

# SIGNAL GENERATORS

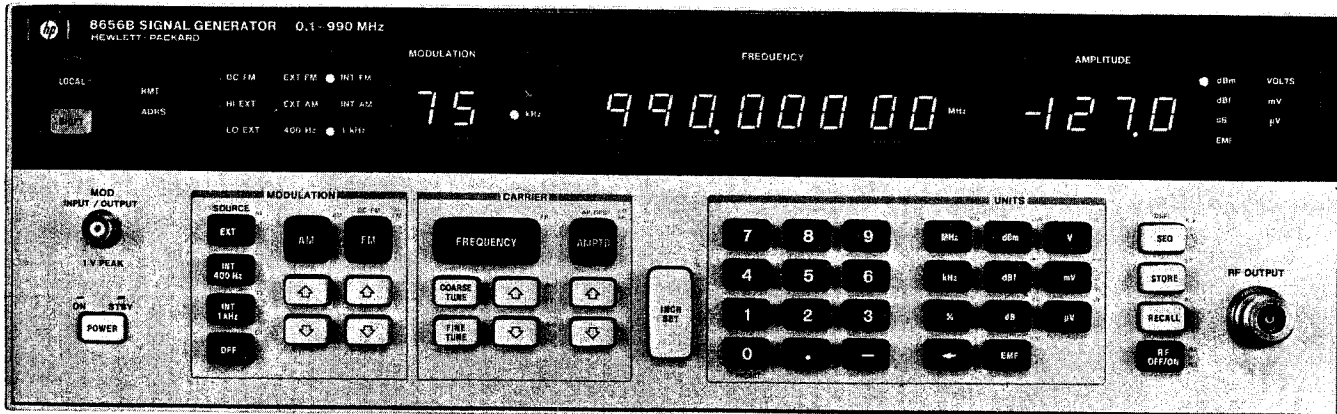
## Synthesized Signal Generator

### Model 8656B

349

- 100 kHz to 990 MHz
- $\pm 1.0$  dB absolute level accuracy
- Amplitude offset and phase adjustment capability

- 150 millisecond frequency switching speed
- Versatile simultaneous modulation including dc FM
- Fully HP-IB programmable



HP 8656B



### Description

The HP 8656B is a programmable synthesized signal generator that offers exceptional value through a powerful combination of performance, quality and economy.

### Frequency

The HP 8656B provides frequency coverage from 0.1 to 990 MHz (with under-range to 10 kHz). This wide range covers the IF and LO frequencies as well as the RF frequencies of most receivers. It also allows testing in a variety of communication systems including the 800 MHz FM mobile band and some telemetry bands. For automated testing, the 150 ms frequency switching speed of the HP 8656B (specified to be within 100 Hz of the final frequency) increases throughput. Frequency resolution of 10 Hz allows convenient setting of increments including narrow channel spacings, while characterization of phase sensitive devices is made easier with the help of the phase increment/decrement feature. The standard internal reference has an aging rate of 2 ppm/year. Improved stability and accuracy can be achieved by adding the optional  $1 \times 10^{-7}$ /day high stability time base (Option 001) or using an external reference of 1, 5 or 10 MHz.

### Output

The output attenuator of the HP 8656B has been designed with high volume automatic test system use in mind. The 8656B also features  $\pm 1.0$  dB absolute level accuracy and 0.1 dB resolution for accurate receiver sensitivity tests, circuit characterization and R&D applications. The output levels are calibrated from +13 dBm (over-range to +17 dBm) to -127 dBm and may be set and displayed in any one of 14 convenient units including dBm, volts, dB $\mu$ V or V<sub>eff</sub>. The output level can also be offset to compensate for cable and/or other losses external to the generator, or turned on or off with a dedicated key. Shielding keeps leakage at <1.0  $\mu$ V for testing RFI susceptible devices, and standard resettable reverse power protection for up to 50 watts guards against accidental damage from transmitters.

