

# HP 8644A specifications

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**Specifications** describe the instrument's warranted performance and apply 24 hours after the unit has been connected to the ac power and 10 minutes after instrument turn on.

**Modes**

Front panel Synthesis Mode keys are used to select between good spectral purity or high deviation FM with faster frequency switching speed. Normal instrument operation uses "AUTO" mode selection which selects the best possible spectral purity for any modulation setting. The standard unit has Mode 1 for high FM deviations and Mode 2 for good spectral purity. Mode 3 is available with Option 004 which improves spectral purity but has lower FM deviations. With this option installed, all standard performance is still available and will be selected automatically with high FM deviations or can be selected manually for improved switching speed. Modes 4 and 5 are presently not used on the HP 8644A.

*Supplemental Characteristics are intended to provide information useful in applying the instrument by giving typical, but not warranted performance. These characteristics are shown in italics or labeled as "typical", "approximate", or "nominal".*

**Frequency**

**Range:** 251.46485 kHz to 1030 MHz, 251.46485 kHz to 2060 MHz with Option 002. See Optional Internal Modulation Source for coverage below 252 kHz.

**Frequency bands:** The exact endpoints and their approximations for each frequency band of the instrument are shown below.

Approximate Frequency Band Endpoints (MHz)	Specified Frequency Band Endpoints (MHz)
1030 - 2060	1030 - 2060
515 - 1030	515 - 1029.9999999
257 - 515	257.5 - 514.9999999
128 - 257	128.75 - 257.4999999
64 - 128	64.375 - 128.7499999
32 - 64	32.1875 - 64.3749999
16 - 32	16.09375 - 32.1874999
8 - 16	8.046875 - 16.0937499
4 - 8	4.0234375 - 8.0468749
2 - 4	2.01171875 - 4.0234374
1 - 2	1.00585937 - 2.0117187
0.5 - 1	0.50292968 - 1.0058593
0.25 - 0.5	0.25146485 - 0.5029296

**Resolution:** 0.01 Hz.

**Stability:** Same as reference oscillator.

**Frequency switching time:** <90 msec. to within 100 Hz of final frequency; <200 msec with FM on, < 300 msec in Mode 3.

**Relative phase adjust:** Adjustable in 1° phase increments.

**Internal reference oscillator**

**Stability, Option 001:** <5×10<sup>-10</sup>/day aging after 10 day warm-up.

	Standard	Option 001
<b>Aging:</b>	± 2 ppm/year after 1 year	± 3×10 <sup>-10</sup> /day after 10 days
<b>Temperature:</b>	± 4 ppm, 0 to 55°C	± 5×10 <sup>-9</sup> , 0 to 55°C
<b>Line voltage:</b>	± 0.1 ppm, ± 10%	± 1×10 <sup>-10</sup> , ± 10%

**Electronic frequency control, Option 001:** ±0.01 ppm for ±1V at rear panel connector. Voltage range is ± 10V. Input impedance 10 kΩ.

**Reference output:** 10 MHz, >1 V<sub>rms</sub> level into 50Ω, output impedance of 50Ω.

**External reference oscillator input:** Accepts 5 or 10 MHz ±1 kHz and a level range of 0.5V to 2 V<sub>rms</sub>. Input impedance is 50Ω.

