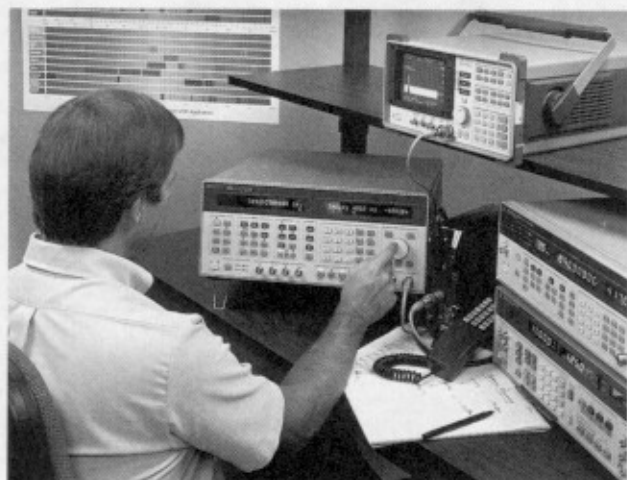


# Signal Sources

## Signal Sources to 110 GHz



Hewlett-Packard offers the widest selection of high-performance signal sources from dc to 110 GHz. They cover every application range from low-frequency navigation signals, through cellular mobile radio, to millimeterwave satellite systems. Each offers synthesized frequency accuracy and stability as well as calibrated level and remote programmability. Modulation capabilities range from general purpose AM,  $\Phi$ M, FM, pulse and I/Q modulation to specific formats such as PSK, QPSK, OQPSK, GMSK,  $\pi/4$  DQPSK, FSK, and QAM.

For more information, visit our web site:  
[http://www.hp.com/go/signal\\_sources](http://www.hp.com/go/signal_sources)

## Signal Sources

### Economy RF Signal Generators

Frequency	Model	Characteristics	Page
0.25 to 1000 MHz	HP E4400B	<b>ESG series analog signal generator platform.</b> Flexible architecture for upgrade paths. Superior level accuracy. Step sweep (frequency, power and list). Electronic attenuator to 4 GHz. Built-in function generator.	208
0.25 to 2000 MHz	HP E4420B		
0.25 to 3000 MHz	HP E4421B		
0.25 to 4000 MHz	HP E4422B		
0.25 to 1000 MHz	HP 8647A	<b>HP's lowest cost synthesized source with electronic attenuator.</b> $\pm 1.5$ dB level accuracy. Remote sequencing capability. 10 Hz frequency resolution. $-110$ dBc/Hz @ 20 kHz SSB phase noise.	210
0.1 to 1000 MHz	HP 8648A	<b>Economy signal generator family.</b> $\pm 1$ dB level accuracy up to 2.5 GHz. Provides HP 8647A performance plus improved residual FM, output power, switching speed and phase noise. Electronic attenuator on HP 8648A. HP 8648B/C/D offer pulse modulation and high power options. All four models offer variable frequency modulation generator (Option 1E2).	210
0.009 to 2000 MHz	HP 8648B		
0.009 to 3200 MHz	HP 8648C		
0.009 to 4000 MHz	HP 8648D		
0.1 to 1040 MHz	HP 8657A	<b>Spectral purity and electronic attenuator at an affordable price.</b> $< -130$ dBc/Hz @ 500 MHz SSB phase noise. $< -60$ dBc spurious. Electronic attenuator. $\pm 1$ dB level accuracy. AM and FM.	212
0.1 to 2060 MHz	HP 8657B	<b>Spectral purity and pulse to 2 GHz at an affordable price.</b> $< -130$ dBc/Hz @ 500 MHz SSB phase noise. $< -60$ dBc spurious. $\pm 1$ dB level accuracy. AM, FM and pulse with $> 90$ dB on/off at 1030 MHz.	212

