These specifications apply to the Agilent Technologies 8591E, 8593E, 8594E, 8595E, and 8596E spectrum analyzers.

**Specifications**
All specifications apply over 0°C to +55°C. The analyzer will meet its specifications after 2 hours of storage at a constant temperature, within the operating temperature range, 30 minutes after the analyzer is turned on, and after CAL FREQ and CAL AMPTD (and for the 8593E, 8595E, and 8596E CAL YTF) have been run.

**Frequency Specifications**

**Frequency Range**

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>8591E</td>
<td>50 Ω 9 kHz to 1.8 GHz, 75 Ω 1 MHz to 1.8 GHz</td>
</tr>
<tr>
<td>8593E</td>
<td>9 kHz to 22 GHz</td>
</tr>
<tr>
<td>Option 026/027</td>
<td>9 kHz to 26.5 GHz</td>
</tr>
</tbody>
</table>

**Band LO harmonic = N**

- 0, 1: 9 kHz to 2.9 GHz
- 1, 1: 2.75 GHz to 6.5 GHz
- 2, 2: 6.0 GHz to 12.8 GHz
- 3, 3: 12.4 GHz to 19.4 GHz
- 4, 4: 18.1 GHz to 22.0 GHz

**Frequency Reference**

<table>
<thead>
<tr>
<th>Aging</th>
<th>±2 x 10⁻⁶/year</th>
<th>±1 x 10⁻⁷/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Stability</td>
<td>±5 x 10⁻⁶</td>
<td>±1 x 10⁻⁸</td>
</tr>
<tr>
<td>Initial Achievable Accuracy</td>
<td>±0.5 x 10⁻⁶</td>
<td>±2.2 x 10⁻⁸</td>
</tr>
</tbody>
</table>

(Opt. 004)

Agilent Technologies
Innovating the HP Way
Frequency Readout
Accuracy
(Start, Stop, Center, Marker)
±(frequency readout x frequency reference error x span accuracy +1% of span +20% of RBW x 100 Hz x N*)

Marker Count Accuracy
Frequency Span ≤10 MHz x N*
±(marker frequency x frequency reference error x counter resolution +100 Hz x N*)
Frequency Span >10 MHz x N*
±(marker frequency x frequency reference error x counter resolution +1 kHz x N*)

Counter Resolution
Frequency Span ≤10 MHz x N*
Selectable from 10 Hz to 100 kHz
Frequency Span >10 MHz x N*
Selectable from 100 Hz to 100 kHz

Frequency Span
Range 0 Hz (zero span), and

<table>
<thead>
<tr>
<th>Opt. 130</th>
<th>Std.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. (KHz)</td>
<td>Min. (KHz)</td>
</tr>
<tr>
<td>8591E</td>
<td>1</td>
</tr>
<tr>
<td>8593E</td>
<td>1 x N*</td>
</tr>
<tr>
<td>8594E</td>
<td>1</td>
</tr>
<tr>
<td>8595E</td>
<td>1</td>
</tr>
<tr>
<td>8596E</td>
<td>1 x N*</td>
</tr>
</tbody>
</table>

Resolution
Four digits or 20 Hz x N* whichever is greater

Accuracy
Span ≤10 MHz x N* ±2% of span
Span >10 MHz x N* ±3% of span

Frequency Sweep Time
Range
Span = 0 Hz, >1 kHz 20 ms to 100 s
Span = 0 Hz (Opt. 101) 20 μs to 100 s

Accuracy
20 ms to 100 s ±3%
20 μs to <20 ms (Opt. 101) ±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 bandwidth.
Option 130 Adds 30, 100, and 300 Hz (3 dB) bandwidths and 200 Hz (6 dB) EMI bandwidth.

Accuracy
±20%

Selectivity (Characteristic)
-60 dB/-3 dB
-60 dB/-3 dB
-60 dB/-3 dB
-60 dB/-3 dB
-60 dB/-3 dB
-60 dB/-3 dB

Video Bandwidth Range
30 Hz to 1 MHz in 1,3 sequence
1 Hz to 1 MHz (Opt 130)

Stability
Noise Sidebands (1 kHz RBW, 30 Hz VBW and 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
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
8593E, 94E, 95E, 96E
1 kHz RBW, 1 kHz VBW ≤(250 x N*) Hz pk-pk in 100 ms
30 Hz RBW, 30 Hz VBW ≤(30 x N*) Hz pk-pk in 300 ms

System-Related Sidebands
>30 kHz offset from CW signal ≤-65 dBc + 20 Log N*

Comb Generator Frequency
8593E, 96E
100 MHz fundamental frequency

Accuracy
±0.007%
Amplitude Specifications
Amplitude specifications do not apply for Analog+ mode and negative peak detector mode except as noted in “Amplitude Characteristics.”