### Modulation

The HP 8656B's versatile modulation capabilities include simultaneous and mixed modulation modes (AM/AM, FM/FM and AM/FM) from internal (1 kHz and 400 Hz) and external sources. AM is ac coupled while FM can be either ac or dc coupled. The new, patented dc coupling technique used in the HP 8656B provides exceptional long term stability (<10 Hz/hour) and center frequency accuracy ( $\pm 500$  Hz) eliminating the need for retuning in the dc FM mode. For calibrated external modulation, a 1V peak signal is required, and HI/LO annunciators on the HP 8656B indicate when the external signal is within 5% of the correct amplitude.

### Ease of Operation

A microprocessor-based controller provides a broad range of operating features for simple, but efficient control. Keyboard data entry uses a function/data/units format, and all function entries are made using a left-to-right keystroke sequence. All information entered is visible via LED displays and annunciators. Modulation, frequency, and level functions can be individually incremented by step sizes that are set by convenient keyboard entries. In addition, resolution control keys allow coarse and fine tuning of frequency in decade steps.

Up to ten front-panel setups can be stored and recalled. A sequence function allows you to cycle through stored setups at the touch of a key or via remote control. The microprocessor also makes troubleshooting aids available at the front panel, enhancing the serviceability of the HP 8656B.

### HP-IB Programmability

Full HP-IB programmability is standard in the HP 8656B. Each programming command has an easy-to-remember, two-character, alpha-numeric HP-IB code that is also labeled next to each key. All functions are quickly and easily programmed using the same function/data/units format as in the manual mode.

# SIGNAL GENERATORS

## Synthesized Signal Generator (cont'd)

### Model 8656B

### HP 8656B Specifications

#### Frequency

**Range:** 100 kHz to 990 MHz (8 digit LED display).  
**Frequency underrange:** 10 kHz with uncalibrated output.  
**Resolution:** 10 Hz.  
**Accuracy and stability:** same as internal time base.

#### Time Base Characteristics

Typical Characteristics	Standard Time Base	Option 001 Time Base
Aging Rate	±2 ppm/year	1x10 <sup>-7</sup> /day
Frequency	50 MHz	10 MHz
External Reference Input (rear panel)	Accepts any 1, 5, or 10 MHz (±0.002%) frequency standard at a level >0.15 Vrms into 50 ohms.	

**Frequency switching speed (to be within 100 Hz of final frequency):** <150 ms.

**Phase Offset:** adjustable via HP-IB or from the front panel in nominal 1 degree increments.

#### Spectral Purity

**Spurious Signals (≤ +7 dBm output levels)**

**Harmonics:** < -30 dBc.

**Non-harmonic spurious (greater than 5 kHz from carrier in CW mode):** < -60 dBc.

**Sub-harmonics:** none.

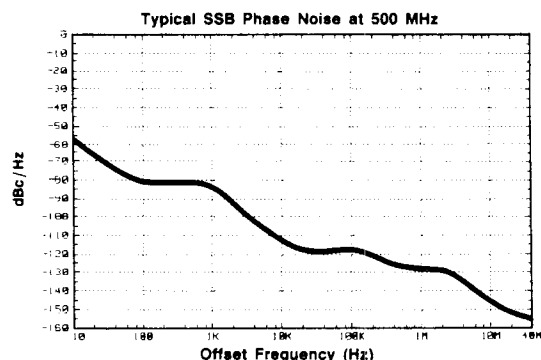
#### Residual FM

Post Detection Noise Bandwidth	Frequency Range (MHz)			
	0.1 to 123.5	123.5 to 247	237 to 494	494 to 990
0.3 to 3 kHz	<7 Hz rms	<2 Hz rms	<4 Hz rms	<7 Hz rms
0.05 to 15 kHz	<15 Hz rms	<4 Hz rms	<8 Hz rms	<15 Hz rms

**Residual AM (0.05 to 15 kHz post detection noise bandwidth):** 0.025%.

#### SSB Phase Noise (CW only)

Offset from Carrier	0.1 to 123.5 MHz (dBc/Hz)	123.5 to 247 MHz (dBc/Hz)	247 to 494 MHz (dBc/Hz)	494 to 990 MHz (dBc/Hz)
20 kHz	<-114	<-126	<-120	<-114



#### Output

**Level range (into 50 ohms):** 13 dBm to -127 dBm (3½ digit LED display; uncalibrated output to 17 dBm).

**Resolution:** 0.1 dB.

**Absolute level accuracy:** <±1.0 dB; 123.5 to 990 MHz <±1.5 dB; f<sub>c</sub> < 123.5 MHz, levels > +7 dBm and < -124 dBm.