### Digital I/Q Modulation

dc to 6 MHz	HP E2747A	<b>Vector waveform generator in a PC-format instrument with a maximum of 3 channels, or a module assembly designed for use with a compatible DSP carrier for developing ATE or large channel systems.</b> Open platform based around a digital transmitter architecture. Accepts data input and generates live messages with protocol. Provides both I and Q outputs (or composite IF). Support new, unique and standard digital modulation formats.	237
	HP E2748A		
0.25 to 1000 MHz	HP E4430B	<b>ESG-D series digital and analog signal generator platform.</b> Flexible architecture for upgrade paths. Excellent modulation accuracy and stability. Analog I and Q. Optional digital modulation formats for single and multichannel CDMA, DECT, GSM, NADC, PDC, PHS, and TETRA. Data generation and burst capabilities. Optional internal bit-error rate analyzer and dual arbitrary waveform generator.	214
0.25 to 2000 MHz	HP E4431B		
0.25 to 3000 MHz	HP E4432B		
0.25 to 4000 MHz	HP E4433B		

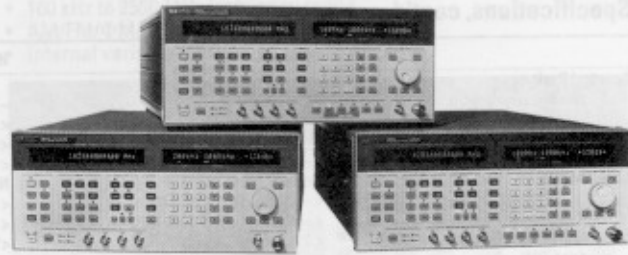
### High-Performance RF Signal Generators

0.252 to 1030 MHz	HP 8643A	<b>Performance signal generator for RF design.</b> $< -130$ dBc/Hz @ 1 GHz SSB phase noise HP 8643A; $< -137$ dBc/Hz HP 8644B. $< -100$ dBc spurious. AM, FM and pulse modulation. Advanced modulation source. Lowest specified leakage. Avionics option available (Option 009).	217
0.252 to 2060 MHz	HP 8644B		
0.01 to 1280 MHz	HP 8662A	<b>Low close-in noise.</b> 0.1 Hz frequency resolution, $5 \times 10^{-10}$ /day stability. Calibrated and leveled output from $+13$ to $-140$ dBm. Digital sweep. Completely HP-IB programmable. AM/FM modulation. Fast switching.	219
0.1 to 2560 MHz	HP 8663A	<b>Low close-in noise with complex modulation.</b> 0.1 Hz frequency resolution, $5 \times 10^{-10}$ /day stability. Calibrated and leveled output from $+16$ to $-130$ dBm. Digital sweep. Completely HP-IB programmable. AM, $\Phi$ M, FM and pulse modulation. Fast switching.	219
0.1 to 3000 MHz	HP 8664A	<b>Performance signal generators for 3.0 GHz, 4.2 GHz and 6 GHz testing.</b> Excellent spectral purity. AM and FM. High-performance pulse modulation. Advanced modulation source.	217
0.1 to 4200 MHz	HP 8665A		
0.1 to 6000 MHz	HP 8665B		
0.252 to 1030 MHz	HP 8645A	<b>Performance signal generator for testing frequency-agile radios and surveillance receivers.</b> 15 $\mu$ s switching speed. Spectral purity. AM, FM, pulse modulation. FM deviation to 20 MHz. Flexible control of frequency.	223
0.252 to 2060 MHz			

## Signal Sources

### High-Performance RF Signal Generators

- Frequency ranges of 1 GHz, 2 GHz, 3 GHz, 4.2 GHz, or 6 GHz
- Lowest overall noise and spurious
- AM, FM, and pulse modulation
- Lowest specified leakage (optional)
- Internal modulation source for complex waveforms
- Onsite repair and calibration



HP 8643A, 8644B, 8665B

These signal generators offer RF designers and manufacturers a selection of frequency range and high performance. The HP 8643A, 8644B, and 8664A are for traditional out-of-channel receiver test applications. The HP 8665A/B are for high-performance applications up to 6 GHz, particularly radar, telemetry and spurious testing of UHF receivers. All signal generators within this performance family have options that allow them to be configured to meet specific application needs.

#### HP 8643A 1 GHz/2 GHz Signal Generator

HP has optimized the HP 8643A's configuration with the performance necessary for out-of-channel receiver tests while maintaining a low price. Options have been limited on the HP 8643A, but many performance/feature capabilities have been included as standard.

