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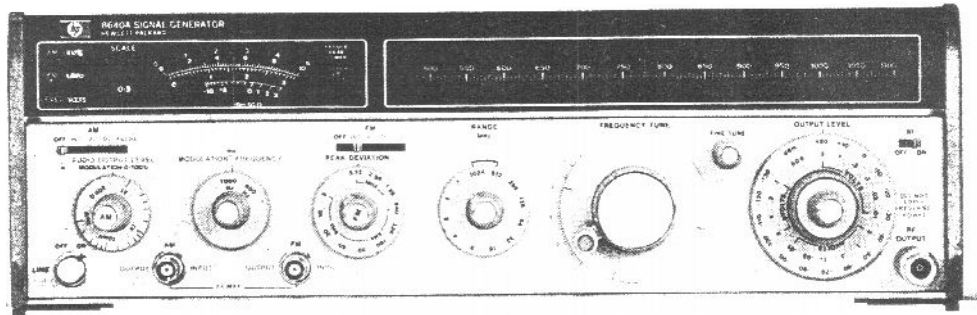


## SIGNAL GENERATORS

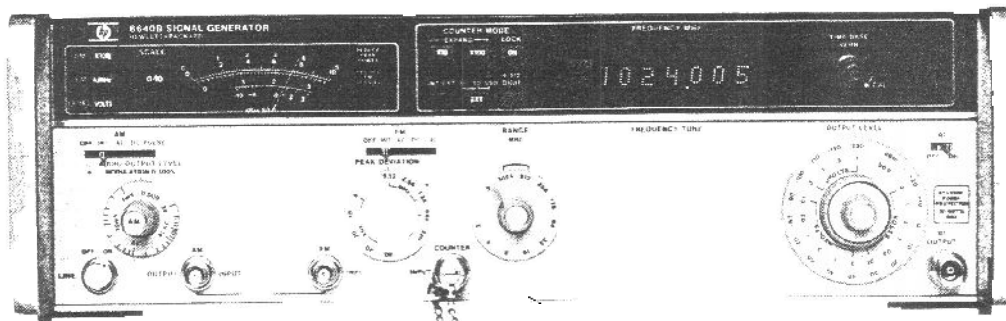
### Mechanically Tuned VHF Generator

Models 8640A, 8640B

- 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
- 8640B also features: internal phase lock synchronizer, digital frequency readout, external count capability to 550 MHz



8640A (with Option 002)



8640B (with Option 001, 002, 003)

### 8640A and 8640B Signal Generators

The 8640 Signal Generator covers the frequency range 500 kHz to 512 MHz (450 kHz to 550 MHz with band overrange) and can be extended to 1024 MHz with an internal doubler (Opt 002). Using the 11710B Down Converter, the 8640 frequency range can be extended down to 10 kHz. An optional audio oscillator (Opt 001) is also available with a frequency range of 20 Hz to 600 kHz. This broad coverage, together with calibrated output and modulation, provides for complete RF and IF performance tests on virtually any type of HF, VHF, or UHF receiver.

Both solid state generators, 8640A and B have an output level range of +19 to -145 dBm (2V to 0.013  $\mu$ V) which is calibrated, metered, and leveled to within  $\pm 0.5$  dB across the full frequency range of the instrument.

The 8640A and 8640B generators provide AM, FM, and pulse modulation for a wide range of receiver test applications. This modulation is calibrated and metered for direct readout under all operating conditions.

A reverse power protection option (Opt 003) is available to eliminate instrument damage due to accidental transmitter keying. This module protects against up to 50 watts of applied power and automatically resets upon removal of the reverse power.

#### Spectrally Pure Output Signals

Noise performance of the 8640 is state-of-the-art for a solid-state generator. The high-Q cavity oscillator has been optimized with use of a low-noise microwave transistor for spectrally pure output signals. At a 20 kHz offset from the carrier, SSB phase noise is  $< -130$  dBc for carrier frequencies from 230 to 450 MHz, and rises to  $-122$  dBc at 550 MHz. The SSB phase noise level decreases by approximately 6 dB for each division of the output frequency down to the broadband noise floor of better than 140 dB/Hz. This exceptional noise performance is also preserved during FM modulation and in the phase-locked mode of the 8640B.

#### Mechanical Dial or Built-in Counter

There are two versions of the 8640 Signal Generator. The 8640A has an easy-to-read slide rule dial with scales for each of the 10 output frequency ranges. There is an additional scale to provide direct readout of the output frequency even in the Option 002 INTERNAL DOUBLER band, 512-1024 MHz.