Amplitude Range

<table>
<thead>
<tr>
<th>Model</th>
<th>Displayed average noise level</th>
</tr>
</thead>
<tbody>
<tr>
<td>8591E (Opt. 001)</td>
<td>-30 dBm to +72 dBmV</td>
</tr>
</tbody>
</table>

Maximum Safe Input Level (input attenuator ≥ 10 dB)

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Peak Power Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 kHz to 1 MHz</td>
<td>1 W</td>
</tr>
<tr>
<td>1 MHz to 1.5 GHz</td>
<td>0.2 W</td>
</tr>
<tr>
<td>1.5 GHz to 2.8 GHz</td>
<td>0.2 W</td>
</tr>
</tbody>
</table>

Gain Compression

- >10 MHz: ≤0.5 dB (total power at input mixer² = -10 dBm)

Nominal Dynamic Range

<table>
<thead>
<tr>
<th>Model</th>
<th>Sensitivity 30 Hz RBW</th>
<th>Third Order Intermod</th>
<th>Second Order Distortion</th>
</tr>
</thead>
<tbody>
<tr>
<td>8593E (Option 130)</td>
<td>10 MHz to 2.9 GHz</td>
<td>12.4 MHz to 19.4 MHz</td>
<td>2.75 MHz to 6.5 MHz</td>
</tr>
</tbody>
</table>

Displayed Average Noise Level

- (Input terminated, 0 dB attenuation, 1 Hz/30 Hz VBV, sample-detector)

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Noise Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 kHz RBW</td>
<td>≤-130 dBm</td>
</tr>
<tr>
<td>1 kHz RBW</td>
<td>≤-115 dBm</td>
</tr>
<tr>
<td>1 MHz to 1.5 GHz</td>
<td>≤-130 dBm</td>
</tr>
<tr>
<td>1.5 GHz to 2.8 GHz</td>
<td>≤-113 dBm</td>
</tr>
<tr>
<td>1 MHz to 1.5 GHz</td>
<td>≤-78 dBmV</td>
</tr>
<tr>
<td>1.5 GHz to 1.8 GHz</td>
<td>≤-76 dBmV</td>
</tr>
</tbody>
</table>

2. Mixer Power Level (dBm) = Input Power (dBm) - Input Attenuation (dB)
Spurious Responses
Second Harmonic Distortion
5 MHz to 1.8 GHz (91E) <-70 dBc for -45 dBm tone at input mixer.\(^2\)
10 MHz to 2.9 GHz (93E) <-70 dBc for -40 dBm tone at input mixer.\(^2\)
>10 MHz (94E, 95E, 98E) <-100 dBc for -10 dBm tone at input mixer\(^2\) (or below displayed average noise level).

Third Order Intermodulation
5 MHz to 1.8 GHz (91E) <-70 dBc for two -30 dBm tones at input mixer\(^2\) and >50 kHz separation.
>10 MHz (93E, 94E, 95E, 96E) <-65 dBc at >=30 kHz offset, for -20 dBm tone at input mixer\(^2\)

Other Input Related Spurious
<1.8 GHz (91E) <-65 dBc at >=30 kHz offset, for -20 dBm tone at input mixer\(^2\)
<2.9 GHz (94E) <-65 dBc at >=30 kHz offset, for -20 dBm tone at input mixer\(^2\)
<6.5 GHz (95E) <-65 dBc at >=30 kHz offset, for -20 dBm tone at input mixer\(^2\)
<12.8 GHz (96E) <-65 dBc at >=30 kHz offset, for -20 dBm tone at input mixer\(^2\)
<22 GHz (93E) <-65 dBc at >=30 kHz offset, for -20 dBm tone at input mixer\(^2\)

Residual Responses (input terminated and 0 dB attenuation)
1 MHz to 1.8 GHz
(91E Opt. 001) <-38 dBmV
150 kHz to 1.8 GHz (91E) <-90 dBm
150 kHz to 2.9 GHz (94E) <-90 dBm
150 kHz to 6.5 GHz (93E, 95E, 96E) <-90 dBm

Display Range
Log Scale 0 to -70 dB from reference level is calibrated; 0.1, 0.2, 0.5 dB/division and 1 to 20 dB/division in 10 steps; eight divisions displayed.
Linear Scale Eight divisions dBm, dBmV, dBuV, V, and W

Marker Readout Resolution 0.05 dB for log scale 0.05% of reference level for linear scale
Fast Sweep Times for Zero Span (Opt. 01 or 301) 20 μs to 20 ms
≤1 GHz 0.7% of reference level for linear scale
>1 GHz 1.0% of reference level for linear scale

