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Specifications and Characteristics

This chapter contains specifications and characteristics for the HP 8590D spectrum analyzer.

The specifications and characteristics in this chapter are listed separately. The specifications are described first, then followed by the characteristics.

General	General specifications and characteristics.
Frequency	Frequency-related specifications and characteristics.
Amplitude	Amplitude-related specifications and characteristics.
Option	Option-related specifications and characteristics.
Physical	Input, output and physical characteristics.

The distinction between specifications and characteristics is described as follows.

- Specifications describe warranted performance over the temperature range 0 °C to +55 °C (unless otherwise noted). The spectrum analyzer will meet its specifications after 2 hours of storage at a constant temperature, within the operating temperature range, 30 minutes after the spectrum analyzer is turned on and after the CAL frequency, and CAL amplitude routines have been run.
- Characteristics provide useful, but nonwarranted information about the functions and performance of the spectrum analyzer. Characteristics are specifically identified.
- Typical Performance, where listed, is not warranted, but indicates performance that most units will exhibit.
- Nominal Value indicates the expected, but not warranted, value of the parameter.

General 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 have been run.

Temperature Range	
Operating	0 °C to +55 °C
Storage	-40 °C to •t 75 °C

EMI Compatibility	Conducted and radiated emission is in compliance with CISPR Pub. 11/1990 Group 1 Class A.

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

Frequency Specifications

Frequency Range	
50 Ω	9 kHz to 1.8 GHz
75 Ω (Option *001)*	1 MHz to 1.8 GHz

Frequency Accuracy	
Readout Accuracy	±(5 MHz + 1% of frequency span)
Resolution	Four digits

Frequency Reference *(Option 013)*	
Aging	±2 x 10^{-6}/year
Settability	f0.5 x 10^{-6}
Temperature Stability	±5 x 10^{-6}

Frequency Readout Accuracy *(Option 013)*	
(Start, Stop, Center, Marker)	±(frequency readout x frequency reference error* + span accuracy + 1% of span + 20% of RBW + 100 Hz)‡

* frequency reference error = (aging rate x period of time since adjustment + initial achievable accuracy + temperature stability). See "Frequency Characteristics."
‡ See "Drift" under "Stability" in Frequency Characteristics.

Marker Count Accuracy† *(Option 013)*	
Frequency Span ≤ 10 MHz	±(marker frequency x frequency reference error* + counter resolution + 100 Hz)
Frequency Span > 10 MHz	±(marker frequency x frequency reference error* + counter resolution + 1 kHz)
Counter Resolution	
Frequency Span ≤ 10 MHz	Selectable from 10 Hz to 100 kHz
Frequency Span > 10 MHz	Selectable from 100 Hz to 100 kHz

* frequency reference error = (aging rate x period of time since adjustment + initial achievable accuracy and temperature stability). See "Frequency Characteristics."
† Marker level to displayed noise level > 25 dB, RBW/Span ≥ 0.01. Span ≤ 300 MHz. Reduce SPAN annotation is displayed when RBW/Span < 0.01.

Frequency Span	
Range	0 Hz (zero span), 50 kHz to 1.8 GHz
Resolution	Four digits
Accuracy	±3% of span

Frequency Sweep Time	
Range	20 ms to 100 s
Accuracy	±3%
Sweep Trigger	Free Run, Single, Line, Video, External

. Frequency Specifications

Stability	
Noise Sidebands	(1 kHz RBW, 30 Hz VBW and sample detector)
>30 kHz offset from CW signal	≤ -95 dBc/Hz
System-Related Sidebands	
>30 kHz offset from CW signal	≤-65 dBc

Calibrator Output Frequency	300 MHz fundamental frequency
Accuracy	±30 kHz

Amplitude Specifications

Amplitude Range	
50 Ω	-115 dBm to +30 dBm
75 Ω (Option 001)	-63 dBmV to + 75 dBmV

Maximum Safe Input Level	(Input attenuator ≥ 10 dB)	
	50 Ω	***75 Ω (Option 001)***
Average Continuous Power	+ 30 dBm (1 W)	+ 75 dBmV (0.4 W)
Peak Pulse Power	+ 30 dBm (1 W)	+ 75 dBmV (0.4 W)
dc	25 Vdc	100 Vdc

Gain Compression	
>10 MHz	≤0.5 dB (total ***power*** at input mixer* = -10 dBm)

* Mixer Power Level (dBm) = Input Power (dBm) – Input Attenuation (dB).