The 8640B combines the same performance features as the 8640A with a built-in 550 MHz frequency counter and phase lock synchronizer.

The internal 6 digit counter displays the output frequency and can also be used to count external input signals from 20 Hz to 550 MHz. This eliminates the need for a separate frequency counter in many measurement systems.

#### Internal Pushbutton Synchronizer

At the push of a button, the 8640B built-in phase lock synchronizer locks the RF output frequency to the crystal time base used in the counter. In this locked mode, the output stability is better than  $5 \times 10^{-7}$ /h and the spectral purity and FM capability of the unlocked mode are preserved. For higher stability, it is possible to lock to an externally applied 5 MHz standard. Two 8640B's can also be locked together for various 2-tone measurements.

In the phase locked mode, increased resolution is available by using the  $\frac{1}{2}$  digit increment button. For example, 500 Hz resolution is possible for frequencies between 100 and 1000 MHz.

#### FM While Phase Locked

In the phase locked mode, full FM capability is preserved down to modulation rates of 50 Hz. The narrow bandwidth of the phase lock loop ( $< 5$  Hz) provides for FM modulation up to 250 kHz rates and assures no degradation in noise from the unlocked mode. This crystal stability, coupled with the precision modulation and low noise, makes the 8640B ideal for testing narrowband FM or crystal-controlled receivers.



## 8640A and 8640B Specifications

(See technical data sheet for complete specifications.) All specifications apply over the nominal frequency ranges and over the top 10 dB of the output level vernier range unless otherwise specified.

### Frequency

**Range:** 500 kHz to 512 MHz in 10 octave ranges (to 1024 MHz with option 002 internal frequency doubler).

**Ranges and range overlap:** ranges extend approximately 10% below and 7% above the nominal frequency ranges shown below.

Frequency ranges (MHz)		
0.5-1	3-16	128-256
1-2	16-32	256-512
2-4	32-64	512-1024
4-8	64-128	(opt.002)

### Fine Tuning

**8640A and 8640B unlocked:** > 1000 ppm total range.

**8640B locked mode:** > ± 20 ppm by varying internal time base vernier.

**Internal counter resolution (8640B unlocked):**

Frequency Ranges (MHz)	Normal Mode	Expand X10	Expand X100
0.5-1	10 Hz	1 Hz	0.1 Hz
1-16	100 Hz	10 Hz	1 Hz
16-128	1 kHz	100 Hz	10 Hz
128-1024	10 kHz	1 kHz	100 Hz

**Optimum counter resolution when phase-locked (8640B):**

Frequency Ranges (MHz)	With 6 Digits	+ 1/2 Digit
0.5-0.9999995	1 Hz	0.5 Hz
1-0.9999995	10 Hz	5 Hz
10-0.9999995	100 Hz	50 Hz
100-0.9999995	1 kHz	500 Hz
1000-1024	10 kHz	5 kHz

### Accuracy:

**8640A:** mechanical dial; accuracy better than ± 1.0%, resettability better than 0.1%.

**8640B:** 6 1/2 digit LED display with X10 and X100 expand; accuracy depends on internal or external reference used.

### Stability (after 2 hour warmup):

**Normal:** < 10 ppm/10 min.

**Locked:** (8640B) < 0.05 ppm/h.

### Restabilization time after frequency change:

**Normal:** < 15 min.

**Locked (8640B):** < 1 min. after relocking to be within 0.1 ppm of steady state frequency.

### Output

**Range:** 10 dB steps and 18 dB vernier provide the following output power settings into 50Ω.

Frequency Range (MHz)	8640A, B	With Option(s)		
		002	003	002/003
0.5 to 512	+19 to -145 dBm	+18.5 to -145 dBm	+18.5 to -145 dBm	+18 to -145 dBm
512 to 1024 (Option 002)		+18 to -145 dBm	+18 to -145 dBm	+12 to -145 dBm

**Level flatness (referred to output at 50 MHz and applies to 1 V range and for top 10 dB of vernier range)**

Frequency Range (MHz)	8640A 8640B	With Option(s)		
		002	003	002/003
0.5 to 64	± 0.5 dB	-0.5 dB	+0.75 dB -1.25 dB	+1.0 dB -2.0 dB
64 to 512		± 1.0 dB		
512 to 1024 (Option 002)		± 1.5 dB		± 2.0 dB

**Level accuracy:** (worst case as indicated on level meter) ± 1.5 dB to ± 4.5 dB depending on level, frequency, and options installed.