Reference Level
Range same as amplitude range
Resolution 0.1 dB for log scale, 0.12% of reference level for linear scale
Accuracy ±0.3 dB @ -20 dBm ±0.3 dB ±0.1 x dB from -20 dBm

Frequency Response 8591E
9 kHz to 1.8 GHz 10 dB input attenuation)
8593E
9 kHz to 2.9 GHz
2.75 GHz to 6.5 GHz
6.0 GHz to 12.8 GHz
12.4 GHz to 19.4 GHz
19.1 GHz to 22 GHz
19.1 GHz to 26.5 GHz
8594E, 95E, 96E
9 kHz to 2.9 GHz
2.75 GHz to 6.5 GHz
6.0 GHz to 12.8 GHz

Calibrator Output
Amplitude -20 dBm ±0.4 dB
8591E Opt. 001 +28.75 dBmV ±0.4 dB

Resolution Bandwidth
Switching Uncertainty
(Referenced 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

Linear to Log Switching ±0.25 dB at reference level

Display Scale Fidelity
Log Maximum Cumulative
0 to -70 dB from reference level
3 kHz to 3 MHz RBW ±(0.3 + 0.01 x dB from reference level)
30 Hz to 1 kHz RBW ±(0.4 + 0.01 x dB from reference level)
Log Incremental Accuracy ±0.4 dB/4 dB
0 to -60 dB from reference level
Linear Accuracy ±3% of reference level

3. Referenced to 300 MHz CAL OUT.
4. Ref. to midpoint between highest and lowest freq. response deviations.
Option Specifications

Option 101 and 111 Tracking Generator

Frequency Range
- 8591E: 100 kHz to 1.8 GHz
- (Opt. 111, 75 Ω): 1 MHz to 1.8 GHz
- 8593E, 94E, 95E, 96E: 9 kHz to 2.9 GHz

Output Level

Range
- 8591E: 0 to −70 dBm
- 8591E (Opt. 011): +42.8 to −27.2 dBmV
- 8593E, 94E, 95E, 96E: −1 to −66 dBm

Resolution
0.1 dB

Absolute Accuracy
(@ 300 MHz, −20 dBm, +28.8 dBmV)
- 8591E: ±1.0 dB
- 8593E, 94E, 95E, 96E: ±0.75 dB

Vernier

Range
- 8591E: 10 dB
- 8593E, 94E, 95E, 96E: 9 dB

Accuracy
- 8591E: ±0.75 dB
- 8593E, 94E, 95E, 96E: ±0.5 dB

Output Attenuator

Range
- 8591E: 0 to 60 dB, 10 dB steps
- 8593E, 94E, 95E, 96E: 0 to 56 dB, 8 dB steps

Output Flatness
- 8591E: ±1.75 dB
- 8593E, 94E, 95E, 96E (>10 MHz): ±2.0 dB

Effective Source Match (Characteristic)
- 8591E: 1.6:1 (10 dB attenuation)
- 8593E, 94E, 95E, 96E: 1.5:1 (8 dB attenuation)

Spurious Output

Harmonic Spurs
- 8591E: (0 dBm, +42.8 dBmV output) <−25 dBC
- 8593E, 94E, 95E, 96E: (−1 dBm output)

Nonharmonic Spurs
- 8591E: <−30 dBC
- 8593E, 94E, 95E, 96E: 300 kHz to 2.0 GHz: ≤−27 dBC
- 2.0 GHz to 2.9 GHz: ≤−23 dBC

Dynamic Range (Characteristic)

<table>
<thead>
<tr>
<th>Model</th>
<th>Dynamic Range5</th>
<th>TG Feedthrough</th>
</tr>
</thead>
<tbody>
<tr>
<td>8591E</td>
<td>106 dB</td>
<td>≤−106 dBm</td>
</tr>
<tr>
<td>8591E (Opt. 111)</td>
<td>100 dB</td>
<td>≤−57.24 dBmV</td>
</tr>
<tr>
<td>8593E (&gt; 400 kHz)</td>
<td>111 dB</td>
<td>≤−112 dBm</td>
</tr>
<tr>
<td>8594E (&gt; 400 kHz)</td>
<td>106 dB</td>
<td>≤−107 dBm</td>
</tr>
<tr>
<td>(&gt; 5 MHz)</td>
<td>111 dB</td>
<td>≤−112 dBm</td>
</tr>
<tr>
<td>8595E (&gt;400 kHz)</td>
<td>109 dB</td>
<td>≤−110 dBm</td>
</tr>
<tr>
<td>8596E (&gt;400 kHz)</td>
<td>109 dB</td>
<td>≤−110 dBm</td>
</tr>
</tbody>
</table>

Power Sweep

Range
- 8591E: (−15 dBm to 0 dBm) (source attenuator setting)
- 8591E (Opt 011): (+27.8 to 42.8 dBmV) (source attenuator setting)
- 8593E, 94E, 95E, 96E: (−10 dBm to 1 dBm) (source attenuator setting)

Resolution
0.1 dB

Option 103 Quasi-Peak Detector

Amplitude response conforms with Publication 16 of Comité International Spécial des Perturbations Radioélectriques (CISPR) Section 1, Clause 2.