#### Standard Electronic Attenuator and Advanced Modulation Source

Reliability is enhanced by the use of an electronic attenuator on the 1 GHz version. Instead of using mechanical relays for setting levels, the HP 8643A uses solid-state components accurate to within  $\pm 1.0$  dB. The HP 8643A comes standard with an advanced internal modulation synthesizer that provides coverage to 400 kHz and two-tone capability with the selection of sine, square, sawtooth, and white Gaussian noise waveforms.

#### HP 8644B 1 GHz/2 GHz High-Performance Signal Generator

The HP 8644B represents the highest overall performance in HP's line of 1 GHz and 2 GHz signal generators. The HP 8644B builds on the HP 8643A's performance by lowering SSB phase noise ( $-136$  dBc/Hz versus  $-130$  dBc/Hz) and lowering spurious ( $-105$  dBc versus  $-100$  dBc). The HP 8644B can be used either for specific tests that require the lowest SSB phase noise or for applications with diversified performance requirements.

#### Specifications

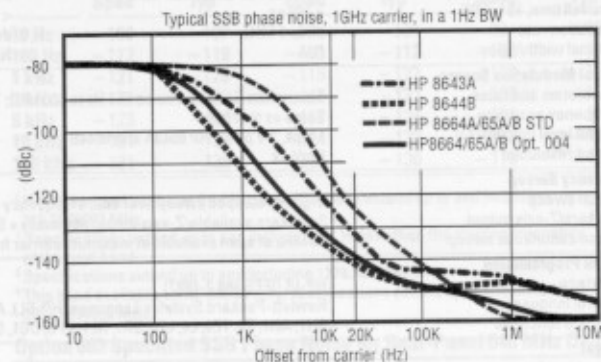
	HP 8643A	HP 8644B	HP 8664A; HP 8665A/B
Frequency Range	0.252 to 1030 MHz 0.252 to 2060 MHz (Option 002)	0.252 to 1030 MHz 0.252 to 2060 MHz (Option 002)	0.1 to 3000 MHz (HP 8664A) 0.1 to 4200 MHz (HP 8665A) 0.1 to 6000 MHz (HP 8665B)
Resolution Accuracy	0.01 Hz Timebase stability $\times f$	0.01 Hz Timebase stability $\times f$	0.01 Hz Timebase stability $\times f$

#### HP 8664A 3 GHz, HP 8665A 4.2 GHz and HP 8665B 6 GHz High-Performance Signal Generators

These three signal generators offer identical performance except for frequency coverage and price. Your application will dictate which instrument is required. The HP 8664A and HP 8665A/B are suited for out-of-channel receiver measurements through the use of Option 004 (low-noise enhancement) and for such applications as radar testing through the use of Option 008 (pulse modulation).

#### Wideband FM and Optional Pulse Modulation

FM rates of up to 2 MHz and deviations to 20 MHz peak are suitable for many applications such as higher-rate digital communications. An optional pulse modulator with on/off ratio of  $> 80$  dB and rise/fall times of  $< 5$  ns is available. Pulse width and delay can be internally adjusted between 50 ns and 999 ms, eliminating the need for an external pulse generator.



Typical SSB Phase Noise, at 1 GHz Carrier, in a 1 Hz BW

# Signal Sources

## High-Performance RF Signal Generators

- 10 kHz to 1280 MHz frequency range
- $< -147$  dBc/Hz SSB phase noise at 10 kHz offset
- 0.1 Hz frequency resolution



HP 8662A

### HP 8662A/HP 8663A Synthesized Signal Generators

Spectral purity is the key contribution of both the HP 8662A and 8663A, making them ideal for many radar, satellite communication, and phase noise measurement applications. Typical absolute phase noise performance of these generators at a 1 kHz offset is as low as  $-135$  dBc/Hz, depending on the band of operation.

The frequency range of the HP 8662A is 10 kHz to 1280 MHz. It offers versatile AM/FM, using either internal 400 Hz and 1 kHz rates or externally applied modulating signals which can be either ac- or dc-coupled. It also has simultaneous modulation capability.

The HP 8663A and 8662A provide the U.S. Air Force MATE (Modular Automatic Test Equipment) capability, via Option 700. This option is an external translator that allows the signal generator to be controlled by the MATE language CIIL (Control Interface Intermediate Language).