### Spectral Purity

**Harmonics (at 1 volt, +10 dBm output range and below):**

> 30 dB below fundamental, 0.5 to 512 MHz.

> 12 dB below fundamental, 512 to 1024 MHz (option 002).

**Spurious output signals (excluding frequencies within 15 kHz of the signal whose effects are specified in residual AM and FM)**

Frequency Range (MHz)	Subharmonically Related		Non-harmonically Related	
	8640A	8640B	8640A	8640B
0.5 to 512	none detectable	> 100 dBc	none detectable	> 100 dBc
512 to 1024 (Option 002)		> 20 dBc		

dBc = dB below the carrier.

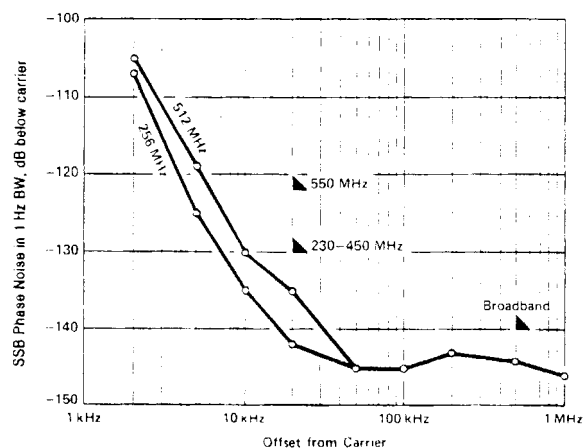
**Residual AM (averaged rms):** 0.3 to 3 kHz post-detection noise bandwidth > 85 dBc.

**Residual FM (averaged rms):** 0.3 to 3 kHz post-detection noise bandwidth. (CW and up to 1% maximum allowable peak deviation.)

0.5 to 512 MHz: < 5 Hz.

512 to 1024 MHz: < 10 Hz.

**Measured SSB noise (typical):** in graph below, triangular markers indicate specified limits.





# SIGNAL GENERATORS

Models 8640A, 8640B (Cont.)

## Modulation

### General

**Types:** Internal AM and FM; External AM, FM, and PULSE; simultaneous AM and FM or PULSE and FM.

**Internal modulation sources** (independently adjustable output level is available at front panel):

**Standard:** 8640A or 8640B.

**Frequency:** fixed 400 Hz and 1 kHz,  $\pm 3\%$ .

**Output level:** 10 mV to 1 V rms into 600 $\Omega$ .

**Optional** (internal variable audio oscillator Option 001, 8640A or 8640B):

**Frequency:** variable 20 Hz to 600 kHz,  $\pm 15\%$  plus fixed 400 Hz and 1 kHz  $\pm 3\%$ .

**Output level:** 1 mV to 3 V rms into 600 $\Omega$ .

### Amplitude Modulation

#### Depth:

**0.5 to 512 MHz:** 0 to 100% for output levels from +13 dBm and below.

**512 to 1024 MHz:** 0 to 100% for output levels of +7 dBm and below, excluding the top 6 dB of output vernier range.

**AM Rates:** INT and EXT ac, 20 Hz to AM 3 dB bandwidth; EXT dc, dc to AM 3 dB bandwidth.

#### AM 3 dB bandwidth:

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

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

Frequency Ranges	0 to 30% AM	30 to 50% AM	50 to 90% AM
0.5 to 512 MHz	<1%		<3%
512 to 1024 MHz	<10%		<20%

