 3 MHz RBW: $\pm (0.3 + 0.01 \times \text{dB from ref level})$

30 Hz to 1 kHz RBW: $\pm (0.4 + 0.01 \times \text{dB from ref level})$

Linear Accuracy: $\pm 3\%$ of ref level

General Specifications

MIL-T-28800: Has been type-tested to the environmental specifications of MIL-T-28800 Class 5

Temperature

Operating: 0° to $+55^\circ$ C

Storage: -40° to $+75^\circ$ C

EMI Compatibility: Conducted and radiated interference CISPR Pub. 11 and Messempefaenger Postverfuegung 526/527/79

Audible Noise: < 37.5 dBA pressure and < 5.0 Bels power (ISODP7779)

Power Requirements

On (line 1): 90 to 132 V rms, 47 to 440 Hz

195 to 250 V rms, 47 to 66 Hz

Power consumption < 500 VA; < 180 W

Standby (line 0): Power consumption < 7 W

User Program Memory (nominal): 238 KB nonvolatile RAM

Data Storage (nominal)

Internal: 24 traces or 32 states

External: 50 traces, 8 states

Memory Cards: HP 85700A (32 KB), 24 traces or 32 states;

HP 85702A (128 KB), 99 traces or 128 states

Video Cassette Recorder (VCR): Continuous video recording of display supported through composite video output

Size (nominal, without handle, feet, or cover): 325 mm W x 163 mm H x 427 mm D

Weight: 14.5 kg (HP 8591E); 16.4 kg (HP 8593E, 8594E, 8595E, 8596E)

Option 010 and 011 Built-In Tracking Generators

Option 010 (50 Ω) is available for all HP 8590 series spectrum analyzers except the HP 8592L. Option 011 (75 Ω) is available for the HP 8590L and 8591E only.

Frequency Range

Option 010: 100 kHz to 1.8 GHz (HP 8590L, 8591E); 9 kHz to 2.9 GHz (HP 8593E, 8594E, 8595E, 8596E)

Option 011: 1 MHz to 1.8 GHz (HP 8590L, 8591E)

Output Level

Range

Option 010: 0 to -15 dBm (HP 8590L); 0 to -70 dBm (HP 8591E);

-1 to -66 dBm (HP 8593E, 8594E, 8595E, 8596E)

Option 011: $+42.8$ to $+27.8$ dBmV (HP 8590L);

$+42.8$ to -27.2 dBmV (HP 8591E)

Resolution: 0.1 dB

Absolute Accuracy: ± 1.5 dB (HP 8590L); ± 1.0 dB (HP 8591E);

± 0.75 dB (HP 8593E, 8594E, 8595E, 8596E)

Vernier

Range: 15 dB (HP 8590L); 10 dB (HP 8591E);

9 dB (HP 8593E, 8594E, 8595E, 8596E)

Accuracy: ± 1.0 dB (HP 8590L); ± 0.75 dB (HP 8591E);

± 0.5 dB (HP 8593E, 8594E, 8595E, 8596E)

Output Flatness: ± 1.75 dB (HP 8590L, 8591E); ± 2.0 dB, > 10 MHz (HP 8593E, 8594E, 8595E, 8596E)

Spurious Output

Harmonic Spurs: 0 dBm + 42.8 dBmV output, < -25 dBc (HP 8590L, HP 8591E); -1 dBm output, < -25 dBc (HP 8593E, 8594E, 8595E, 8596E)

Nonharmonic Spurs: < -30 dBc (HP 8590L, 8591E); ≤ -27 dBc, 300 kHz to 2.0 GHz, ≤ -23 dBc, 2.0 GHz to 2.9 GHz (HP 8593E, 8594E, 8595E, 8596E)

Dynamic Range (characteristic; max. output level $-TG$ feedthrough)

Option 010: 106 dB (HP 8590L, 8591E); 106 dB (HP 8594E, > 400 kHz);

109 dB (HP 8595E, 8596E, > 400 kHz); 111 dB (HP 8593E, > 400 kHz)

Option 011: 100 dB

Power Sweep

Range

Option 010: -15 dBm to 0 dBm (HP 8590L); -75 dBm to 0 dBm

(HP 8591E); -66 dBm to -1 dBm in 8 dB increments (HP 8593E, 8594E, 8595E, 8596E)

Option 011: $+27.8$ dBmV to $+42.8$ dBmV (HP 8590L);

-32.2 to $+42.8$ dBmV (HP 8591E)

Resolution: 0.1 dB

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