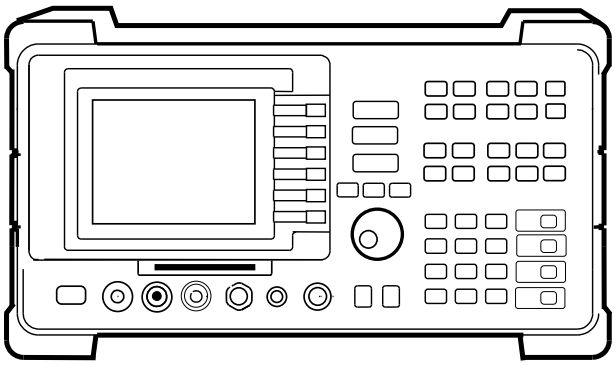
HEWLETT® PACKARD

HP 8590 E-Series Portable Spectrum Analyzers

Technical Specifications

Product Specifications and data



These specifications apply to the HP 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 HP 8593E, 8595E, and 8596E CAL YTF) have been run.

Frequency Specifications

Frequency Range

HP 8591E

50 Ω		9 kHz to 1.8 GHz
75 Ω		1 MHz to 1.8 GHz

HP 8593E 9 kHz to 22 GHz

Option 026/027 9 kHz to 26.5 GHz

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	19.1 GHz to 22.0 GHz
4	4 (Opt. 026/027)	19.1 GHz to 26.5 GHz

HP 8594E

dc coupled 9 kHz to 2.9 GHz

ac coupled 100 kHz to 2.9 GHz

HP 8595E

dc coupled 9 kHz to 6.5 GHz

ac coupled 100 kHz to 6.5 GHz

HP 8596E

dc coupled 9 kHz to 12.8 GHz

ac coupled 100 kHz to 12.8 GHz

Band	LO harmonic = N	
0	1	9 kHz to 2.9 GHz (dc coupled)
0	1	100 kHz to 2.9 GHz (ac coupled)
1	1	2.75 GHz to 6.5 GHz
2	2	6.0 GHz to 12.8 GHz

Frequency Reference

		(Opt. 004)
Aging	$\pm 2 \times 10^{-6}$/year	$\pm 1 \times 10^{-7}$/year
Temperature Stability	$\pm 5 \times 10^{-6}$	$\pm 1 \times 10^{-8}$
Initial Achievable Accuracy	$\pm 0.5 \times 10^{-6}$	$\pm 2.2 \times 10^{-8}$

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
>10 MHz x N* ±(marker frequency x frequency 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)
HP 8591E	1	10	1.8
HP 8593E	1 x N*	10 x N*	19.25
HP 8594E	1	10	2.9
HP 8595E	1	10	6.5
HP 8596E	1 x N*	10 x N*	12.8

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, extemal

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.

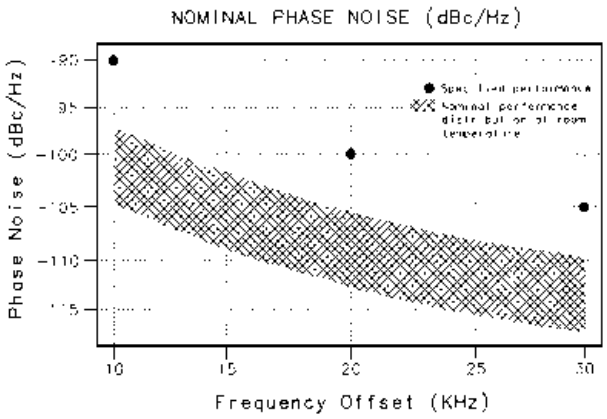
Accuracy ±20%

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 ≤–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, 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

HP 8593E, 96E I00 MHz fundamental frequency

Accuracy ±0.007%

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

1. 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."

Amplitude Range

	Displayed average noise level to +30 dBm
HP 8591E (Opt. 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 (Opt. 001)	+72 dBmV (0.2 W)
Peak Pulse Power	
HP 8591E	+30 dBm (1 W)
HP 8591E (Opt. 001)	+72 dBmV (0.2 W)
HP 8593E, 94E, 95E, 96E	+50 dBm (100 W) for < 10 µs pulse width and <1 % duty cycle, input attenuation ≥30 dB.
dc	
HP 8591E	25 Vdc
HP 8591E (Opt. 001)	100 Vdc
HP 8593E	0 Vdc
HP 8594E, 95E, 96E	0 V (dc coupled) 50 V (ac coupled)

Gain Compression

>10 MHz	≤0.5 dB (total power at input mixer[2] = –10 dBm)