#### External AM sensitivity (400 Hz and 1 kHz rates):

**0.5 to 512 MHz:** (0.1  $\pm$  0.005)% AM per mV peak into 600 $\Omega$  with AM vernier at full clockwise position.

**512 to 1024 MHz:** nominal 0.1% AM per mV peak into 600 $\Omega$  with AM vernier at full clockwise position.

#### Indicated AM accuracy (400 Hz and 1 kHz rates using internal meter):

**0.5 to 512 MHz:**  $\pm 5.5\%$  of reading  $\pm 1.5\%$  of full scale from 0 to 50°C.

**512 to 1024 MHz:** not specified; each generator can be individually calibrated using operating manual procedure.

#### Peak incidental phase modulation (at 30% AM):

**0.5 to 128 MHz:** <0.15 radian.

**128 to 512 MHz:** <0.3 radian.

**512 to 1024 MHz:** <0.6 radian.

**Peak incidental frequency deviation:** equals peak incidental phase modulation x modulation rate.

### Pulse Modulation<sup>1</sup>

	Frequency Ranges (MHz)					
	0.5-1	1-2	2-8	8-32	32-512	512-1024
Rise and Fall Times	<9 $\mu$ s	<4 $\mu$ s	<2 $\mu$ s	<1 $\mu$ s		<1 $\mu$ s typical
Pulse Repetition Rate	50 Hz to 50 kHz		50 Hz to 100 kHz	50 Hz to 250 kHz	50 Hz to 500 kHz	
Pulse Width Minimum*	10 $\mu$ s		5 $\mu$ s	2 $\mu$ s		
Pulse ON/OFF ratio at max. vernier	>40 dB				>60 dB	
Peak Input Required	Nominally +0.5 V (5 V max). Sinewave or pulse return to zero into 50 $\Omega$ .					

<sup>1</sup>Pulse performance degrades below 500 Hz repetition rates.

\*For level accuracy within 1 dB of CW (>0.1% duty cycle).

## Frequency Modulation

**Deviation:** maximum allowable deviation equals 1% of lowest frequency in each nominal output frequency range.

Frequency Range (MHz)	Maximum Peak Deviation (kHz)
0.5-1	5
1-2	10
2-4	20
4-8	40
8-16	80
16-32	160
32-64	320
64-128	640
128-256	1280
256-512	2560
512-1024	5120

**FM 3 dB Bandwidth:** internal and external ac, 20 Hz to 250 kHz; external dc, dc to 250 kHz. (8640B locked mode: FM above 50 Hz only.)

#### FM distortion (at 400 Hz and 1 kHz rates):

<1% for deviations up to  $\frac{1}{2}$  maximum allowable.

<3% up to maximum allowable deviation.

**External FM sensitivity:** 1 volt peak into 600 $\Omega$  yields maximum deviation indicated on PEAK DEVIATION switch with FM vernier at full clockwise position.

**Indicated FM accuracy (400 Hz and 1 kHz rates from 15° to 35°C, using internal meter):**  $\pm$  (7% of reading + 1.5% of full scale).

#### Incidental AM (at 400 Hz and 1 kHz rates)

**0.5 to 512 MHz:** <0.5% AM for FM up to  $\frac{1}{2}$  maximum allowable deviation; <1% AM for FM at maximum allowable deviation.

**512 to 1024 MHz (Opt 002):** <1% AM for FM up to  $\frac{1}{2}$  maximum allowable deviation; <7% AM for FM deviations up to maximum allowable.

## Counter (8640B)

### External RF Input

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

**Sensitivity:**  $\geq 100$  mV rms into 50 $\Omega$ , ac only.

**Resolution:** 6-digit LED display.

Mode	Normal	Expand X10	Expand X100
0-10 MHz	100 Hz	10 Hz	1 Hz
10-550 MHz	10 kHz	1 kHz	100 Hz

**External reference input:** 5 MHz, nominally >0.5 V p-p (5 V maximum) into 1 k $\Omega$ .

**Internal Reference (after 2 h warm-up and calibration at 25°C)**

**Aging Rate:** <0.05 ppm/h; <2 ppm/90 days.

**Temperature Drift:**

< $\pm 2$  ppm from 15° to 35°C.

< $\pm 10$  ppm from 0° to 50°C.

**Typical Overall Accuracy (within 3 months of calibration and from 15° to 35°C):**  $\pm 2$  ppm.

## General

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

**Power Requirements:** 100 or 120 volts (+5%, -10%) from 48 to 440 Hz; or 220 or 240 volts (+5%, -10%) from 48 to 66 Hz. 175 VA max (Option 002: 190 VA max).

**Weight (8640A and 8640B):** net, 20.8 kg (46 lb); shipping, 24.1 kg (53 lb).

**Size:** 140 H x 425 W x 476 D (5.5" x 16.75" x 18.75").

### Ordering Information

**8640A Signal Generator**

**8640B Signal Generator**

**Option 001:** internal variable audio oscillator, 20 Hz to 600 kHz (8640A/B)

**Option 002:** internal doubler 512-1024 MHz (8640A/B)

**Option 003:** reverse power protection (8640A/B)

**Option 004:** avionics option (8640B only)

**Option 908:** rack mount kit (8640A/B)

**Option 910:** extra operating and service manual (8640A/B)