

Agilent 8590 E-Series **Portable Spectrum Analyzers**

Data Sheet



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

Specifications

All specifications apply over O°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 tumed on, and after CAL FREQ and CAL AMPTD (and for the 8593E, 8595E, and 8596E CAL YTF) have been run.

Frequency Specifications

Frequency	Range		
8591E			
50 Ω		9 kHz to 1.8	3 GHz
75 Ω		1 MHz to 1.	.8 GHz
8593E		9 kHz to 22	GHz
Option 02	26/027	9 kHz to 26	.5 GHz
Band	LO har	monic = N	
0	1	9	kHz to 2.9 GHz
1	1	2	.75 GHz to 6.5 GHz
2	2	6	6.0 GHz to 12.8 GHz
3	3	1	2.4 GHz to 19.4 GHz
4	4	1	9.1 GHz to 22.0 GHz
4	4 (Opt.	026/027) 1	9.1 GHz to 26.5 GHz



Frequency Reference

Aging	±2 x 10 ⁻⁶ /year
Temperature Stability	±5 x 10 ⁻⁶
Initial Achievable Accuracy	±0.5 x 10 ⁻⁶

(Opt. 004) ±1 x 10⁻⁷/year ±1 x 10⁻⁸ ±2.2 x 10⁻⁸





Agilent Technologies Innovating the HP Way

Frequency Readout

Accuracy	
(Start, Stop, Center, Marker)	±(frequency readout x frequency
	reference error ¹ +span accuracy +1%
	of span +20% of RBW+100 Hz x N*)

Marker Count Accuracy

Frequency Span	
≤10 MHz x N*	±(marker frequency x frequency
	reference error ¹ + counter resolution
	+100 Hz x N*)
Frequency Span	±(marker frequency x frequency
>10 MHz x N*	reference error ¹ + 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		
	Opt. 130 Min. (KHz)	Std. Min. (KHz)	Max (GHz)
8591E 8593E 8594E 8595E 8596E	1 1 x N* 1 1 x N*	10 10 x N* 10 10 10 x N*	1.8 19.25 2.9 6.5 12.8

Resolution

Four digits or 20 Hz x N* whichever is greater

Accuracy	
Span ≤10 MHz x N*	
Span >10 MHz x N*	

±2% of span ±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
	bandwidths.
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		
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 (Opt 130)

Stability

Noise Sidebands (1 kHz RBW, 30 Hz VBW and sample detector) >10 kHz offset from CW signal >20 kHz offset from CW signal >30 kHz offset from CW signal

 \leq -90 dBc/Hz + 20 Log N* \leq -100 dBc/Hz + 20 Log N* <-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	\leq (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

Accuracy

100 MHz fundamental frequency ±0.007%

N = LO harmonic. N = 1 for 91E, 94E, 95E

Frequency reference error = (aging rate x period of time since adjustment + initial achievable accuracy + temperature stability).

Amplitude Specifications

Amplitude specifications do not apply for Analog+ mode and negative peak detector mode except as noted in "Amplitude Characteristics."

Displayed Average Noise Level

(Input terminated, 0 dB attenuation, 1 Hz/30 Hz VBW, sampledetector) 8591E 30 Hz RBW

