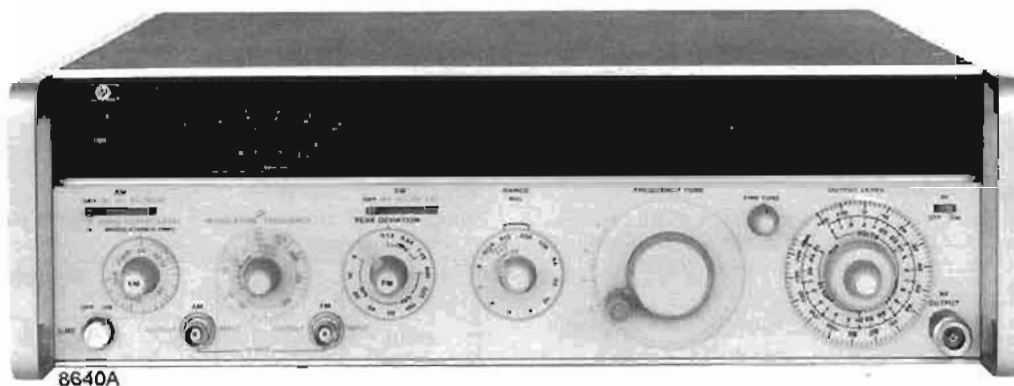


SIGNAL GENERATORS

Precision, high stability, AM-FM, 0.5 to 1024 MHz
Models 8640A, 8640B

- Wide frequency and power range
- Low broadband and close-in noise
- Calibrated, metered AM and FM

- All 8640A features plus
- Internal pushbutton synchronizer
- External counter to 550 MHz



8640A



8640B

Description

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 1100 MHz with an internal doubler (option 002). An optional audio oscillator is also available to extend the CW output range of the generator down to 20 Hz. This broad coverage, together with calibrated output and modulation, provides for complete RF and IF performance tests on virtually any type of HF, VHF, and UHF receivers.

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

The 8640A/B 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 to over 25 watts of applied power and automatically resets upon removal of the excessive signal.

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 20 kHz offsets from 230 to 450 MHz, SSB phase noise is >130 dB/Hz below the carrier level and rises to 122 dB/Hz at 550 MHz. This signal-to-noise ratio increases 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 Generators. One, 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 INTERNAL DOUBLER band, 512-1024 MHz.

The 8640B has the same performance features as the 8640A, but incorporates a built-in 550 MHz frequency counter and phase lock synchronizer.

The built-in 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 5×10^{-6} /hr 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.

FM while phase locked

When phase locked, 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 spectral stability, coupled with the precision modulation and low noise, makes the 8640B ideal for testing narrowband FM or crystal-controlled receivers.

8640A/B specifications

(See Technical Data Sheet for Complete Specifications). All specifications apply over the nominal Frequency Bands and over the top 10 dB of the output level vernier range unless otherwise specified.

Frequency characteristics

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

Bands and band overlap: bands extend 10% below and 7% above the nominal frequency bands shown below.

Frequency bands (MHz)		
0.5 - 1	8 - 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.

Counter resolution (8640B):

Frequency Bands (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

Accuracy

8640A: mechanical dial; accuracy better than 0.5%, resetability better than 0.1%.

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

Stability (after 2 hour warmup)

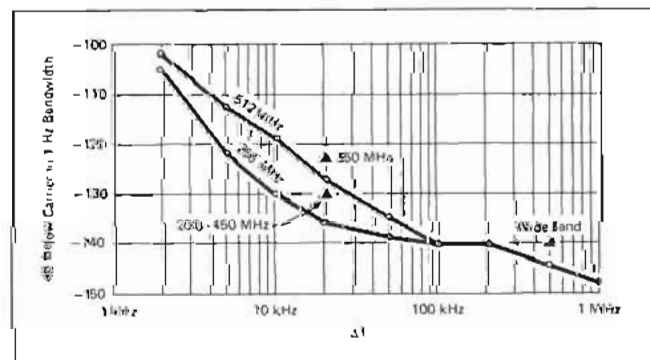
Normal: < 10 ppm/10 min.

Locked (8640B): < 0.05 ppm/hr.

Restabilization time after frequency change

Normal: < 15 min.

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



Measured SSB Noise vs. Offset from carrier. Markers indicate specified limits.

Output characteristics

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)	—	+13 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/B	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 ± 4.0 dB depending on level frequency and options installed.

Spectral purity

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

> 35 dB below fundamental, 0.5 to 128 MHz.

> 30 dB below fundamental, 128 to 512 MHz.

> 12 dB below fundamental, 512 to 1024 MHz.

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 ¹	—	—	—

Residual AM (averaged rms): 0.3 to 3 kHz post detection noise bandwidth < 85 dB down.