**Spectral purity**

**Phase noise (CW, AM, or FM<sup>1</sup> operation)**

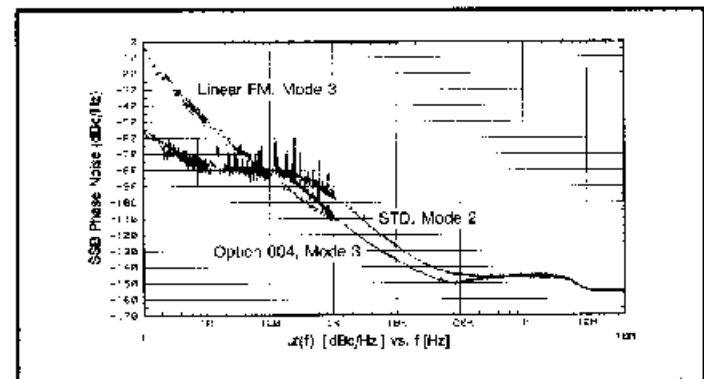
**Standard:**

Carrier Frequency (MHz)	Offset Frequency		
	1 kHz (dBc/Hz)	20 kHz (dBc/Hz)	100 kHz (dBc/Hz)
1030 - 2060	-84	-121	-131
515 - 1030	-91	-128	-138
257 - 515	-96	-134	-141
128 - 257	-101	-138	-142
64 - 128	-106	-140	-144
32 - 64	-111	-142	-145
16 - 32	-117	-144	-145
8 - 16	-120	-145	-145
4 - 8	-125	-145	-145
2 - 4	-129	-145	-145
1 - 2	-133	-145	-145
0.5 - 1	-137	-145	-145
0.25 - 0.5	-140	-145	-145

**Mode 3:** Available with Option 004

Carrier Frequency (MHz)	Offset Frequency		
	1 kHz (dBc/Hz)	20 kHz (dBc/Hz)	100 kHz (dBc/Hz)
1030 - 2060	-94	-131	-141
515 - 1030	-101	-137	-144
257 - 515	-106	-143	-145
128 - 257	-111	-145	-145
64 - 128	-116	-145	-145
32 - 64	-121	-145	-145
16 - 32	-127	-145	-145
8 - 16	-130	-145	-145
4 - 8	-135	-145	-145
2 - 4	-135	-145	-145
1 - 2	-135	-145	-145
0.5 - 1	-135	-145	-145
0.25 - 0.5	-135	-145	-145

**Typical single side band phase noise and spurs at 1 GHz**



<sup>1</sup> FM at 1% maximum specified deviation for offsets >1 kHz. For offset ≤1 kHz, FM at .001% of maximum or 1 Hz, whichever is greater.

**Spurious signals**

**Harmonics:** -30 dBc, output  $\leq +10$  dBm.

**Harmonics, with Option 002:**

<-30 dBc, 0.25 to 1030 MHz, output  $\leq +8$  dBm.

<-25 dBc, 1030 to 2060 MHz, output  $\leq +8$  dBm.

**Harmonics, with Option 005:**

<-25 dBc, 0.25 to 1030 MHz, output  $\leq +8$  dBm.

**Sub harmonics:**

None, 0.25-515 MHz.

<-60 dBc, 515-1030 MHz.

<-40 dBc, 1030-2060 MHz.

**Non harmonics** (Typ) 0c - 10 kHz  $\leq -30$  dB *AGC*

Mode 2: <-100 dBc, >15 kHz offset, 0.25-1030 MHz. *Power*

<-94 dBc, >15 kHz offset, 1030-2060 MHz. *Power*

Mode 3: <-110 dBc, >10 kHz offset, 0.25-1030 MHz.

<-104 dBc, >10 kHz offset, 1030-2060 MHz.

**Residual FM<sup>2</sup> (CW, AM, FM<sup>3</sup> operation)**

**Standard:**

Carrier Frequency (MHz)	Post Detection Bandwidth	
	0.3 to 3 kHz (Hz rms)	0.05 to 15 kHz (Hz rms)
0.25 - 257	<1	<1.2
257 - 515	<1.2	<2
515 - 1030	<2	<4
1030 - 2060	<3	<8

**Mode 3: Available with Option 004**

Carrier Frequency (MHz)	Post Detection Bandwidth	
	0.3 to 3 kHz (Hz rms)	0.05 to 15 kHz (Hz rms)
0.25 - 257	<0.5	<0.8
257 - 515	<0.5	<1
515 - 1030	<1	<2
1030 - 2060	<2	<4

**Residual AM**

<0.01% AM rms, 0.3 to 3 kHz post detection bandwidth.

**SSB AM noise floor, >100 kHz offset:**

<-157 at +10 dBm output, 0.25-1030 MHz.