1 kHz RBW

noted in Amplitude O	naracteristics.	400 kHz to 1 MHz	≤–130 dBm	≤–115 dBm
Amplitude Range		1 MHz to 1.5 GHz	≤–130 dBm	≤–115 dBm
Ampiltude hange	Displayed average noise level	1.5 GHz to 1.8 GHz	≤–128 dBm	≤–113 dBm
	to +30 dBm	8591E (Opt. 001)		
8591E (Opt. 001)	Displayed average noise level to	1 MHz to 1.5 GHz	≤–78 dBmV	≤–63 dBmV
0331E (Opt. 001)	+72 dBmV	1.5 GHz to 1.8 GHz	≤–76 dBmV	≤–61 dBmV
Maximum Safe Input Level		8593E		
Average Continuous Power	+30 dBm (1 W)	400 kHz to 2.9 GHz	≤–127 dBm	≤–112 dBm
8591E (Opt. 001)	+72 dBmV (0.2 W)	2.75 GHz to 6.5 GHz	≤–129 dBm	≤–114 dBm
Peak Pulse Power		6.0 GHz to 12.8 GHz	≤–117 dBm	≤–102 dBm
8591E	+30 dBm (1 W)	12.4 GHz to 19.4 GHz	≤–113 dBm	≤–98 dBm
8591E (Opt. 001)	+72 dBmV (0.2 W)	19.1 GHz to 22 GHz	≤–107 dBm	≤–92 dBm
8593E, 94E, 95E, 96E	+50 dBm (100 W) for < 10 μs pulse	8593E (Opt. 026/027)		
00002, 012, 002, 002	width and <1 % duty cycle, input	19.1 GHz to 26.5 GHz	≤–102 dBm	≤–87 dBm
	attenuation \geq 30 dB.	8594E		
dc		400 kHz to<5 MHz	≤–122 dBm	≤–107 dBm
8591E	25 Vdc	5 MHz to 2.9 GHz	≤–127 dBm	≤–112 dBm
8591E (Opt. 001)	100 Vdc	8595E		
8593E	0 Vdc	400 kHz to 2.9 GHz	≤–125 dBm	≤–110 dBm
8594E, 95E, 96E	0 V (dc coupled)	2.75 GHz to 6.5 GHz	≤–127 dBm	≤–112 dBm
00012,002,002	50 V (ac coupled)	8596E		
		400 kHz to 2.9 GHz	≤–125 dBm	≤–110 dBm
Gain Compression		2.75 GHz to 6.5 GHz	≤–127 dBm	≤–112 dBm
-	otal power at input mixer ² = –10 dBm)	6.0 GHz to 12.8 GHz	≤–115 dBm	≤–100 dBm



Nominal Dynamic Range

2. Mixer Power Level (dBm) = Input Power (dBm) Input Atten. (dB)

Spurious Responses

Second Harmonic Distortion 5 MHz to 1.8 GHz (91E) 10 MHz to 2.9 GHz (93E) >10 MHz (94E, 95E, 96E)

>2.75 GHz (93E, 95E,96E)

 Third Order Intermodulation

 Distortion

 5 MHz to 1.8 GHz (91E)

 >10 MHz (93E, 94E,

 95E, 96E)

 Other Input Related Spurious

 ≤1.8 GHz (91E)

 ≤2.9 GHz (94E)

 ≤6.5 GHz (95E)

 ≤12.8 GHz (96E)

 ≤18 GHz (93E)

 ≤22 GHz (93E)

<-70 dBc for -45 dBm tone at input mixer.² <-70 dBc for -40 dBm tone at input mixer.² <-100 dBc for -10 dBm tone at input mixer² (or below displayed average noise level).

<-70 dBc for two -30 dBm tones at input mixer² and >50 kHz separation. <-65 dBc at \geq 30 kHz offset, for

–20 dBm tone at input mixer²

<-60 dBc at \geq 30 kHz offset, for -20 dBm tone at input mixer²

Residual Responses (input terminated and 0 dB attenuation)

<-38 dBmV

<-90 dBm

<-90 dBm

<-90 dBm

1 MHz to 1.8 GHz (91E Opt. 001) 150 kHz to 1.8 GHz (91E) 150 kHz to 2.9 GHz (94E) 150 kHz to 6.5 GHz (93E, 95E, 96E)

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 1 dB steps; eight divisions displayed.
Linear Scale	Eight divisions
Scale units	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 Sp	an (Opt. 101 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 Resolution Accuracy 0 dBm to –59.9 dBm Frequency Response same as amplitude range

(10 dB input attenuation)

Preselector peaked in band > 0

(dc coupled preselector peaked)

±0.3 dB @ -20 dBm

Absolute³

Absolute³

±1.5 dB

±2.0 dB

±2.5 dB

±3.0 dB

±3.0 dB

±5.0 dB

Absolute³

±1.5 dB

±2.0 dB

±2.5 dB

±1.5 dB

0.1 dB for log scale, 0.12% of

reference level for linear scale

 $\pm (0.3 \text{ dB} + .01 \text{ x dB} \text{ from} - 20 \text{ dBm})$

Relative Flatness⁴

Relative Flatness⁴

Relative Flatness⁴

±1.0 dB

±1.0 dB

±1.5 dB

±2.0 dB

±2.0 dB

±2.0 dB

±2.0 dB

±1.0 dB

±1.5 dB

±2.0 dB

8591E 9 kHz to 1.8 GHz 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 dB1 kHz RBW±0.5 dB30 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	\pm (0.3 + 0.01 x dB from reference
	level)
30 Hz to 1kHz RBW	\pm (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.

