

# SIGNAL GENERATORS

## Mechanically Tuned VHF Signal Generators

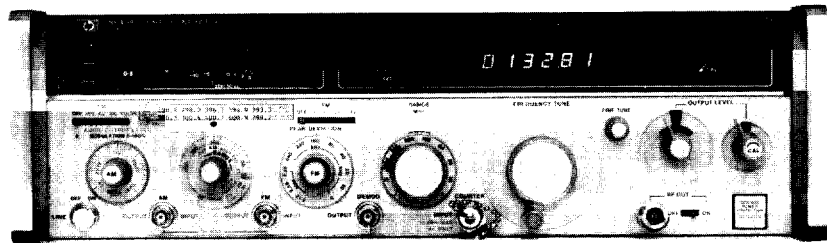
### Models 8640B and 8640B Option 004

375

- 0.5 to 512 MHz frequency range with optional coverage to 1024 MHz
- +19 to -145 dBm output power range
- Low SSB phase noise
- Calibrated, metered AM, FM and pulse modulation
- Internal phase lock/synchronizer, digital frequency readout, external count capability to 550 MHz
- Avionics version



HP 8640B (with Option 001, 002, 003)



HP 8640B Option 004 (with Option 001, 003)

### HP 8640B Signal Generator

The HP 8640B Signal Generator covers the frequency range 500 kHz to 512 MHz and can be extended to 1024 MHz with an internal doubler (Option 002). Using the HP 11710B Down Converter, the HP 8640B frequency range can be extended down to 10 kHz. An optional internal audio oscillator has a frequency range of 20 Hz to 600 kHz.

The HP 8640B has an output level range of +19 to -145 dBm (2V to 0.013  $\mu$ V) which is calibrated, metered, and leveled to within +0.5 dB across the full frequency range of the instrument. The output is protected against up to 50W of reverse power (with Option 003).

The 8640B also has AM, FM, and pulse modulation for a wide range of receiver test applications.

### Spectrally Pure Output Signals

Noise of the HP 8640B is extremely low beyond 10 kHz offsets. At a 20 kHz offset from the carrier, SSB phase noise is <-130 dBc at 450 MHz and <-122 dBc at 550 MHz. Broadband noise floor is better than -140 dBc/Hz (-130 dBc/Hz for Option 004).

### Phase Locked Stability

The HP 8640B can phase lock to the RF output frequency of the crystal timebase used in the counter (resulting in drift that is better than  $5 \times 10^{-8}$ /hr) while still maintaining its spectral purity. The HP 8640B can also be locked to an external 5 MHz standard.

In the phase locked mode, FM capability and spectral purity are maintained while providing FM rates from 50 Hz to 250 kHz.

### HP 8640B Avionics Option 004 Signal Generator

The HP 8640B Option 004 NAV/COM Signal Generator is an HP 8640B AM/FM signal generator specially adapted for testing ILS, VOR, and VHF receivers. Option 004 is designed with low distortion modulation circuitry for use with suitable VOR/ILS audio generators.

### Demodulated Output

RF peak detected AM is available from the front panel for precise AM settings. A choice of combined ac/dc at 1V rms or ac only at 5V rms is provided.

### Output Level Setting

Option 004 provides excellent demodulated output linearity by using a 10 dB and a 1 dB step attenuator and vernier. Output levels from +15 dBm to -142 dBm (1.3V to 0.018  $\mu$ V).

### Low Distortion Modulation

Option 004 provides flat AM response and minimum phase shift at 30 Hz and 9960 Hz as well as constant group delay between 9 kHz and 11 kHz for accurate VOR and ILS testing.

Operation and specifications of the HP 8640B Option 004 are the same as the standard HP 8640B except where noted.

### HP 8640B Specifications

#### Frequency

**Range:** 500 kHz to 512 MHz in 10 octaves, (1024 MHz with Option 002 internal frequency doubler).

**Resolution:** (Dependent upon phase lock mode and frequency ranges).

#### Fine Tuning

**Unlocked:** > 1000 ppm total range.

**Locked mode:**  $\geq \pm 20$  ppm by varying internal time base vernier.

**Accuracy:**  $6\frac{1}{2}$  digit LED display with X10 and X100 expand; accuracy depends on internal or external reference used.

#### Stability (after 2 hr warmup):

Normal: <10 ppm/10 min. Locked: <0.05 ppm/hr.

#### Restabilization time after frequency change:

Normal: <15 min. Locked: <1 min. to be within 0.1 ppm.