<-150 at +13 dBm output, 1030-2060 MHz.

**Output**

**Maximum level:** +16 dBm, 0.25 to 1030 MHz.

**Option 002:** +14 dBm, 0.25 to 1030 MHz.

+13 dBm, 1030 to 2060 MHz.

**Option 005:** +13 dBm, 0.25 to 1030 MHz.

**Minimum level:** -137 dBm.

**Resolution:** 0.1 dB.

**Absolute accuracy:**  $\pm 1$  dB, output  $\geq -127$  dBm. Typically

$\pm 3$  dB, output  $< -127$  dBm.

**Reverse power protection:** 50 watts from a 50 $\Omega$  source, 25 Vdc.

**Third order intermodulation:** <-50 dBc, for frequencies up to 1300 MHz with two signals at +8 dBm, 25 kHz apart passing through a resistive combiner.

**Output level overrange:** Typically 2 dB more than maximum level.

**Level switching time:** <50 msec.

SWR:	Output Level	SWR
	>-2 dBm	<2.2:1
	<-2 dBm	<1.7:1
	<-10 dBm	<1.5:1

**Output impedance:** 50 $\Omega$ .

**Modulation**

**External modulation input:** Coupling is ac or dc for AM, FM and PM. Pulse modulation input is dc coupled. 1V  $\pm$  1% peak input is required for calibrated operation in AM, FM and PM.

**Simultaneous modulation:**

AM/FM, AM/Pulse, FM/Pulse, AM/FM/Pulse.

**Simultaneous internal and external modulation input:**

AM and FM.

**Amplitude Modulation**

**AM depth:** 0 to 100%, for output  $\leq +7$  dBm.

**AM resolution:** 0.1%.

**AM indicator accuracy:**  $\pm$ (6% of setting + 1%), up to 90% depth, 1 kHz rate.

**AM distortion, at 400 Hz and 1 kHz rates:**

Depth	Configuration	
	Standard	With Option 002
0-70%	3%	4%
70-90%	5%	7%

**AM 3 dB bandwidth:**

>5 kHz, 0.25 to 8 MHz.

>50 kHz, 8 to 128 MHz.

>100 kHz, 128 to 2060 MHz.

**Incidental phase modulation at 30% AM and 1 kHz rate:**

<0.2 radians peak.

**External AM input impedance:** 600 $\Omega$

**Frequency Modulation**

**FM deviation range:**

Carrier Frequency (MHz)	Maximum Peak Deviation (kHz)	Maximum Rate (kHz)
1030 - 2060	20000	100
515 - 1030	10000	100
257 - 515	5000	100
128 - 257	2500	100
64 - 128	1250	100
32 - 64	625	100
16 - 32	312	100
8 - 16	156	100
4 - 8	78.1	78.1
2 - 4	39	39
1 - 2	19.5	19.5
0.5 - 1	9.76	9.76
0.25 - 0.5	4.88	4.88

Peak deviation in Mode 2 is 10% of maximum.  
Peak deviation in Mode 3 is 1% of maximum.

<sup>2</sup> Specified for 48 to 63 Hz power line. Typical for 400 Hz power line.

<sup>3</sup> Deviation  $\leq 0.1\%$  of maximum available.

# HP 8644A specifications cont'd

FM resolution: 3 digits.

FM indicator accuracy:<sup>4</sup>

Accuracy	Percent Deviation	Rates
5%	≤10%	0-30 kHz
10%	≤10%	0-100 kHz
12%	100%	0-30 kHz
20%	100%	0-100 kHz

FM distortion, rates 20 Hz to 100 kHz:

FM Deviation	Standard
0-5%	3%
5-100%	5%

FM distortion, mode 3: 1%.

Carrier frequency accuracy in FM: ±0.5% of FM deviation setting.

Incidental AM: <0.5%, deviation ≤6% of maximum or 20 kHz, whichever is less.

FM group delay flatness: <10 μsec, 20 Hz to 100 kHz. Decreases to <1 μsec using special function 120, AC coupled, 300 Hz to 100 kHz.