 Ref. to midpoint between highest and lowest freq. response deviations.

Option Specifications Dynamic Range (Characteristic) Dynamic Range⁵ TG Feedthrough **Option 010 and 011 Tracking Generator** 8591E 106 dB ≤–106 dBm **Frequency Range** 8591E (Opt. 011) 100 dB ≤–57.24 dBmV 100 kHz to 1.8 GHz 8591E 8593E (> 400 kHz) 111 dB ≤–112 dBm 1 MHz to 1.8 GHz (Opt. 011, 75 Ω) 8594E (> 400 kHz) 106 dB ≤–107 dBm 8593E, 94E, 95E, 96E 9 kHz to 2.9 GHz (> 5 MHz) 111 dB ≤–112 dBm 8595E (>400 kHz) 109 dB ≤–110 dBm Output Level 8596E (> 400 kHz) 109 dB ≤–110 dBm Range 0 to -70 dBm 8591E **Power Sweep** 8591E (Opt. 011) +42.8 to -27.2 dBmV 8593E, 94E, 95E, 96E Range -1 to -66 dBm 0.1 dB 8591E (-15 dBm to 0 dBm) -(source Resolution Absolute Accuracy attenuator setting) (@ 300 MHz, -20 dBm, +28.8 dBmV) 8591E (Opt 011) (+27.8 to 42.8 dBmV)-(source attenuator setting) 8591E ±1.0 dB 8593E, 94E, 95E, 96E 8593E, 94E, 95E, 96E (-10 dBm to -1 dBm)-(source ±0.75 dB attenuator setting) Vernier Resolution 0.1 dB Range 8591E 10 dB **Option 103 Quasi-Peak Detector** 8593E, 94E, 95E, 96E 9 dB Amplitude response conforms with Publication 16 of Comité Accuracy International Spécial des Perturbations Radioélectriques (CISPR) 8591E ±0.75 dB Section 1, Clause 2. 8593E, 94E, 95E, 96E ±0.5 dB **Option 105 Time Gated Spectrum Analysis Output Attenuator Gate Delav** Range Range 1 µs to 65.535 ms 8591E 0 to 60 dB, 10 dB steps Resolution 1 µs 8593E, 94E, 95E, 96E 0 to 56 dB, 8 dB steps $\pm (1 \ \mu s + 0.01\% \ x \ Gate \ Delay \ Readout)^6$ Accuracy (From Gate Trigger Input to positive edge of Gate Output) **Output Flatness** 8591E ±1.75 dB **Gate Length** 8593E, 94E, 95E, 96E 1 µs to 65.535 ms Range (>10 MHz) ±2.0 dB Resolution 1 µs Accuracy $\pm(0.2 \ \mu s + (0.01\% \ x \ Gate \ Length)$ Effective Source Match (Characteristic) Readout)) 1.6:1 (10 dB attenuation) 8591F (From positive edge to negative edge of Gate Output) 8593E, 94E, 95E, 96E 1.5:1 (8 dB attenuation) **Spurious Output** Additional Gate Amplitude Error⁷ ±0.8 dB Harmonic Spurs Log Scale <2 us ≥2 µs ±0.5 dB 8591E (0 dBm, +42.8 dBmV output) <-25 dBc 8593E, 94E, 95E, 96E **General Specifications** (-1 dBm Output) Nonharmonic Spurs **Temperature Range** Operating 0°C to +55°C 8591E <--30 dBc 8593E, 94E, 95E, 96E -40°C to +75°C Storage 300 kHz to 2.0 GHz ≤–27 dBc **EMI Compatibility** Conducted and radiated 2.0 GHz to 2.9 GHz ≤–23 dBc interference CISPR Pub. 11 and Messempfaenger Postverfuegung 526/527/79. **Audible Noise** <37.5 dBa pressure and <5.0 Bels

power (ISODP7779)