#### Output

**Range with Opt. 003 (10 dB steps and 18 dB vernier provide the following output power settings into 50 ohms):**

**Standard:** +18.5 to -145 dBm.

**Opt. 002:** +18 to -145 dBm,  $f_c$ : 0.5 - 512 MHz; +12 to -145 dBm,  $f_c$ : >512 MHz.

**Option 004:** +15 dBm to -142 dBm (1.3 to 0.018  $\mu$ V).

**Option 004 attenuators:** 10 dB and 1 dB step attenuators with a >2 dB vernier.

**Level flatness with Opt. 003 (referred to 1V at 50 MHz at top 10 dB of vernier):**

**Standard:** +0.75 dB, -1.25 dB.

**Opt. 002:** +1.0 dB, -2.0 dB, ( $\pm 2$  dB for  $f_c$  >512 MHz).

# SIGNAL GENERATORS

## Mechanically Tuned VHF Signal Generators (cont'd)

### Models 8640B and 8640B Option 004

**Opt. 004 (referred to 190 MHz and  $\pm 10$  to  $-10$  dBm):**  $\leq \pm 0.75$  dB;  $f_c$ : 0.5 to 512 MHz,  $\leq \pm 0.5$  dB;  $f_c$ : 108 to 336 MHz.

#### Level accuracy:

**Standard:**  $\pm 1.5$  dB to  $\pm 4.5$  dB depending on level and frequency.  
**Option 004:**  $\pm 2$  dB;  $+15$  to  $-10$  dBm,  $\pm 2.5$  dB;  $-10$  to  $-50$  dBm;  $\pm 3.0$  dB;  $-50$  to  $-142$  dBm (subtract 0.5 dB for 108 - 336 MHz).

#### Spectral Purity

##### Harmonics (at 1V, +10 dBm output range and below):

$< -30$  dBc, 0.5 to 512 MHz;  
 $< -12$  dBc, 512 to 1024 MHz (Option 002).

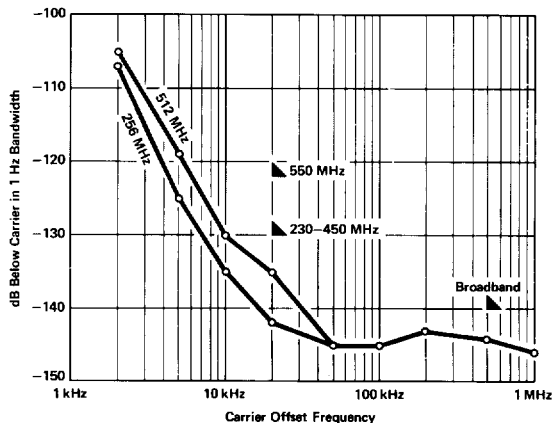
##### Spurious (greater than 15 kHz offsets):

**Nonharmonically related:**  $< -100$  dBc;  
**Subharmonically related:**  $< -100$  dBc,  $< -20$  dBc;  $f_c > 512$  MHz

##### Residual AM (averaged rms in a 0.3 - 3 kHz BW):

$< -85$  dBc.  
**Residual FM (averaged rms in a 0.3 - 3 kHz BW):**  $< 5$  Hz, ( $< 10$  Hz;  $f_c > 512$  MHz).

**Measured SSB phase noise (typical):** triangles are specified limits.



#### Modulation

**General:** internal AM, FM, external AM, FM and Pulse.

##### Simultaneous AM and FM or Pulse and FM.

**Frequency:** fixed 400 Hz and 1 kHz  $\pm 3\%$ ; also, 20 Hz to 600 KHz,  $\pm 15\%$  with Opt. 003.

**Output level:** Standard: 10 mV to 1  $V_{RMS}$  into 600 $\Omega$ .  
 Opt. 003: 1 mV to 3  $V_{RMS}$  into 600 $\Omega$ .

##### Amplitude Modulation

(Option 004 specifications apply to output settings of  $+10$  dBm and below)

**Depth:** 0 to 100%, amplitude  $< +13$  dBm; 0 to 100%, amplitude  $< +7$  dBm (excluding top 6 dB of vernier) at  $f_c > 512$  MHz.

##### AM Bandwidth

**Standard:** 3 dB bandwidth (lower ac limit is 20 Hz)

Frequency Ranges	0 to 50% AM	50 to 90% AM
0.5 to 2 MHz	dc - 20 kHz	dc - 12.5 kHz
2 to 8 MHz	dc - 40 kHz	dc - 25 kHz
8 to 512 MHz	dc - 60 kHz	dc - 50 kHz
512 to 1024 MHz	dc - 60 kHz	dc - 50 kHz

**Option 004 frequency response:** (lower ac limit is 20 Hz);  $\leq \pm 0.04$  dB; 90 Hz to 150 Hz,  $f_c$ : 108 - 118 and 329 - 335 MHz;  $\leq \pm 0.1$  dB; 9 kHz to 11 kHz,  $f_c$ : 108 - 118 MHz.

##### AM distortion (400 Hz and 1 kHz rates):

$< 1\%$ , 0 - 50% AM;  $< 3\%$ , 50 - 90% AM;  
 $< 10\%$ , 0 - 30% AM ( $f_c > 512$  MHz);  
 $< 20\%$ , 30 - 90% AM ( $f_c > 512$  MHz).

##### External input impedance:

**Standard:** 600 $\Omega$ .  
**Opt. 004:** 2 k $\Omega$  nominally.

##### AM sensitivity (400 Hz and 1 kHz rates into 600 $\Omega$ ):

0.1% AM/mV peak; (0.1  $\pm$  0.005)% AM/mV pk when  $f_c < 512$  MHz.

