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SIGNAL GENERATORS

Synthesized Signal Generator

Model 8662A

- 10 kHz to 1280 MHz frequency range
- 0.1 Hz frequency resolution
- <420 μ s frequency switching speed
- <-144 dBc/Hz SSB phase noise at 10 kHz offset
- ± 1 dB level accuracy
- Fully HP-IB programmable



8662A

HP-IB

8662A Synthesized Signal Generator

The 8662A is a high performance synthesized signal generator covering the wide frequency range of 10 kHz to 1280 MHz in a single instrument while providing a wide range of accurately calibrated output power as well as full AM/FM capability.

Precision Synthesized Signal Generator

The 8662A derives exceptional RF performance from an indirect frequency synthesis technique that results in frequency resolution of 0.1 Hz (0.2 Hz above 640 MHz). Its frequency accuracy and stability are determined by a low noise quartz reference oscillator which has an aging rate of less than 5×10^{-10} /day.

The 8662A output level ranges from +13 dBm (+16 dBm in over-range) to -139.9 dBm with 0.1 dB resolution in both manual and remote (HP-IB) operation. From +13 to -120 dBm the absolute level accuracy is held to ± 1 dB using microprocessor correction. These exceptional output level characteristics make the 8662A an ideal generator for performing precise receiver sensitivity tests either manually or in automated systems.

The 8662A offers versatile phase-locked AM/FM using either internal 400 Hz and 1 kHz rates or externally applied modulating signals, which can be either DC or AC coupled. Several different modes of simultaneous modulation (such as AM + FM or FM + FM) are possible using internal and external modulation as well as a rear panel auxiliary FM input.

Exceptional Spectral Purity

The key contribution of the 8662A is spectral purity. Fast-tuning, switched inductance oscillators combined with a low noise reference oscillator result in very low SSB phase noise, especially at small offsets from the carrier. The phase noise at 20 to 50 kHz offsets is comparable to that of the best fundamental cavity-tuned oscillators. Such excellent noise performance combined with programmability makes possible complete automation of receiver adjacent channel selectivity measurements.

With its excellent long and short-term frequency stability, high output power, fine frequency resolution and broad frequency range, the 8662A also meets the requirements of the most critical low noise local oscillator applications. In addition, its fast frequency switching and sweep capabilities also permit its use in many frequency agile and swept local oscillator applications.

Measurement Efficiency

An advanced microprocessor-based controller allows convenient keyboard control of all 8662A functions. For example, all functions can be incremented and decremented in any user-defined step size within the resolution of the synthesizer using the "increment" keys and the "knob". Up to nine full front panel setups can be stored in the 8662A's memory and recalled for later use in any user-defined sequence at the touch of a pushbutton. This permits time-saving semi-automation of generator operation in production setups where the generator must perform many different tests.

The microprocessor controller also allows convenient HP-IB programmability of all generator functions with the same resolution as manual operation. Each front panel button is represented by a two-character alphanumeric HP-IB programming code. The sequence of HP-IB commands used in remote operation is identical to the sequence of keystrokes used in manual operation. In addition, two special programming "learn" modes allow the HP-IB controller to store 8662A front panel settings or decrease the 8662A frequency switching time to under 420 microseconds. Partial remote 8662A operation without an HP-IB controller is possible using a rear panel auxiliary control connector.

Precision Digital Sweep

Fast frequency switching combined with microprocessor control gives the 8662A a powerful sweep capability. Automatic, single, and manual modes are available for both linear and logarithmic sweeps with user-selectable step size and number of steps. Five different sweep speeds can be chosen and up to five amplitude or Z-axis markers can be set for calibrating swept frequency displays. All sweep parameters can be controlled with full synthesizer resolution.

With this kind of sweep capability, the 8662A is ideal for the characterization of extremely narrow-band devices such as crystal filters. By storing two different sweep setups in the 8662A memory and using its "auto-sequence" capability, both wide-band and narrow-band swept characteristics of a device under test can be viewed simultaneously on an oscilloscope or network analyzer.



8662A Specifications

Frequency

Range: 10 kHz to 1280 MHz (1279.999998 MHz).

Resolution: 0.1 Hz (0.2 Hz above 640 MHz).

Accuracy and stability: same as reference oscillator.

Internal reference oscillator: 10 MHz quartz oscillator. Aging rate $< 5 \times 10^{-10}$ /day after 10 day warm-up (typically 24 hrs in normal operating environment).

Spectral Purity

Residual SSB phase noise in 1 Hz BW ($320 \leq f_c < 640$ MHz):

Offset from carrier	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz
SSB phase noise in 1 Hz BW (CW and AM mode)	-100 dBc	-112 dBc	-121 dBc	-132 dBc	-133 dBc

SSB broadband noise floor in 1 Hz BW at 3 MHz offset from carrier: < -146 dBc for f_c between 120 and 640 MHz at output levels above +10 dBm.

