

HP 8647A  
HP 8648A  
HP 8648B  
HP 8648C  
HP 8648D

- ±1 dB level accuracy through 2.5 GHz
- 4 Hz residual FM at 500 MHz
- Electronic attenuator (1 GHz models)
- +10/+13 to -136 dBm output power
- Simple, dependable operation
- Pager signaling (HP 8648A Option 1EP)



HP 8648A/B/C/D

### HP 8647A and HP 8648A/B/C/D Synthesized Signal Generators



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#### Superior Value in Economy Signal Generators

The HP 8647A and 8648A/B/C/D family of synthesized signal generators delivers solid performance and reliability at an affordable price. These signal generators provide the features and performance needed for semi-automated receiver testing and for use in a variety of general-purpose applications over a 9 kHz to 4000 MHz frequency range.

#### High Reliability and Simplicity

Designed to Hewlett-Packard's stringent quality specifications, these signal generators provide consistent performance. The all-electronic attenuator in the HP 8647A and 8648A easily handles millions of amplitude cycles with highly repeatable output levels.

An easy-to-use front panel interface shortens the operator's learning curve and increases productivity. A front panel organized in functional blocks speeds identification of the task and simplifies operation.

#### Ideal for Manufacturing and Semi-Automated Test

The HP 8647A and 8648 series are ideal for manufacturing high-volume products such as cordless telephones, pagers and two-way radios. The HP 8647A is the basic model providing essential performance. The HP 8648 series provides enhancements in frequency range, residual FM, level accuracy, and phase noise, in addition to optional high power, pulse modulation, and waveform modulation. The HP 8648 series provides ±1 dB absolute amplitude accuracy up to 2.5 GHz. All of the models offer ultra stable dc FM, with ±500 Hz carrier frequency accuracy below frequencies of 1001 MHz, and low RF leakage.

Applications such as receiver tuning and alignment benefit from the simple user interface. These signal generators are so easy to learn and use that experienced operators are no longer required. With 300 full storage registers and ten user-definable sequences, the signal generator easily adapts to any test procedure. Once setups are stored in registers, operators can quickly sequence through them, either from the front panel or through a remote keypad (HP 83300A). In addition, the HP 83301A memory interface provides the means to transfer register information from one HP 8647/48 to another.

For automated test applications, the HP 8647/48 offers full HP-IB programmability and uses SCPI programming codes. In addition, the HP 8648 series reduces software development costs by providing full HP-IB code compatibility with the HP 8656B and 8657A/B signal generators.

#### New Cost-Effective Pager Testing

The HP 8648A with Option 1EP provides an economical, one-box solution for pager test. Option 1EP adds the pager encoding capability for POCSAG, FLEX, and FLEX-TD formats to the HP 8648A. Ideal for pager test applications, the HP 8648A with Option 1EP offers superior frequency accuracy, deviation accuracy, and dc FM performance.

### Specifications

#### Frequency

- HP 8647A: 250 kHz to 1000 MHz
- HP 8648A: 100 kHz to 1000 MHz
- HP 8648B: 9 kHz to 2000 MHz
- HP 8648C: 9 kHz to 3200 MHz
- HP 8648D: 9 kHz to 4000 MHz

#### Resolution

HP 8647A: 1 Hz; HP 8648A/B/C/D: 0.001 Hz

Display: 10 Hz

#### Switching Speed (typical)

- HP 8647A: < 120 ms
- HP 8648A/B/C/D: <1001 MHz: < 75 ms; ≥ 1001 MHz: < 100 ms

**Accuracy** (after one hour warm-up and within one year calibration): Typically ± 3 x 10<sup>-6</sup> x carrier frequency in Hz, ± 0.15 x 10<sup>-6</sup> x carrier frequency in Hz for Option 1E5 (typically ± 0.072 x 10<sup>-6</sup> x fc)

#### Internal Reference Oscillator

**Accuracy and Stability** (calibration adjustment dependent; after one hour warm-up and within one year of calibration), ± aging rate ± temperature effects ± line voltage effects

