SIGNAL GENERATORS

Synthesized Signal Generator

Model 8656A

- 100 kHz to 990 MHz
- ± 1.5 dB absolute output level accuracy
- 0.1 dB output level resolution
- Versatile modulation
- Increments and Store/Recall/Sequence
- Fully HP-IB programmable

8656A

DESIGNED FOR HP-IB SYSTEMS

Description

The 8656A is a programmable synthesized signal generator that offers exceptional value through versatility, ease of operation, and a broad range of standard features.

Frequency

The 8656A provides frequency coverage from 0.1 to 990 MHz (with underrange 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. Frequency resolution of 100 Hz or 250 Hz allows convenient setting of increments including 6.25 kHz channel spacings. Frequency accuracy and stability are determined by the reference used. The standard internal reference has an aging rate of 2 ppm/year. Improved stability and accuracy can be achieved by adding the optional 1 x 10^{-9}/day high stability time base (Option 001) or using an external reference of 1, 5, or 10 MHz.

Output

The 8656A features ± 1.5 dB absolute accuracy and 0.1 dB resolution for more accurate receiver sensitivity tests, circuit characterization, and R&D applications. The output levels are calibrated from +13 to −127 dBm and may be set and displayed in convenient units including dBm, volts, dBμV, or EMF. Shielding keeps leakage at <1μV for testing RFI susceptible devices, and standard resettable reverse power protection for up to 50 watts guards against accidental damage from transmitters.

Modulation

The 8656A has versatile modulation capabilities: internal 400 Hz and 1 kHz tones, simultaneous and mixed modulation modes (AM-AM, FM-FM, AM-FM) from internal and external sources, and the ability to accept low frequency digital unsquelching signals. For calibrated external modulation, a 1V peak signal is required. HI/LO annunciators on the 8656A 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 output 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.

HP-IB Programmability

Full HP-IB programmability is standard in the 8656A. Each programming command has an easy-to-remember, two-character, alphanumeric HP-IB code, and all functions are quickly programmed using the same format as in the manual mode.

8656A Specifications

Frequency

Range: 100 kHz to 990 MHz (8 digit LED display).
Resolution: 100 and 250 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	1×10^{-9}/day
Frequency	50 MHz	10 MHz
External Reference Input (rear panel)	Accepts any 10, 5 or 1 MHz (±0.002%) frequency standard at a level >0.15 Vrms into 50 ohms.	
Frequency Underrange	10 kHz with uncalibrated output	

Typical frequency switching speed (to be within 100 Hz of final frequency): <2 seconds.

Spectral Purity

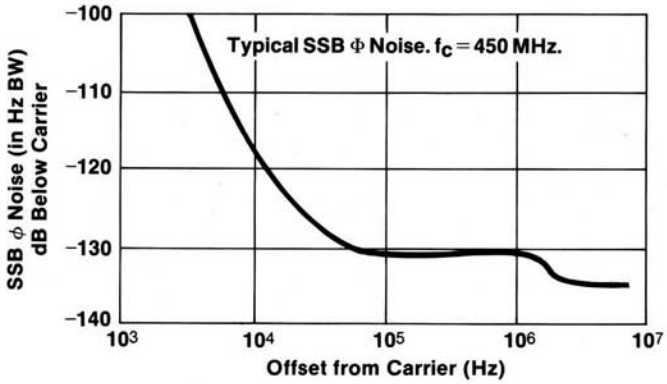
Spurious signals (≤ +7 dBm output levels)
Harmonics: <−25 dBc.
Non-harmonic spurious (greater than 5 kHz from carrier in CW mode): <−60 dBc.
Sub-harmonic spurious: none.
Residual FM:

Post Detection Noise Bandwidth	Frequency Range (MHz)			
	0.1 to 123.5	123.5 to 247	247 to 494	494 to 990
0.3 to 3 kHz	<15 Hz rms	<3 Hz rms	<6 Hz rms	<15 Hz rms
0.05 to 15 kHz	<30 Hz rms	<8 Hz rms	<16 Hz rms	<30 Hz rms

Residual AM (0.05 to 15 kHz post detection noise bandwidth): <−70 dBc.

Typical 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	<−115	<−127	<−121	<−115
500 kHz	<−125	<−135	<−131	<−125



Output

Level range (into 50 ohms): +13 dBm to −127 dBm (3½ digit LED display).
Resolution: 0.1 dB.
Absolute level accuracy: ≤1.5 dB.
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 (typical) of RF power to 990 MHz into generator output; dc voltage cannot exceed 25 V.

Modulation

Amplitude modulation (2 digit LED display)
AM depth[1]: 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), 25 Hz to 25 kHz.
AM distortion (at internal rates): <1.5%, 0-30% AM; <3%, 31-70% AM; <5%, 71-90% AM.
Indicator accuracy (for depths <90% and internal rates)[1]: (±4% of reading) ±2%.
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 (f_c)	Maximum Peak Deviation (Δf_{pk})*	
	Rates ≥ 60 Hz	Rates <60 Hz
0.1–123.5 MHz	99 kHz	1600 x Rate
123.5–247 MHz	25 kHz	400 x Rate
247–494 MHz	50 kHz	800 x Rate
494–990 MHz	99 kHz	1600 x Rate
*FM not specified for $f_c - \Delta f_{pk} < 100$ 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 bandwidth, ac coupled), 25 Hz to 25 kHz.
FM distortion (for 100 Hz to 99 kHz peak deviations and internal rates): <0.5% THD.
Indicator accuracy[1]: ±5% of reading at internal rates. (Add ±5% if 250 Hz frequency increments are used).
Incidental AM (for center frequency ≥500 kHz, peak deviation >20 kHz and internal rates): <0.1%.
Digital FM: will accept typical digital unsquelching signals. Sag of resultant demodulated signal is typically less than 8% at 1 kHz deviation for a 10 Hz square-wave modulating signal.

Remote Programming

Interface: HP-IB (Hewlett-Packard's implementation of IEEE Standard 488).
Interface functions implemented: SH1, AH1, T0, L2, SRO, RL1, PP0, DC1, DT0, and C0.

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 461A, VDE 0871, and CISPR Publication 11. 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 V, (+5, −10%); 48 to 66 Hz; 125 VA maximum.
Weight: net, 18.1 kg (40 lb); shipping, 24.5 kg (54 lb).
Size: 133 H x 425 W x 520 D mm (5.25″ x 16.75″ x 20.5″). 5.25″ x 1 MW x 17″, system II module. For cabinet accessories, see pages 714-719.
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

	Price
8656A Signal Generator[2]	$7,150
Option 001: High stability time base	add $850
Option 002: Rear panel input and output	add $175
Option 907: Front handle kit	add $43
Option 908: Rack flange kit	add $25
Option 909: Rack flange and front handle kit	add $65
Option 910: Extra operating & service manual	add $25

[1] AM depth and FM deviation are further limited by Indicator Accuracy specifications.
[2] HP-IB cables not supplied, see page 29 for description and prices.