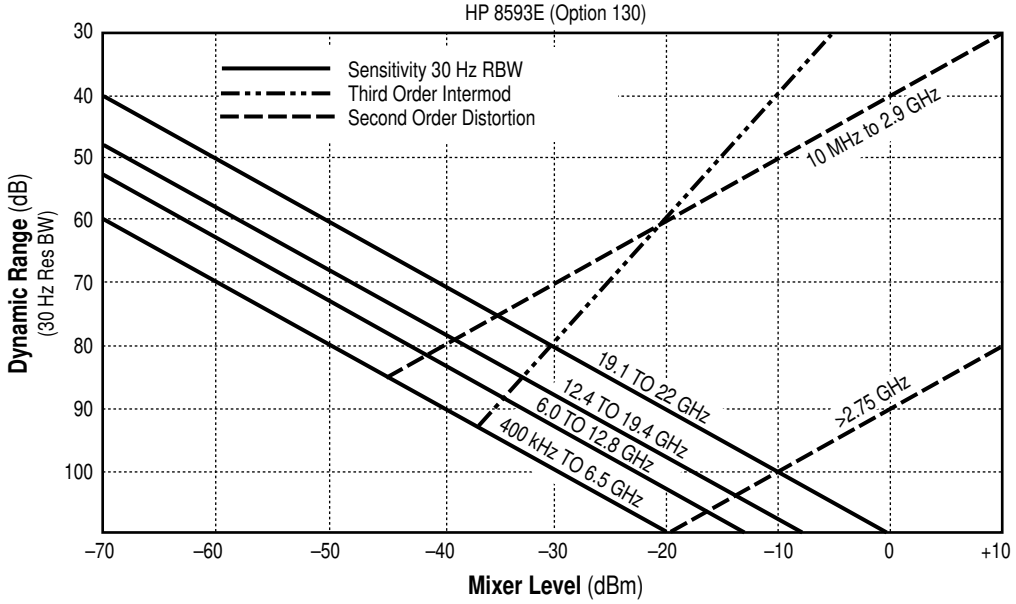
Displayed Average Noise Level

(Input terminated, 0 dB attenuation, 1 Hz/30 Hz VBW, 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 (Opt. 001)		
1 MHz to 1.5 GHz	≤–78 dBmV	≤–63 dBmV
1.5 GHz to 1.8 GHz	≤–76 dBmV	≤–61 dBmV
HP 8593E		
400 kHz to 2.9 GHz	≤–127 dBm	≤–112 dBm
2.75 GHz to 6.5 GHz	≤–129 dBm	≤–114 dBm
6.0 GHz to 12.8 GHz	≤–117 dBm	≤–102 dBm
12.4 GHz to 19.4 GHz	≤–113 dBm	≤–98 dBm
19.1 GHz to 22 GHz	≤–107 dBm	≤–92 dBm
HP 8593E (Opt. 026/027)		
19.1 GHz to 26.5 GHz	≤–102dBm	≤–87 dBm
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 GHz to 6.5 GHz	≤–127 dBm	≤–112 dBm
HP 8596E		
400 kHz to 2.9 GHz	≤–125 dBm	≤–110 dBm
2.75 GHz to 6.5 GHz	≤–127 dBm	≤–112 dBm
6.0 GHz to 12.8 GHz	≤–115 dBm	≤–100 dBm

Nominal Dynamic Range

HP 8593E (Option 130)



2. Mixer Power Level (dBm) = Input Power (dBm) - Input Atten. (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, 96E)	
>2.75 GHz (93E, 95E,96E)	<–100 dBc for –10 dBm tone at input mixer.[2] (or below displayed average noise level).
Third Order Intermodulation Distortion	
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)	
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)	
≤6.5 GHz (95E)	
≤12.8 GHz (96E)	
≤18 GHz (93E)	
≤22 GHz (93E)	<–60 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 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 Span (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	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 dBm to –59.9 dBm	±(0.3 dB +.01 x dB from –20 dBm)

Frequency Response (10 dB input attenuation)

HP 8591E	Absolute[3]	Relative Flatness[4]
9 kHz to 1.8 GHz	±1.5 dB	±1.0 dB
HP 8593E	Preselector peaked in band > 0	
	Absolute[3]	Relative Flatness[4]
9 kHz to 2.9 GHz	±1.5 dB	±1.0 dB
2.75 GHz to 6.5 GHz	±2.0 dB	±1.5 dB
6.0 GHz to 12.8 GHz	±2.5 dB	±2.0 dB
12.4 GHz to 19.4 GHz	±3.0 dB	±2.0 dB
19.1 GHz to 22 GHz	±3.0 dB	±2.0 dB
19.1 GHz to 26.5 GHz	±5.0 dB	±2.0 dB
HP 8594E, 95E, 96E	(dc coupled preselector peaked)	
	Absolute[3]	Relative Flatness[4]
9 kHz to 2.9 GHz	±1.5 dB	±1.0 dB
2.75 GHz to 6.5 GHz	±2.0 dB	±1.5 dB
6.0 GHz to 12.8 GHz	±2.5 dB	±2.0 dB