Displayed Average Noise Level	(Input terminated, 0 dB attenuation, 1 kHz RBW, 30 Hz VBW, sample detector)	
	50 Ω	*75 Ω (Option 001)*
400 kHz to 1 MHz	≤–115 dBm	N/A
1 MHz to 1.5 GHz	≤–115 dBm	≤–63 dBmV
1.5 GHz to 1.8 GHz	≤–113 dBm	≤–61 dBmV

Spurious Responses	
Second Harmonic Distortion	
5 MHz to 1.8 GHz	<-70 dBc for -45 dBm tone at input mixer.*
Third Order Intermodulation Distortion	
5 MHz to 1.8 GHz	<–70 dBc for two -30 dBm tones at input mixer* and >50 kHz separation.
Other Input Related Spurious	<-65 dBc at ≥30 kHz offset, for -20 dBm tone at input mixer ≤1.8 GHz.

* Mixer Power Level (dBm) = Input Power (dBm) – Input Attenuation (dB).

Residual Responses	(Input terminated and 0 dB attenuation)	
	50 Ω	75 Ω *(Option 001)*
150 kHz to 1 MHz	<–90 dBm	N/A
1 MHz to 1.8 GHz	<–90 dBm	<–38 dBmV

Amplitude Specifications

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, dBμV, V, and W

Marker Readout Resolution	0.05 dB for log scale 0.05% of reference level for linear scale

leference Level	
Range	
Log Scale	Minimum amplitude to maximum amplitude * *
Linear Scale	-99 dBm to maximum amplitude * *
Resolution	
Log Scale	±O.O1 dB
Linear Scale	±0.12% of reference level
Accuracy	(referenced to -20 dBm reference level, 10 dB input attenuation, at a single frequency, in a Exed RBW)
0 dBm to -59.9 dBm	±(0.3 dB + .01 x dB from -20 dBm)
-60 dBm and below	±(0.6 dB + .01 x dB from -20 dBm)

'* See "Amplitude Range."

Frequency Response	(10 dB input attenuation)	
	Absolutes	**Relative Flatness†**
	±1.5 dB	±l.O dB

† Referenced to midpoint between highest and lowest frequency response deviations.
§ Referenced to 300 MHz CAL OUT.

Calibrator Output Amplitude	
50 Ω	-20 dBm f0.4 dB
75 Ω (Option 001)	+ 28.75 dB mV f0.4 dB

Absolute Amplitude Calibration Uncertainty‡‡	±0.15 dB

‡‡ Uncertainty in the measured absolute amplitude of the CAL OUT signal at the reference settings after CAL FREQ and CAL AMPTD self-calibration. Absolute amplitude reference settings are: Reference Level -20 dBm; Input Attenuation 10 dB; Center Frequency 300 MHz; Res BW 3 kHz; Video BW 300 Hz; Scale Linear; Span 50 kHz; Sweep Time Coupled, Top Graticule (reference level), Corrections ON.

Input Attenuator	
Range	0 to 60 dB, in 10 dB steps

Resolution Bandwidth Switching Uncertainty	(At reference level, referenced to 3 kHz RBW)
3 kHz to 3 MHz RBW	±0.4 dB
1 kHz RBW	±0.5 dB

Linear to Log Switching	±0.25 dB at reference level

Display Scale Fidelity	
Log Maximum Cumulative	
0 to -70 dB from Reference Level	± (0.4 dB + 0.01 x dB from reference level)
Log Incremental Accuracy	
0 to -60 dB from Reference Level	±0.4 dB/4 dB
Linear Accuracy	±3% of reference level

Option Specifications

Tracking Generator Specifications (Option 010 or 011)

All specifications apply over 0 °C to + 55 °C. The spectrum-analyzer/tracking-generator combination will meet its specifications after 2 hours of storage at a constant temperature within the operating temperature range, 30 minutes after the spectrum-analyzer/tracking-generator is turned on and after CAL FREQ, CAL AMPTD, CAL TRK GEN, and TRACKING PEAK have been run.