	Standard Timebase	Option 1E5
<b>Aging</b>	< ± 2 ppm/yr	< ± 0.1 ppm/yr; < ± 0.0005 ppm/day
<b>Temperature</b>	< ± 1 ppm	< ± 0.01 ppm (typ.)
<b>Line Voltage</b> (± 5%)	< ± 0.5 ppm	N/A

**Output:** 10 MHz, typically > 0.5 V<sub>rms</sub> into 50 Ω

**External Reference Oscillator Input:** Accepts 2, 5, 10 MHz ±5 ppm and a level range of 0.5 V to 2 V<sub>rms</sub> into 50 Ω

#### Spectral Purity

**Harmonics** (output ≤ 4 dBm): < -30 dBc

**Subharmonics** (output ≤ +4 dBm) < 1001 MHz: -60 dBc;

≥ 1001 MHz: -50 dBc; > 3200 MHz: -40 dBc

**Nonharmonics** (≥ 5 kHz offset, ≤ +4 dBm output level)

HP 8647A: < -60 dBc (-55 dBc from 220 to 250 MHz)

HP 8648A/B/C/D

< 249 MHz: < -55 dBc; < 2001 MHz: < -54 dBc

< 1001 MHz: < -60 dBc; ≤ 4000 MHz: < -48 dBc

#### Residual FM (CCITT, rms)

HP 8647A

< 249 MHz: < 20 Hz, typically < 11 Hz

< 501 MHz: < 10 Hz, typically < 6 Hz

≤ 1000 MHz: < 20 Hz, typically < 11 Hz

HP 8648A/B/C/D

< 249 MHz: < 7 Hz, typically < 4 Hz

< 501 MHz: < 4 Hz, typically < 2 Hz

< 1001 MHz: < 7 Hz, typically < 4 Hz

< 2001 MHz: < 14 Hz, typically < 8 Hz

≤ 4000 MHz: < 28 Hz, typically < 12 Hz

#### SSB Phase Noise (at 20 kHz offset, typical)

HP 8647A

@ fc 500 MHz: < -110 dBc/Hz; @ fc 1000 MHz: < -106 dBc/Hz

HP 8648A/B/C/D

@ fc 500 MHz: < -120 dBc/Hz; @ fc 3000 MHz: < -106 dBc/Hz

@ fc 1000 MHz: < -116 dBc/Hz; @ fc 4000 MHz: < -104 dBc/Hz

@ fc 2000 MHz: < -110 dBc/Hz

#### Output Range

HP 8647A and 8648A: +10 to -136 dBm

HP 8648B/C/D: ≤ 2500 MHz: +13 to -136 dBm;

> 2500 MHz: +10 to -136 dBm

Max. Power with Option 1EA (High Power) on HP 8648B/C/D only						
Freq. (MHz)	< 0.1	≤ 1000	≤ 1500	≤ 2100	≤ 2500	≤ 4000
Power (dBm)	+17	+20	+19	+17	+15	+13

**Display Resolution:** 0.1 dB

**Accuracy** (specified power < 13 dBm to -127 dBm)

HP 8647A: ± 1.5 dB

HP 8648A/B/C/D (applies at 25° ± 5° C):

≤ 2500 MHz: ± 1.0 dB

≤ 3200 MHz: ± 1.5 dB (≥ -100 dBm; ± 3.0 dB < -100 dBm)

≤ 4000 MHz: ± 2.0 dB (≥ -100 dBm; ± 3.0 dB < -100 dBm)

#### Reverse Power Protection (watts into 50 Ω)

HP 8647A and 8648A/B: 50 watts

HP 8648C/D: 50 watts ≤ 2000 MHz; 25 watts > 2000 MHz

**SWR:** (output < -6 dBm, typical)

**HP 8647A:** < 2.0:1

**HP 8648A/B/C/D:**

< 249 kHz: < 2.5:1

≤ 2500 MHz: < 1.5:1

≤ 3200 MHz: < 2.0:1

**Output Impedance:** Nominally 50 Ω

### Frequency Modulation

Peak Deviation (rates > 25 Hz ac FM)	8647A	8648A/B/C/D
< 249 MHz	0 to 100 kHz	0 to 200 kHz
< 501 MHz	0 to 50 kHz	0 to 100 kHz
< 1001 MHz	0 to 100 kHz	0 to 200 kHz
< 2001 MHz	N/A	0 to 400 kHz
≤ 4000 MHz	N/A	0 to 800 kHz