5. Maximum output level minus TG feedthrough.

6. Up to 1 Vs 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)	

Standby (Line 0)

User Program Memory

Data Storage (nominal)

Internal External Memory card (85700A)

Inputs/Outputs

Front Panel Connectors

Input (Opt 001) (Opt 026) (Opt 027) Cal Output 100 MHz Comb Out Probe Power

Rear Panel Connectors

Earphone (Opt 102 and 103) LO Output (Opt 009) TV Trigger Output (Opt 101 and 102) Gate Trigger Input (Opt 105) Gate Output (Opt 105) SWEEP + Tune Output (Opt 009)

Ext. ALC Input 1 MW, Sweep Output High Sweep In/Out

Aux Video Out Aux IF Output 195 to 250 V rms, 47 to 66 Hz Power consumption <500 VA; <180W Power consumption <7 W 238 Kbytes non-volatile RAM I) 24 traces or 32 states 50 traces, 8 states

32 Kbytes

90 to 132 V rms, 47 to 440 Hz

50 Ω Type N 75 Ω BNC female APC 3.5 mm male 50 Ω Type N female 50 Ω BNC, -20 dBm, 300 MHz 100 MHz ±0.007%, SMA +15 Vdc, -12.6 Vdc, and Gnd (150mA max each)

1/8 inch monaural jack 50 Ω SMA Female, 3.0 to 6.8214 GHz BNC, TTL levels, negative edge trigger after sync pulse 50 Ω BNC, Pulsewidth >30 ns (TTL) 50 Ω BNC (TTL)

2 k Ω BNC, 0 to +10V, 0.36V/GHz of CF -66 dBV to +6 dBV BNC, 5 k W, 0 to +10 V ramp BNC, high TTL = sweep, low TTL = Retrace 50 Ω BNC, 0-1 V Uncalibrated 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 subminature D-shell female for parallel
RS-232 and Parallel (Opt 043)	9 Pin subminature D-shell female and 25 Pin subminature 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 \pm 5 vdc \pm 5%; 150 mA max
	Pin 9 +15 vdc $\pm 5\%$; 150 mA max
Monitor Out	50Ω BNC,
Selectable Format	NTSC, 15.75 kHz, 60 Hz
	PAL, 15.625 kHz, 50 Hz
Dimensions (Nominal)	
(Without handle, feet,	163 mm (H) x 325 mm (W)
or cover)	x 427 mm (D)
(Overall)	184 mm (H) x 373 mm (W)
	X 461 mm (D)
Weight (Nominal)	
8591E	15.4 kg (34 lb)
8593E 8594E	16.4 kg (36 lb) 16.4 kg (36 lb)
8595E	16.4 kg (36 lb)
8596E	16.4 kg (36 lb)



Related Literature General Purpose Information Agilent 8590L and 8592L	Pub. Number
Product Overview	5962-7275E
Agilent 8590C/E/L and EM Series	
Configuration Guide	5963-6858E
Agilent 8590 E-Series Brochure	5963-6908E
Product Feature Briefs	
Analog + Display	5091-4054E
Transmitter Power Measurements	
(ACP, OBW)	5091-4055E
Zoom Window	5091-4051E
Measuring AM with FFT	5091-4049E
Time Gated Spectrum Analysis	5091-4053E
Editing Keyboard	5091-4048E
Marker and Peaks Table	5091-4050E
Third Order Intermodulation,	

N & B Bandwidth, and Percent AM 5091-4052E

Product Notes

Application Notes

Spectrum Analysis Basics (150)	5952-0292
Amplitude and Frequency	
Modulation (150)-1)	5954 - 9130

Agilent Technologies' Test and Measurement Support, Services, and Assistance

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

Our Promise

"Our Promise" means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage

"Your Advantage" means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, outof-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

Get assistance with all your test and measurement needs at: www.agilent.com/find/assist

Product specifications and descriptions in this document subject to change without notice.

Copyright © 1996, 2000 Agilent Technologies Printed in U.S.A. 5/00 5963-6909E