Warm-Up	30 minutes

Output Frequency	
Range	
50 Ω (Option 010)	100 kHz to 1.8 GHz
75 Ω (Option 011)	1 MHz to 1.8 GHz

Output Power Level	
Range	
50 Ω (Option 010)	Oto-15dBm
75 Ω (Option 011)	+ 42.8 to + 27.8 dBmV
Resolution	0.1 dB
Absolute Accuracy	± 1.5 dB (at 300 MHz and – 10 dBm source power)
	(Option 011: use +38.8 dBmV instead of -10 dBm)
Vernier	
Range	15 dB
Accuracy	± 1 .O dB (referenced to – 10 dBm source power)
	(Option 011: referenced to t38.8 ***dBmV instead of -10 dBm)***

Output Power Sweep	
Range	
50 Ω (Option 010)	– 15 dBm to 0 dBm
75 Ω (Option ***011)***	+27.8 to t 42.8 dBmV
Resolution	0.1 dB
Accuracy (zero span)	<2 dB peak-to-peak

Output Flatness	
(referenced to 300 MHz)	±1.75 dB

Spurious Outputs	
50 Ω (Option 010)	(0 dBm output, 100 kHz to 1.8 GHz)
75 Ω (Option 011)	(+ 42.8 dBmV output, 1 MHz to 1.8 GHz)
Harmonic Spurs	<-25 dBc
Nonharmonic Spurs	<-30 dBc

Dynamic Range	
Tracking Generator Feedthrough	
50 Ω (Option *010)*	<- 106 dBm
75 Ω (Option 011)	<-57.24 dBmV

Frequency Characteristics

These are not specifications. Characteristics provide useful but nonwarranted information about instrument performance.

Stability	
Drift	≤75 kHz/5 minutes after 2 hour warmup and 5 minutes after setting center frequency
Drift* (Option 013)	
Frequency Span ≤ 10 MHz, Free Run	<2 kHz/minute of sweep time

* *(Option 013)* Because the analyzer is locked at the center frequency before each sweep, drift occurs only during the time of one sweep. For Line, Video or External trigger, additional drift occurs while waiting for the appropriate trigger signal.

Resolution Handwidth (-3 dB)	
Range	1 kHz to 3 MHz, selectable in 1, 3 and 10 increments, accuracy ±20% and 5 MHz. Resolution bandwidths may be selected manually, or coupled to frequency span.
Shape	Synchronously tuned four poles. Approximately Gaussian shape.
60 dB/3 dB Bandwidth Ratio	
Resolution Bandwidth	
100 kHz to 3 MHz	15:1
30 kHz	16:1
3 kHz to 10 kHz	15:1
1 kHz	16:1

Video Bandwidth (-3 dB)	
Range	30 Hz to 1 MHz, selectable in 1, 3, 10 increments, accuracy ±30% and 3 MHz. Video bandwidths may be selected manually, or coupled to resolution bandwidth and frequency span.
Shape	Post detection, single pole low-pass filter used to average displayed noise.

FFT Bandwidth Factors	**FLATTOP**	**HANNING**	**UNIFORM**
Noise Equivalent Bandwidth†	3.63x	1.5x	1x
3 dB Bandwidth†	3.60x	1.48x	1x
Sidelobe Height	<-90 dB	-32 dB	-13 dB
Amplitude Uncertainty	0.10 dB	1.42 dB	3.92 dB
Shape Factor (60 dB BW/3 dB BW)	2.6	9.1	>300

† Multiply entry by one-divided-by-sweep time.

Amplitude Characteristics

These are not specifications. Characteristics provide useful but nonwarranted information about instrument performance.