### HP 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  $< 5 \times 10^{-9}$ /day after 10-day warmup (typically 24 hrs. in normal operating environment).

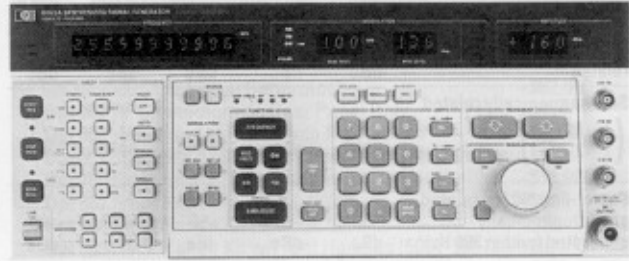
#### Spectral Purity

**Front-Panel Absolute SSB Phase Noise (dBc/Hz):**

Frequency range (MHz)					
0.01 to 119.9 <sup>1</sup>		120 to 159.9 <sup>2</sup>		160 to 319.9 <sup>2</sup>	
Spec	Typ	Spec	Typ	Spec	Typ
1 Hz	-68	-78	-66	-76	-60
10 Hz	-98	-108	-96	-106	-90
100 Hz	-116	-126	-115	-125	-109
1 kHz	-126	-132	-129	-135	-124
3 kHz	-126	-135	-129	-138	-124
5 kHz	-128	-138	-131	-141	-126
10 kHz	-132	-138	-142	-148	-142
100 kHz	-132	-139	-142	-148	-142

Frequency range (MHz)					
320 to 639.9 <sup>2</sup>		640 to 1279.9 <sup>2</sup>		1280 to 2559.9 <sup>4</sup>	
Spec	Typ	Spec	Typ	Spec	Typ
1 Hz	-54	-64	-48	-58	-42
10 Hz	-84	-94	-78	-88	-72
100 Hz	-103	-114	-97	-108	-92
1 kHz	-118	-125	-112	-119	-106
3 kHz	-118	-127	-112	-121	-106
5 kHz	-120	-130	-114	-124	-108
10 kHz	-131	-136	-124	-130	-118
100 kHz	-131	-136	-124	-130	-118

- 100 kHz to 2560 MHz frequency range
- AM/FM/ΦM/pulse in one generator
- Internal variable modulation oscillator



HP 8663A

**Residual SSB Phase Noise (dBc/Hz):**

Frequency range (MHz)					
0.01 to 119.9 <sup>1</sup>		120 to 159.9 <sup>2</sup>		160 to 319.9 <sup>2</sup>	
Spec	Typ	Spec	Typ	Spec	Typ
10 Hz	-108	-114	-112	-119	-106
100 Hz	-121	-126	-122	-129	-118
1 kHz	-128	-133	-131	-138	-127
3 kHz	-128	-136	-131	-139	-127
5 kHz	-129	-138	-133	-141	-129
10 kHz	-132	-137	-142	-147	-136
100 kHz	-132	-137	-142	-147	-136

Frequency range (MHz)					
320 to 639.9 <sup>2</sup>		640 to 1279.9 <sup>2</sup>		1.28 to 2559.9 <sup>4</sup>	
Spec	Typ	Spec	Typ	Spec	Typ
10 Hz	-100	-107	-93	-101	-88
100 Hz	-112	-119	-105	-112	-100
1 kHz	-121	-128	-115	-122	-109
3 kHz	-121	-129	-115	-123	-109
5 kHz	-123	-130	-117	-124	-111
10 kHz	-131	-136	-124	-130	-118
100 kHz	-131	-136	-124	-130	-118

<sup>1</sup> HP 8663A band begins at 0.1 MHz; specifications extend up to and including 119.999999 MHz.

<sup>2</sup> Specifications extend up to and including 0.1 Hz less than the starting frequency of the next band.

<sup>3</sup> Specifications extend up to and including 1279.999998 MHz.

<sup>4</sup> This band available on HP 8663A only; specifications extend up to and including 2559.999996 MHz.