##### AM accuracy: (400 and 1 kHz rates)

$\pm (5.5\%$  of reading  $+1.5\%$  of full scale),  $f_c < 512$  MHz.

**Incidental FM (at 30% AM):**  $< 0.15$  rad,  $f_c < 128$  MHz;  $< 0.3$  rad,  $f_c < 512$  MHz; 0.6 rad,  $f_c > 512$  MHz.

#### General Option 004 AM Specifications

**Demodulated output:** output vernier in CAL position, 108 to 118 MHz and 329 to 336 MHz and 20% - 80% AM.

**AC only output:** proportional to AM depth; 90 to 150 Hz AM rates. **% AM equals:** (20  $\pm$  0.6)% per  $V_{RMS}$ ; 0 to 55°C, (20  $\pm$  0.4)% per  $V_{RMS}$ ; 20 to 30°C, (20  $\pm$  0.2)% per  $V_{RMS}$  using CAL data.

**AC and dc output:** proportional to AM depth; 90 to 150 Hz AM rates. DC output equals (1.41  $\pm$  0.01) V dc with vernier in CAL position. **% AM equals:** (100  $\pm$  3)% per  $V_{RMS}$ ; 0 to 55°C, (100  $\pm$  2)% per  $V_{RMS}$  20 to 30°C, (100  $\pm$  1)% per  $V_{RMS}$  using DEMOD CAL data.

**Phase shift from audio input to demodulated output (108 - 118 MHz, AM EXT DC mode):**  $< \pm 0.01^\circ$ ; 30 Hz rate,  $\pm 3^\circ$ ; 30 Hz to 10 kHz,  $\pm 2^\circ$ ; 9 kHz to 11 kHz.

##### Pulse Modulation

**Rise/fall time:**  $< 1$   $\mu$ sec,  $f_c$ : 8 - 512 MHz, 1  $\mu$ sec typ. for  $f_c > 512$  MHz, 1 to 9  $\mu$ sec for  $f_c < 8$  MHz (depending on carrier frequency).

**Rate:** 50 Hz to 500 kHz at 512 MHz.

**On/off ratio:**  $> 40$  dB;  $f_c < 512$  MHz,  $> 60$  dB;  $f_c > 512$  MHz.

##### Frequency Modulation

**Deviation:** 640 kHz,  $f_c$ : 64 to 128 MHz. (Deviation doubles at each octave above 128 MHz and halves at each octave below 64 MHz.)

**FM rate (3 dB BW):** dc/20 Hz - 250 kHz (50 Hz min. in locked mode).

**FM distortion (400 and 1 kHz):**  $< 3\%$ , ( $< 1\%$ , dev.  $< 1/8$  maximum).

**FM sensitivity:** 1V peak into 600 $\Omega$ .

**FM accuracy (400 and 1 kHz):**  $\pm (7\% + 1.5\%$  of full scale).

**Incidental AM (400 and 1 kHz):**  $< 1\%$  AM, ( $< 0.5\%$  AM, dev.  $< 1/8$  max.),  $< 7\%$ ,  $f_c > 512$  MHz ( $< 1\%$ , dev.  $< 1/8$  maximum).

#### Counter

**Frequency range:** 1 Hz to 550 MHz.

**Sensitivity:**  $> 200$  mV $_{RMS}$  from a 50 source impedance, ac only.

**Resolution (6 digit LED display with X10 and X100 expand mode):** 100 Hz for  $f_c$ : 0 - 10 MHz; 10 kHz for  $f_c$ : 10 - 550 MHz.

#### General

**External reference input:** 5 MHz, nominally  $> 0.5$  V $_{pp}$  into 1 k $\Omega$ .

**Internal reference (after 2 hr. warmup at 25°C):**

**Aging rate:**  $< 0.05$  ppm/hr;  $< 2$  ppm/90 days.

**Drift:**  $\leq \pm 2$  ppm; 15 to 35°C,  $< +10$  ppm; 0 to 50°C.

**Typical accuracy:**  $\pm 2$  ppm; 15 to 35°C.

**Operating temperature:** 0 to 55°C.

**Power requirements:** 100, 120V ( $+5\%$ ,  $-10\%$ ); 48 to 440 Hz, 220, 240V ( $+5\%$ ,  $-10\%$ ); 48 to 66 Hz. 175 VA max (Opt. 002: 190 VA max).

**Weight:** net, 20.8 kg (46 lb); shipping, 24.1 kg (53 lb).

**Size:** 140H x 425W x 467 mmD (5.5" x 16.75" x 18.75").

#### Ordering Information

8640B Signal Generator	Price
Opt 001 20 - 600 kHz internal audio oscillator	\$12,000
Opt 002 Internal doubler 512 - 1024 MHz	+\$525
Opt 003 Reverse power protection	+\$1,050
Opt 004 Avionics version	+\$375
Opt 908 Rack mount kit (5060-8740)	+\$1,575
Opt 910 2 sets of operation/calibration (08640-90208) and service manuals (08640-90215)	+\$37.50
Opt 915 Service manual supplied with instrument (08640-90215)	+\$340
	+\$150