FM preemphasis: 750 μsec, special function 122, internal or external modulation.

External FM input impedance: 600Ω.

## Phase modulation

Maximum phase deviation: 400 radians, 1030 to 2060 MHz decreases by half for each frequency band below this band.

Phase modulation indicator accuracy: ±10%

Phase modulation distortion: <1%.

Phase modulation 3 dB bandwidth: >150 Hz.

External input impedance: 600Ω.

## Pulse modulation

On/off ratio: >35 dB

>80 dB for 1030-2060 MHz

Rise fall time: <100 nsec, between 10% and 90% response points.

Maximum pulse repetition frequency: 1 MHz.

Minimum pulse width: 0.5 μsec.

Video feedthrough and overshoot: <15%, 10 to 2060 MHz.

Output level accuracy: ±2 dB.

External input level required:

On: >3.0V peak.

Off: <0.8V peak.

Damage Level: ≥±10V peak.

External input impedance: 600Ω

## Internal modulation source

Rates: .3, .4, 1, 3 kHz

Frequency accuracy: ±5%

Output level: 2 Vpk into 600Ω.

Distortion: -60 dBc

Amplitude level accuracy: 2%

Switching speed: Typically 25 msec

## Optional internal modulation source

Waveforms: sine, triangle, square, sawtooth and white Gaussian noise.

Frequency range: 0.1 Hz to 400 kHz. Internal modulation 3 dB bandwidth is 100 kHz.

Frequency resolution: 0.1 Hz.

Frequency accuracy: Same as internal reference oscillator.

Maximum output level: 2V peak into 600Ω. Typical accuracy 1%, output ≤100 kHz.

Output level resolution: 2 mV<sub>rms</sub>.  
Typical output impedance: 600Ω.

Distortion: <0.1%, output at 2V peak and rates ≤15kHz.

External output: For carrier frequencies below 252 kHz, complete AM/FM/PM and pulse is available from the audio output.

## Frequency sweep

### Phase continuous sweep

Sweep type: Linear, phase continuous.

Sweep time: 20 msec to 10 sec.

Maximum sweep span:

Frequency Range (MHz)	Maximum Span (MHz)
1030 - 2060	40
515 - 1030	20
257 - 515	10
128 - 257	5
64 - 128	2.5
32 - 64	1.25
16 - 32	0.625
8 - 16	0.31
4 - 8	0.15
2 - 4	0.075
1 - 2	0.039
0.5 - 1	0.019
0.25 - 0.5	0.009

### Digitally stepped sweep

Sweep type: Linear or log, frequency stepped.

Sweep time range: 500 msec to 1000 sec. The number of steps maximized for the selected sweep time. Typical time per step is 90 msec.

X axis output: Nominal 0 to 10V.

Z axis output: Nominal +5V during retrace.

Markers available: 3.

## Remote programming

Interface: HP-IB (Hewlett-Packard's implementation of IEEE-488.2).

HP-IB select code range: 00 to 30. Interface function is listener and talker.

Control language: Hewlett-Packard Systems Language (HP-SL).

Functions controlled: All front panel functions except power switch and knob.

IEEE-488 functions implemented: SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC0, DT1, C0, E2.

<sup>4</sup> Accuracy at time of setting for rates that do not exceed maximum rate.

## General

**Power requirements:**  $\pm 10\%$  of 100V, 120V, 220V, or 240V; 48 to 440 Hz, 400 VA maximum.

**Operating temperature range:** 0 to 55°C.

**Storage temperature range:** -55 to +75°C.

**Leakage:** Typical leakage is  $< 1 \mu\text{V}$  induced in a two-turn loop 1 inch from any surface with output level  $< 0 \text{ dBm}$ .

Conducted and radiated interference meets MIL STD 461B RE02 and FTZ 1046. Specified leakage with Option 010 is  $0.1 \mu\text{V}$  induced in a resonant dipole 1 inch from any surface except the rear panel at the following frequencies: 500 MHz, 800 MHz, 1200 MHz. This is approximately equivalent to  $0.05 \mu\text{V}$  induced in a two-turn loop.