### Resolution

**For ≤ 10% peak deviation**

< 2001 MHz: 10 Hz

≥ 2001 MHz: 20 Hz

**For > 10% to maximum peak deviation**

< 2001 MHz: 100 Hz

≥ 2001 MHz: 200 Hz

### Deviation Accuracy (internal 1 kHz rate)

**HP 8647A:** ± 7.5% of FM deviation ± 30 Hz

**HP 8648A/B/C/D**

< 1001 MHz: ± 3% of deviation ± 30 Hz

< 2001 MHz: ± 3% of deviation ± 60 Hz

≤ 4000 MHz: ± 3% of deviation ± 120 Hz

**HP 8648A Option 1EP only:**

50 Hz at 276 to 284 MHz, 406 to 512 MHz, and 929 to 932 MHz

### Rates

**HP 8647A**

Internal: 400 Hz or 1 kHz

External dc: DC to 75 kHz (typical, 3 dB BW)

External ac: 20 Hz to 75 kHz (typical, 3 dB BW)

**HP 8648A/B/C/D**

Internal: 400 Hz to 1 kHz (10 Hz to 20 kHz for Option 1E2)

External dc: dc to 150 kHz (typical, 3 dB BW)

External ac: 1 Hz to 150 kHz (typical, 3 dB BW)

### Distortion (1 kHz rate, THD + N, 0.3 to 3 kHz BW)

< 1001 MHz: < 1% at deviations > 4 kHz

< 2001 MHz: < 1% at deviations > 8 kHz

≤ 4000 MHz: < 1% at deviations > 16 kHz

**HP 8648A/B/C/D** 88 to 108 MHz: < 0.5% at deviations ≥ 75 kHz

### Carrier Frequency Accuracy (relative to CW in dc FM, at 25° ± 5° C)

< 1001 MHz: ± 100 (typ. 40\*) Hz, deviations < 10 kHz

< 2001 MHz: ± 200 (typ. 80\*) Hz, deviations < 20 kHz

≤ 4000 MHz: ± 400 (typ. 160\*) Hz, deviations < 40 kHz

**FM + FM:** Internal 1 kHz to 400 Hz source plus external. In internal plus external FM mode, the internal source produces the set level of deviation. The external input should be set to ± 0.5 V peak or 0.5 Vdc (one-half the set deviation).

### Phase Modulation

#### Peak Deviation

< 249 MHz: 0 to 10 radians

< 501 MHz: 0 to 5 radians

< 1001 MHz: 0 to 10 radians

< 2001 MHz: 0 to 20 radians

≤ 4000 MHz: 0 to 40 radians

#### Resolution

< 2001 MHz: 0.01 radian

≥ 2001 MHz: 0.02 radian

#### Deviation Accuracy (internal 1 kHz rate, typical)

**HP 8647A:** ± 7.5% of deviation ± 0.05 radians

**HP 8648A/B/C/D**

< 1001 MHz: ± 3% of deviation ± 0.05 radians

< 2001 MHz: ± 3% of deviation ± 0.1 radians

≤ 4000 MHz: ± 3% of deviation ± 0.2 radians

#### Rates

Internal: 400 Hz or 1 kHz (10 Hz to 20 kHz for Option 1E2, 8648A/B/C/D only)

External: 20 Hz to 10 kHz (typical, 3 dB BW)

#### Distortion (1 kHz rate)

**HP 8647A** < 2% at deviations ≥ 3 radians

**HP 8648A/B/C/D**

< 1001 MHz: < 1% at deviations ≥ 3 radians

< 2001 MHz: < 1% at deviations ≥ 6 radians

≤ 4000 MHz: < 1% at deviations ≥ 2 radians

### Amplitude Modulation

(AM is not specified below 1.5 MHz and is typical above 1001 MHz.)