Residual FM (averaged rms): 0.3 to 3 kHz post detection noise bandwidth.

0.5 to 512 MHz < 5 Hz.

512 to 1024 MHz < 10 Hz.

¹dBc = dB below the carrier

Modulation characteristics

General

Types: Internal AM and FM, External AM, FM and PULSE.

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

Standard: 8640A or 8640B.

Frequency: fixed 400 Hz and 1 kHz, $\pm 2\%$.

Output level: 10 mV to 1 V. Accuracy $\pm 20\%$.

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

Frequency: variable 20 Hz to 600 kHz, $\pm 10\%$ plus fixed 400 Hz and 1 kHz $\pm 3\%$.

Output level: 10 mV to 3 V. Accuracy $\pm 20\%$.

Amplitude modulation

(AM specifications apply to the top 10 dB of output vernier range unless otherwise specified.)

Depth

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

512 to 1024 MHz: 0 to 100% for output levels of +7 dBm and below and for top 16 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 Bands	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 Bands	0 to 50% AM	50 to 90% AM
0.5 to 512 MHz	<1%	<3%
512 to 1024 MHz	<5%	<10%

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 Ω with AM vernier at full CW position.

512 to 1024 MHz: nominal 0.1% AM per mV peak into 600 Ω with AM vernier at full CW position.

Indicated AM Accuracy (400 Hz and 1 kHz rates using internal meter)

0.5 to 512 MHz: $\pm 8\%$ of reading on 0 - 10 scale.
 $\pm 9\%$ of reading on 0 - 3 scale (for greater than 10% of full scale).

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 radians.

128 to 512 MHz: <0.3 radians.

512 to 1024 MHz: <0.6 radians.

Peak Incidental frequency deviation: equals peak incidental phase modulation X modulation rate.

Pulse modulation:

Frequency Bands (MHz)	0.5 - 1	1 - 2	2 - 4	4 - 8	8 - 32	32 - 1024
Rise and Fall Times	<9 μ S	<4 μ S	<2 μ S	<1 μ S		
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 ¹	10 μ S		5 μ S	2 μ S		
ON/OFF ratio at max vernier	>40 dB 0.5 to 512 MHz >60 dB 512 to 1024 MHz					
Peak Input Required	Nominally +0.5 V (5 V max) Sinewave or Pulse return to zero into 50 Ω schmitt trigger					

¹For level accuracy within 1 dB of 10W (<0.1% duty cycle).

Frequency modulation

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

Frequency Band (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.

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

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

<3% for maximum allowable deviation.

External FM sensitivity: 1 volt peak yields maximum deviation indicated on PEAK DEVIATION switch with FM vernier at full CW position.

Indicated FM accuracy: (using internal meter) $\pm 10\%$ of meter reading, above 10% of full scale.

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

<0.5% AM for FM up to $\frac{1}{2}$ max allowable deviation.

<1% AM for FM at maximum allowable deviation to 512 MHz.

<7% AM for FM at maximum allowable deviation to 1024 MHz.

Counter characteristics (8640B)

External RF input:

Frequency range: 20 Hz to 550 MHz.

Sensitivity: ≥ 100 mV rms into 50 Ω .

Resolution: 6-digit LED DISPLAY.

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

Internal reference characteristics: (after 2-hr warmup).

Accuracy: (after calibration at 25°C)

Better than ± 1 ppm for 15° to 35°C.

Better than ± 3 ppm for 0° to 55°C.

Drift rate: (constant temperature and line voltage) <0.05 ppm per hour; <2 ppm per year.

Frequency tuning: $> \pm 20$ ppm using internal time base vernier.

Rear output: >0.5 V p-p into 500 Ω . This will drive another 8640B.

External reference input: 5 MHz, nominally >0.5 V (5 V max) into 1 k Ω .

General characteristics

Operating temperature range: 0 to 55°C.

Power requirements: 100, 120, 220, and 240 volts, +5%, -10%, 48 to 440 Hz; 175 VA maximum.

Weight: 8640A and 8640B: net, 20.4 kg (45 lb); shipping 24.1 kg (53 lb).

Dimensions: 124 mm high X 425 mm wide X 476 mm deep (5 $\frac{1}{4}$ X 16 $\frac{1}{2}$ X 18 $\frac{3}{4}$ ”).

Model number and name:

8640A Signal Generator

8640B Signal Generator

Option 001: (internal variable audio oscillator, 20 Hz to 600 kHz)

Option 002: (internal doubler 512-1024 MHz)

Option 003: (reverse power protection)

Option 004: (avionics option) 8640B only

Price

\$4900

\$6400

add \$275

add \$850

add \$300

add \$800