Log Scale Switching Uncertainty	Negligible error

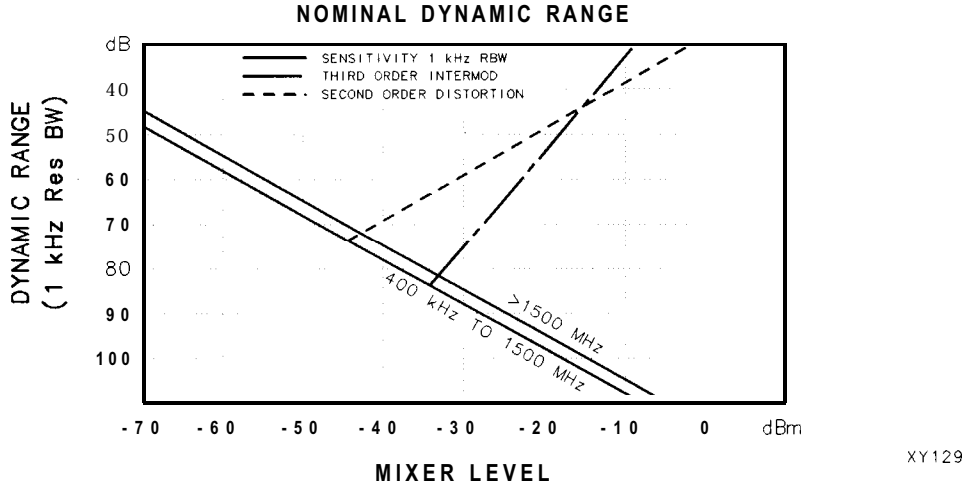
Input Attenuation Uncertainty*	
Attenuator Setting	
0 dB	±0.5 dB
10 dB	Reference
20 dB	±0.5 dB
30 dB	±0.6 dB
40 dB	±0.8 dB
50 dB	±1.0 dB
60 dB	±1.2 dB

* Referenced to 10 dB input attenuator setting from 9 kHz to 1.8 GHz. See the "Specifications" table under "Freauencv Resoonse."

Input Attenuator Repeatability	
300 MHz	±0.03 dB
1.8 GHz	±1.0 dB

RF Input SWR	(Attenuator setting 10 to 60 dB) 1.35:1

DYNAMIC RANGE



Dynamic Range .

Immunity Testing	
Radiated Immunity	When tested at 3 V/m according to IEC 801-3/1984 the displayed average noise level will be within specifications over the full immunity test frequency range of 27 to 500 MHz except that at immunity test frequencies of 278.6 MHz ± selected resolution bandwidth and 321.4 MHz ± selected resolution bandwidth the displayed average noise level may be up to -45 dBm. When the analyzer tuned frequency is identical to the immunity test signal frequency there may be signals of up to -70 dBm displayed on the screen.
Electrostatic Discharge	When an air discharge of up to 8 kV according to IEC 801-2/1991 occurs to the shells of the BNC connectors on the rear panel of the instrument spikes may be seen on the CRT display. Discharges to center pins of any of the connectors may cause damage to the associated circuitry.

Option Characteristics

output Tracking	
Drift (usable in 10 kHz bandwidth after 30-minute warmup)	1 kHz/5 minutes

Spurious Outputs (>1.8 GHz to 4.0 GHz)	
50 Ω (Option *010)*	
0 dBm output	
75 Ω (Option 011)	
+ 42.8 dBmV, output	
Harmonic	<-*20* dBc
Nonharmonic	<-40 dBc
2121.4 MHz Feedthrough	
(Option 010)	< -45 dBm
(Option 011)	< + 42.8 dBmV

RF Power-Off Residuals	
100 kHz to *1.8* GHz *(Option 010)*	<-65 dBm
1 MHz to 1.8 GHz *(Option 011)*	<-16.2 dBmV

Dynamic Range (difference between maximum power out and tracking generator feedthrough)	
100 kHz to 1.8 GHz *(Option 010)*	>106 dB
1 MHz to 1.8 GHz (Option *011)*	>100 dB

Physical Characteristics

Front-Panel Inputs and Outputs

INPUT 50Ω	
Connector	Type N female
Impedance	50 Ω nominal
INPUT 75Ω (Option *001*)	
Connector	BNC female
Impedance	75 Ω nominal