**Range:** 0 to 100%; output ≤ +4 dBm

**Resolution:** 0.1%

**Accuracy** (1 kHz rate): ± 5% of setting ± 1.5% (for HP 8648B/C/D, specification is applicable at 25° ± 5° C and < 70% depth)

#### Rates

Internal: 400 Hz or 1 kHz (10 Hz to 20 kHz for Option 1E2, 8648A/B/C/D only)

External dc: dc to 25 kHz (typical, 3 dB BW)

External ac: 1 Hz to 25 kHz (typical, 3 dB BW)

#### Distortion (1 kHz rate, THD + N, 0.3 to 3 kHz BW)

**HP 8647A and 8648A:** @ 30% AM: < 2%; @ 90% AM: < 3%

**HP 8648B/C/D:** @ 30% AM: < 2%; @ 70% AM: < 3%

#### Pager Test Option 1EP (HP 8648A only)

**Signaling Formats:** POCSAG, FLEX, and FLEX-TD (RCR-43)

**Pulse Option 1E6 (HP 8648B/C/D only)**

**On/Off Ratio:** > 80 dB < 2000 MHz; > 70 dB ≥ 2000 MHz

**Rise/Fall Times:** < 10 ns

#### Modulation Generator Option 1E2 (HP 8648A/B/C/D only)

Adds variable frequency modulation generator.

**Frequency Range:** Sine: 10 Hz to 20 kHz;

Square, Triangle, Sawtooth: 100 Hz to 2 kHz

**Frequency Accuracy:** ± 0.01% typical

**Frequency Resolution:** 1 Hz (3 digits displayed)

#### Modulation Source

**Internal:** 400 Hz or 1 kHz, front panel BNC connector provided at nominally 1 V (p-p) into 600 Ω

**External:** 1 V peak into 600 Ω (nominal) required for full scale modulation. (High/Low indicator provided for external signals ≤ 10 kHz.)

#### Remote Programming

**Interface:** HP-IB (IEEE-488.2-1987) with Listen and Talk

**Control Languages:** SCPI version 1992.0. The HP 8648A/B/C/D are code compatible with the HP 8656B and 8657.

**Functions Controlled:** All front panel functions except power switch and knobs

**IEEE-488:** SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, CO, E2

#### ISO Compliant

The HP 8647A and 8648A/B/C/D signal generators are manufactured in an ISO 9002 registered facility in concurrence with HP's commitment to quality.

### General

**Power Requirements:** 90 to 264 V, 48 to 440 Hz; 170 VA max.

**Operating Temperature:** 0° to 50° C

**Leakage:** Conducted and radiated interference meets MIL-STD-461B RE02 and FTZ 1046. Typically < 1 μV.

### Key Literature

HP 8647A and 8648A/B/C/D Data Sheet, p/n 5965-3432E

Signal Generator Selection Guide, p/n 5965-3094E

HP 8647A and 8648A/B/C Brochure, p/n 5962-6191E

HP 8648A Option 1EP Pager Encoder Datasheet, p/n 5964-4116E

### Ordering Information

**HP 8647A** Synthesized Signal Generator

**HP 8648A** Synthesized Signal Generator

**HP 8648B** Synthesized Signal Generator

**HP 8648C** Synthesized Signal Generator

**HP 8648D** Synthesized Signal Generator

**Opt 1EA** High Power (HP 8648B/C/D only)

**Opt 1EP** Pager Encoder (HP 8648A only)

**Opt 1E6** Pulse (HP 8648B/C/D only)

**Opt 1E2** Modulation Generator

**Opt 1E5** High-Stability Timebase

**Opt 1CM** Rack Kit, p/n 08647-61020 (HP 8647A)

**Opt 1CM** Rack Kit, p/n 08648-60001 (HP 8648)

**HP 83300A** Remote Interface

**HP 83301A** Memory Interface

HP 8647A

HP 8648A

HP 8648B

HP 8648C

HP 8648D

\*Within one hour after dc FM calibration