Calibrator Output

Amplitude	–20 dBm ±0.4 dB
HP 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 1kHz 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	
LinearAccuracy	±3% of reference level

Option Specifications

Option 010 and 011 Tracking Generator

Frequency Range

HP 8591E	100 kHz to 1.8 GHz
(Opt. 011, 75 Ω)	1 MHz to 1.8 GHz
HP 8593E, 94E, 95E, 96E	9 kHz to 2.9 GHz

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

Output Level

Range	
HP 8591E	0 to –70 dBm
HP 8591E (Opt. 011)	+42.8 to –27.2 dBmV
HP 8593E, 94E, 95E, 96E	–1 to –66 dBm
Resolution	0.1 dB
Absolute Accuracy (@ 300 MHz, –20 dBm, +28.8 dBmV)	
HP 8591E	±1.0 dB
HP 8593E, 94E, 95E, 96E	±0.75 dB

Vernier

Range	
HP 8591E	10 dB
HP 8593E, 94E, 95E, 96E	9 dB
Accuracy	
HP 8591E	±0.75 dB
HP 8593E, 94E, 95E, 96E	±0.5 dB

Output Attenuator

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

Output Flatness

HP 8591E	±1.75 dB
HP 8593E, 94E, 95E, 96E	
(>10 MHz)	±2.0 dB

Effective Source Match (Characteristic)

HP 8591E	1.6:1 (10 dB attenuation)
HP 8593E, 94E, 95E, 96E	1.5:1 (8 dB attenuation)

Spurious Output

Harmonic Spurs	
HP 8591E	
(0 dBm, +42.8 dBmV output)	<–25 dBc
HP 8593E, 94E, 95E, 96E	
(–1 dBm Output)	
Nonharmonic Spurs	
HP 8591E	<–30 dBc
HP 8593E, 94E, 95E, 96E	
300 kHz to 2.0 GHz	≤–27 dBc
2.0 GHz to 2.9 GHz	≤–23 dBc

Dynamic Range (Characteristic)

	Dynamic Range[5]	TG Feedthrough
HP 8591E	106 dB	≤–106 dBm
HP 8591 E (Opt. 011)	100 dB	≤–57.24 dBmV
HP 8593E (> 400 kHz)	111 dB	≤–112 dBm
HP 8594E (> 400 kHz)	106 dB	≤–107 dBm
(> 5 MHz)	111 dB	≤–112 dBm
HP 8595E (>400 kHz)	109 dB	≤–110 dBm
HP 8596E (> 400 kHz)	109 dB	≤–110 dBm

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 Sweep

Range	
HP 8591E	(–15 dBm to 0 dBm) –(source attenuator setting)
HP 8591E (Opt 011)	(+27.8 to 42.8 dBmV)–(source attenuator setting)
HP 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 Comite' International Spe'cial des Perturbations Radioe'lectriques (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 Readout)[6]

(From 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 Error[7]

Log Scale	<2 µs	±0.8 dB
	≥2 µs	±0.5 dB

General Specificaton

Temperature Range

Operating	0°C to +55°C
Storage	–40°C to +75°C

EMI Compatibility Conducted and radiated interference CISPR Pub. 11 and Messempfaenger 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; <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 (HP 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, –20 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

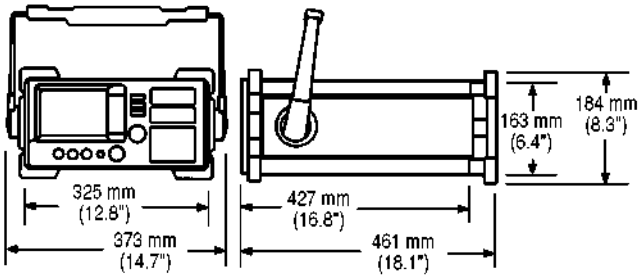
Earphone (Opt 102 and 103)	1/8 inch monaural jack
LO Output (Opt 009)	50 Ω SMA Female, 3.0 to 6.8214 GHz
TV Trigger Output (Opt 101 and 102)	BNC, TTL levels, negative edge trigger after sync pulse
Gate Trigger Input (Opt 105)	50 Ω BNC, Pulsewidth >30 ns (TTL)
Gate Output (Opt 105)	50 Ω BNC (TTL)
SWEEP + Tune Output (Opt 009)	2 k Ω BNC, 0 to +10V, 0.36V/GHz of CF
Ext. ALC Input 1 MW,	–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 keyboards
Ext. Trigger Input	BNC, TTL levels, positive edge trigger
HPIB 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 +5 vdc ±5%; 150 mA max Pin 9 +15vdc ±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)	163 mm (H) x 325 mm (W) x 427 mm (D)
(Overall)	184 mm (H) x 373 mm (W) X 461 mm (D)

Weight (Nominal)

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



Literature Reference Index

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General Purpose Information	
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