**Option 003 Specified SSB Phase Noise for Rear-Panel 640 MHz Output:**

	Spec	Typ
1 Hz	-54	-64
10 Hz	-84	-94
100 Hz	-104	-114
1 kHz	-121	-126
3 kHz	-121	-127
5 kHz	-129	-138
10 kHz	-145	-149
100 kHz	-157	-159

**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.

# Signal Analyzers

## Measurement Personalities

- One button measurement solutions
- Save time, money and training
- Customized for your application
- Easy to use



Easy-to-install measurement personalities

## Measurement Personalities

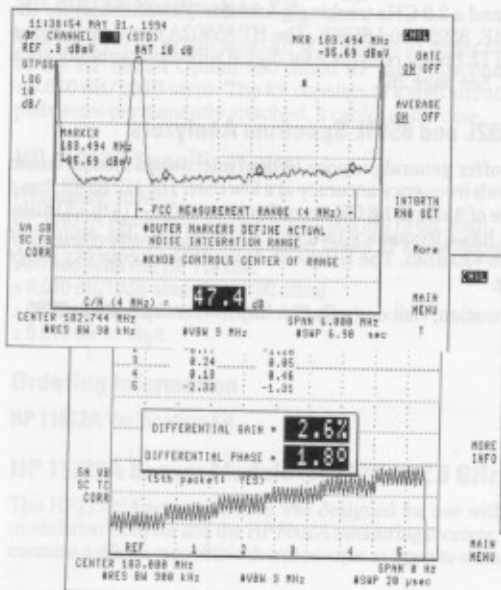
Measurement personalities are software programs provided on ROM-based memory cards. They customize your HP 8590 analyzer to perform complex tests simply and quickly with the push of a button from easy-to-follow screen menus. The personalities automatically set the analyzer controls and perform calculations required by application standards, improving accuracy and repeatability.

### Cable TV and Broadcast

(See page 528 for more information.)

#### HP 85721A Cable TV Measurements and System Monitor Personality

The HP 85721A measurement personality customizes the HP 8591C and 8590 E-series analyzers for easy, noninterfering proof-of-performance measurements on NTSC-, PAL-, or SECAM-format signals. The personality includes the capability to measure power levels for digital carriers. This software adds dedicated cable TV test functions and measurements for channel and system operation. Three video measurements as well as differential gain and phase and chrominance-to-luminance delay inequality can be performed if the spectrum analyzer has Option 107 TV receiver/video tester.



#### HP 85724A Broadcast Measurement Personality

The HP 85724A adds measurements for testing TV broadcast transmitters and relays. It allows selection of PAL-I/B/G, NTSC-M and SECAM-D/K systems, channel bands CCIR VHF, UHF, S, M & B, FCC-AIR and PRC and channel number. Tests include carrier level, chroma level, vision, three-tone intermodulation, depth of modulation, spurious signals, NICAM carrier power and intermodulation and FE deviation. Three video measurements as well as differential gain and phase, and chrominance-to-luminance delay inequality can be performed if the spectrum analyzer has Option 107 TV receiver/video tester.

### Lightwave

(See page 428 for more information.)

#### HP 11982A Option 001 Lightwave Converter Personality

The HP 11982A Option 001 personality provides frequency response correction and amplitude conversion of the optical marker for lightwave signals when used with the HP 11982A amplified lightwave converter and an HP 8590 series analyzer.

### Component Test

(See page 258 for more information.)

#### HP 85714A Scalar Measurement Personality

An HP 85714A measurement personality and HP 8590 series analyzer with optional built-in tracking generator make fast, accurate scalar transmission measurements from 100 kHz to 2.9 GHz. Features include guided calibration, pass/fail limit line testing, 120 dB display, bandwidth, Q factor, and shape factor. The HP 85630A scalar test set adds simultaneous transmission/reflection display.

#### HP 85719A Noise Figure Measurement Personality

The HP 85719A noise figure measurement personality customizes an HP 8590 Option 119 E-series spectrum analyzer for displayed swept noise figure and gain measurements from 10 MHz to 2.9 GHz.

### Electromagnetic Compatibility

(See page 336 for more information.)

#### HP 85712D EMC Auto-Measurement Personality

The HP 85712D simplifies precompliance EMI measurements. The spectrum analyzer is set up automatically with the correct limit lines, transducer factor corrections, frequency range, and bandwidths which are supplied on the personality card. It can perform automatic peak, quasi-peak, and average on up to 20 signals at a time and print the results directly, or store them to a RAM card for future viewing.