Option 105 Time Gated Spectrum Analysis

Gate Delay

Range
1 μs to 65.535 ms

Resolution
1 μs

Accuracy
≤1 μs + 0.01% x Gate Delay Readout6

(Gate Trigger Input to positive edge of Gate Output)

Gate Length

Range
1 μs to 65.535 ms

Resolution
1 μs

Accuracy
≤(0.2 μs + (0.01% x Gate Length Readout))

(From positive edge to negative edge of Gate Output)

Additional Gate Amplitude Error7

Log Scale
<2 μs ±0.8 dB
≥2 μs ±0.5 dB

General Specifications

Temperature Range

Operating
0°C to +65°C

Storage
−40°C to +75°C

EMI Compatibility

Conducted and radiated interference CISPR Pub. 11 and Messenfuaenger Postverfufung 526/527/79.

Audible Noise
<37.5 dBA pressure and <5.0 Bel power (ISODP7777)

5. Maximum output level minus TG feedthrough.
6. Up to 1 μs jitter due to 1 μs resolution of gate delay clock.
7. With GATE ON enabled and triggered, CW Signal, Peak Detector Mode.
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; <180W
Standby (Line 0) Power consumption <7 W
User Program Memory 238 Kbytes non-volatile RAM
Data Storage (nominal)
Internal 24 traces or 32 states
External 50 traces, 8 states
Memory card (85700A) 32 Kbytes

Inputs/Outputs
Front Panel Connectors
Input 50 Ω Type N
( Opt 001) 75 Ω BNC female
( Opt 026) APC 3.5 mm male
( Opt 027) 50 Ω Type N female
Cal Output 50 Ω BNC, ~0 dBm, 300 MHz
100 MHz Comb Out 100 MHz ±0.007%, SMA
Probe Power +15 Vdc, −12.6 Vdc and Gnd
(150mA max each)

Rear Panel Connectors
Earphone (Opt 102 and 103) 1/8 inch monaural jack
LO Output (Opt 009) 50 Ω SMA Female, 3.0 to 6.8214 GHz
TV Trigger Output (Opt 101 and 102) BNC, TTL levels, negative edge
Gate Trigger Input (Opt 105) trigger after sync pulse
Gate Output (Opt 105) 50 Ω BNC (TTL)
Sweep Output (Opt 009) 2 k Ω BNC, 0 to +10V, 0.36V/GHz of CF
Ext. ALC Input 1 kW, –66 dBV to +6 dBV
Sweep Output BNC, 5 k W, 0 to +10 V ramp
High Sweep In/Out BNC, high TTL = sweep, low TTL = Retrace
Aux Video Out 50 Ω BNC, 0-1 V Uncalibrated
Aux IF Output 50 Ω BNC, -10 to -60 dBm, 21.4 MHz

Keyboard (Opt. 041 or 043) 5 Pin mini-DIN, compatible with HP C1405B and most IBM/AT key
boards
Ext. Trigger Input BNC, TTL levels, positive edge
trigger
GPIB and Parallel (Opt 041)
SH1, AH1, T6, L4, ST1, RL1, PPO, DC1, C1 C2, C3, & C28 and 25 Pin
subminiature D-shell female for parallel
RS-232 and Parallel (Opt 043) 9 Pin subminiature D-shell female
and 25 Pin subminiature D-shell
female for parallel
Ext Ref In 50 Ω BNC, 10 MHz, –2 to +10 dBm
10 MHz Ref Output 50 Ω BNC, 10 MHz, 0 dBm
Aux Interface 9 pin “D” subminiature
Pin 1-4, TTL Output
Pin 5 TTL Input
Pin 6 Gnd
Pin 7 –15 vdc ±5%; 150 mA max
Pin 8 +5 vdc ±5%; 150 mA max
Pin 9 +15 vdc ±5%; 150 mA max
Monitor Out 50 Ω BNC.
Selectable Format NTSC, 15.75 kHz, 60 Hz
PAL, 15.625 kHz, 50 Hz

Dimensions (Nominal)
(Without handle, feet, or cover) 183 mm (H) x 325 mm (W)
(Overall) 184 mm (H) x 373 mm (W)
X 461 mm (D)

Weight (Nominal)
8591E 15.4 kg (34 lb)
8593E 16.4 kg (36 lb)
8594E 16.4 kg (36 lb)
8595E 16.4 kg (36 lb)
8596E 16.4 kg (36 lb)