Spurious signals:¹

	Frequency range (MHz)				
	0.01 to 120	120 to 160	160 to 320	320 to 640	640 to 1280
Spurious non-harmonically related	-90 dBc	-100 dBc	-96 dBc	-90 dBc	-84 dBc
Sub-harmonically related ($\frac{f}{2}$, $\frac{3f}{2}$, etc.)	none	none	none	none	-75 dBc
Power line (50-60Hz) related or microphonically generated (within 300 Hz)	-90 dBc	-85 dBc	-80 dBc	-75 dBc	-70 dBc
Harmonics	< -30 dBc				

Output

Level range: +13 to -139.9 dBm (1 V to 0.023 μV_{rms} into 50 Ω).

Resolution: 0.1 dB.

Absolute level accuracy (+15° to +45°C): ± 1 dB between +13 and -120 dBm, ± 3 dB between -120 and -130 dBm.

Amplitude Modulation

Depth: 0 to 95% at output levels of +8 dBm and below (+10 dBm in uncorrected mode). AM available above these output levels but not specified.

Resolution: 1%, 10 to 95% AM; 0.1%, 0 to 9.9% AM.

Incidental PM (at 30% AM): 0.15-640 MHz, < 0.11 radians peak; 640-1280 MHz, < 0.07 radians peak.

Incidental FM (at 30% AM): 0.15-640 MHz, $< 0.11 \times f_{mod}$; 640-1280 MHz, $< 0.07 \times f_{mod}$.

Indicated accuracy: $\pm 5\%$ of reading $\pm 1\%$ AM. Applies for rates given in table below, internal or external mode, for depths $\leq 90\%$.

Rates and distortion with internal or external modulating signal:

Frequency range	AM Distortion			
	AM rate	0-30% AM	30-70% AM	70-90% AM
0.15-1 MHz	dc-1.5 kHz	2%	4.0%	5.75%
1-10 MHz	dc-5 kHz	2%	4.0%	5.75%
10-1280 MHz	dc-10 kHz	2%	4.0%	5.75%

Frequency Modulation

FM rates (1 dB bandwidth): external ac, 20 Hz to 100 kHz; external dc, dc to 100 kHz.

FM deviation: from 25 to 200 kHz depending on carrier frequency. **Indicated FM accuracy:** $\pm 6\%$ of reading plus 10 Hz (50 Hz to 20 kHz).

FM resolution: 100 Hz for deviations < 10 kHz, 1 kHz for deviations > 10 kHz.

Incidental AM (AM sidebands at 1 kHz rate and 20 kHz deviation): < -72 dBc, $f_c < 640$ MHz; < -65 dBc, $f_c \geq 640$ MHz.

FM distortion: $< 1.7\%$ for rates < 20 kHz, $< 1\%$ for rates < 1 kHz.

Center frequency accuracy and long term stability in AC mode: same as CW mode.

Remote Programming

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

Functions controlled: all functions controlled from the front panel with the exception of the line switch are programmable with the same accuracy and resolution as in manual mode.

General

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

Leakage: meets radiated and conducted limits of MIL STD 461A methods RE02 and CE03 as well as VDE 0871. Furthermore, less than 1 μV is induced in a two turn, 1 inch diameter loop 1 inch away from the front panel and measured into a 50 ohm receiver.

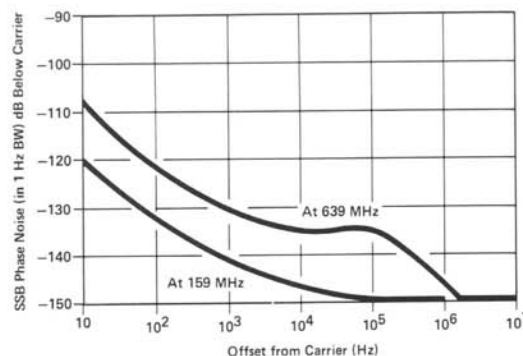
Power requirements: 115 (90-126) V or 230 (198-252) V; 48 to 66 Hz; 420 VA max.

Weight: net 30 kg (65.5 lb); shipping 36 kg (80 lb).

Dimensions: 178 mm H x 425 mm W x 572 mm D (7" x 16.75" x 22.5") depth includes front panel depth of 45 mm (1.75").

Supplemental Characteristics

Supplemental characteristics give typical, but non-warranted performance.



Measured residual SSB phase noise versus offset from carrier. Carrier frequency 639 MHz and 159 MHz.

Frequency switching speed:² From 420 μ sec to 12.5 msec, depending on the programming mode.

Ordering Information

8662A Synthesized Signal Generator

(Note: HP-IB cables not supplied; see page 28)

Opt 001: Rear panel RF output

11721A External frequency doubler for operation to

2.56 GHz

11714A Service Support Kit (required for service)

Price

\$24,700

\$175

\$250

\$450

¹In the remote mode it is possible to have microprocessor clock related spurious signals spaced 3 kHz apart at an absolute level of typically less than -145 dBm.

²Due to automatic leveling loop bandwidth changes, brief (30 msec) level inaccuracies may occur when switching through 150 kHz and 1 MHz RF output frequencies.