**Acoustic noise:** Typically  $< 5.5$  bels.

**Internal calibration:** The operator can initiate an instrument calibration function that will ensure all specifications are being met with a confidence level exceeding the accepted standard of 95%.

**Internal diagnostics:** The instrument monitors its operation and will alert the user to most internal malfunctions. Built-in test capability locates circuit malfunctions to allow repair through module or cable replacement.

**Calibration interval:** 3 years (MTBC)

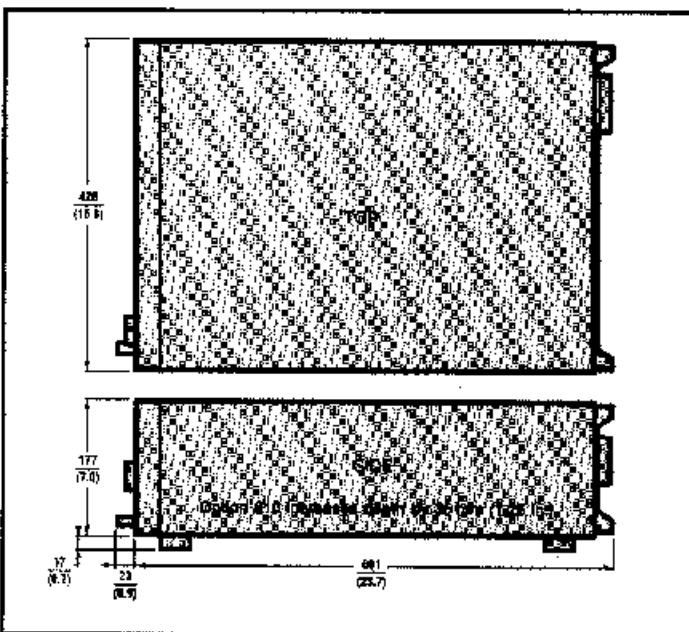
**Storage registers:** 10 full-function and 40 frequency/amplitude registers.

**Memory erasure:** All memory contents with the exception of the instrument's generic calibration data can be erased by executing a special function. Erasure is accomplished through the sequential writing of 1's and 0's into all user-accessible memory locations as described by Mil Std 380-380.

**Weight:** Approximately 26 kg (57 lbs.) net and 37 kg (81 lbs.) shipping.

**Dimensions:** Approximately 177 mm H  $\times$  426 mm W  $\times$  624 mm D (7  $\times$  16.8  $\times$  24.6 in.)

Option 010 adds 35 mm (1.4 in.) to the depth.



## Ordering Information

U.S. List  
Price

<b>HP 8644A Synthesized Signal Generator</b> .....	\$17,000
<b>Option:</b>	
001: High Stability Time Base .....	\$1,500
002: 2 GHz Doubled Output .....	\$7,000
003: Rear Panel Inputs/Outputs .....	\$400
(deletes front panel inputs/outputs)	
004: Enhanced Spectral Purity .....	\$4,000
005: Electronic Attenuator .....	\$500
(5 year warranty on attenuator, cannot be used with option 002)	
007: Synthesized Audio Oscillator .....	\$1000
010: Reduced Leakage Configuration .....	\$1500
011: Transit Case (9211-2662) .....	\$300
(includes handles and wheels)	
907: Front Handle Kit (5061-9690) .....	\$65
908: Rack Flange Kit (5061-9678) .....	\$35
909: Combined Front Handle/Rack Flange Kit (5061-9684) .....	\$90
910: Extra Manual Set .....	\$190
(includes Service Manual)	
915: Add Service Manual .....	\$65
W03: 90 day On-site Warranty .....	N/C
(instead of standard 1-year return to Hewlett-Packard)	
W30: 3 year Extended Return to Hewlett-Packard Warranty .....	\$380
Rack Slide Kit (1494-0059) .....	\$100
Service Kit (08645-61116) .....	\$500