**Level flatness (100 kHz to 990 MHz):** ±1.0 dB at an output level setting of 0.0 dBm.

**Reverse power protection:** protects signal generator from application of up to 50 watts (from a 50Ω source) of RF power to 990 MHz into generator output; dc voltage cannot exceed 25V.

#### Amplitude Modulation (2 digit LED display)

**AM depth<sup>1</sup>:** 0 to 99% to +7 dBm and 0 to 30% to +10 dBm.

**Resolution:** 1%.

**AM rate:** internal 400 Hz and 1 kHz, ±3%; external (1 dB bandwidth), 20 Hz to 40 kHz.

**AM distortion (at internal rates):** <1.5%, 0-30% AM; <3%, 31-70% AM; <4%, 71-90% AM.

**Indicator accuracy (for depths <90% internal rates and levels < +7 dBm):** ≤±(2% + 4% of reading).

**Incidental phase modulation (at 30% AM depth and internal rates):** <0.3 radian peak.

#### Frequency Modulation (2 digit LED display)

##### FM Peak Deviation

Center Frequency	Maximum Peak Deviation	
	AC Mode	DC Mode
0.1 to 123.5 MHz	The lesser of 99 kHz or 4000 x rate (Hz)	99 kHz
123.5 to 247 MHz	50 kHz or 1000 x rate (Hz)	50 kHz
247 to 494 MHz	99 kHz or 2000 x rate (Hz)	99 kHz
494 to 990 MHz	99 kHz or 4000 x rate (Hz)	99 kHz

FM not specified for f<sub>c</sub> - (Δf<sub>pk</sub>) < 100 kHz

**Resolution:** 100 Hz for deviations less than 10 kHz; 1 kHz for deviations greater than 10 kHz.

**FM rate:** internal 400 Hz and 1 kHz, ±3%; external (1 dB BW), dc coupled, dc to 50 kHz; ac coupled, 20 Hz to 50 kHz.

**Center frequency accuracy in dc FM mode:** <±500 Hz.

**Center frequency stability in dc FM mode:** <10 Hz/hour.

**FM distortion (internal rates and ≥3 kHz peak deviations):** <0.5%.

**Indicator accuracy<sup>1</sup>:** ±5% of reading at internal rates.

**Incidental AM (for center frequency ≥500 kHz, peak deviation <20 kHz and internal rates):** <0.1%.

#### Remote Programming

**Interface:** HP-IB (Hewlett-Packard's implementation of IEEE - 488).

**HP-IB interface functions:** SH0, AH1, T0, L2, SR0, RL1, PP0, DC1, DT0, C0 and E1. (For more on these codes, refer to the HP-IB section of this catalog.)

#### General

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

**Leakage:** conducted and radiated interference is within the requirements of methods CE03 and RE02 of MIL STD 461B, FTZ 1115. Furthermore, RF leakage of less than 1.0 μV is induced in a two-turn loop, 2.5 cm in diameter, held 2.5 cm away from the front surface.

**Power requirements:** 100, 120, 220, or 240 Vac; +5%, -10%; 48 to 440 Hz, 125 VA maximum.

**Weight:** net, 18.2 kg (40 lb); shipping, 23.6 kg (52 lb).

**Size:** 133 H x 425 W x 520 mm D (5.25" x 16.75" x 20.5"). HP System II module size: 5¼ H x 1 MW x 17 D. For cabinet accessories, see page 738.

**Rack slides and transit case:** HP part numbers are: slide kit, 1494-0018; tilt slide kit, 1494-0025; full module transit case, 9211-2661.

#### Ordering Information

**HP 8656B Signal Generator<sup>2</sup>**

**Opt 001** High stability time base

**Opt 002** RF connectors on rear panel only

**Opt 907** Front handle kit

**Opt 908** Rack flange kit

**Opt 909** Rack flange and front handle kit

**Opt 910** Additional operating & service manual

<sup>1</sup>AM depth and FM deviation are further limited by Indicator Accuracy specifications.

<sup>2</sup>HP-IB cables not supplied. For description and price, see HP-IB section.