RF OUT *(Option 010, 011)*	
Connector	
(Option 010)	Type N female
(Option 011)	BNC female
Impedance	
(Option 010)	50 Ω nominal
(Option 011)	75 Ω nominal
Maximum Safe Reverse Level	
(Option 010)	+ 20 dBm (0.1 W), 25 Vdc
(Option 011)	+ 69 dBmV (0.1 W), 100 Vdc

PROBE POWER‡	
Voltage/Current	+ 15 Vdc, ±7% at 150 mA max.
	– 12.6 Vdc ±10% at 150 mA max.

‡ Total current drawn from the + 15 Vdc on the PROBE POWER and the AUX INTERFACE cannot exceed 150 mA. Total current drawn from the – 12.5 Vdc on the PROBE POWER and the – 15 Vdc on the AUX INTERFACE cannot exceed 150 mA.

Rear-Panel Inputs

AUXIFOUTPUT	
Frequency	21.4 MHz
Amplitude Range	-10 to -60 dBm
Impedance	50 Ω nominal

AUXVIDEOOUTPUT	
Connector	BNC female
Amplitude Range	0 to 1 V (uncorrected)

EXT ALC INPUT *(Option 010 or 011)*	
Impedance	1 MO
Polarity	Positive or negative
Range	-66 dBV to + 6 dBV
Connector	BNC

EXT KEYBOARD *(Option 021* or 023)	Interface compatible with HP part number Cl405 Option ABA and most IBM/AT non-auto switching keyboards.

EXT TRIG INPUT	
Connector	BNC female
Trigger Level	Positive edge initiates sweep in EXT TRIG mode (TTL).

HI-SWEEP IN/OUT	
Connector	BNC female
output	High = sweep, Low = retrace (TTL)
Input	Open collector, low stops sweep.

MONITOR OUTPUT	
Connector	BNC female
Format	
SYNC NRM	Internal Monitor
SYNC NTSC	NTSC Compatible 15.75 kHz horizontal rate 60 Hz vertical rate
SYNC PAL	PAL Compatible 15.625 kHz horizontal rate 50 Hz vertical rate

REMOTE INTERFACE	
HP-IB (Option 021)	
HP-IB Codes	SH1, AH1, T6, SR1, RL1, PPO, DC1, Cl, C2, C3 and C28
RS-232 (Option 023)	

SWEEP OUTPUT	
Connector	BNC female
Amplitude	0 to + 10 V ramp

Physical Characteristics

AUX INTERFACE

Connector Type: 9 Pin Subminiature "D"
Connector Pinout

Pin #	Function	Current	"Logic" Mode	"Serial Bit" Mode
1	Control A	—	TTL Output Hi/Lo	TTL Output Hi/Lo
2	Control B	—	TTL Output Hi/Lo	TTL Output Hi/Lo
3	Control C	—	TTL Output Hi/Lo	Strobe
4	Control D	—	TTL Output Hi/Lo	Serial Data
5	Control I	—	TTL Input Hi/Lo	TTL Input Hi/Lo
6	Gnd	—	Gnd	Gnd
7†	− 15 Vdc ±7%	150 mA	—	—
8*	+ 5 Vdc ±5%	150 mA	—	—
9†	+ 15 Vdc ±5%	150 mA	—	—

* Exceeding the + 5 V current limits may result in loss of factory correction constants.
† Total current drawn from the + 15 Vdc on the PROBE POWER and the AUX INTERFACE cannot exceed 150 mA. Total current drawn from the − 12.6 Vdc on the PROBE POWER and the − 15 Vdc on the AUX INTERFACE cannot exceed 150 mA.

WEIGHT

Net	
HP 8590D	14.1 kg (31 lb)
Shipping	
HP 8590D	16.8 kg (37 lb)

DIMENSIONS

A = 8 in (200 mm)
B = 7.25 in (184 mm)
C = 14.69 in (373 mm)
D = 13.25 in (337 mm)
E = 18.12 in (460.5 mm)