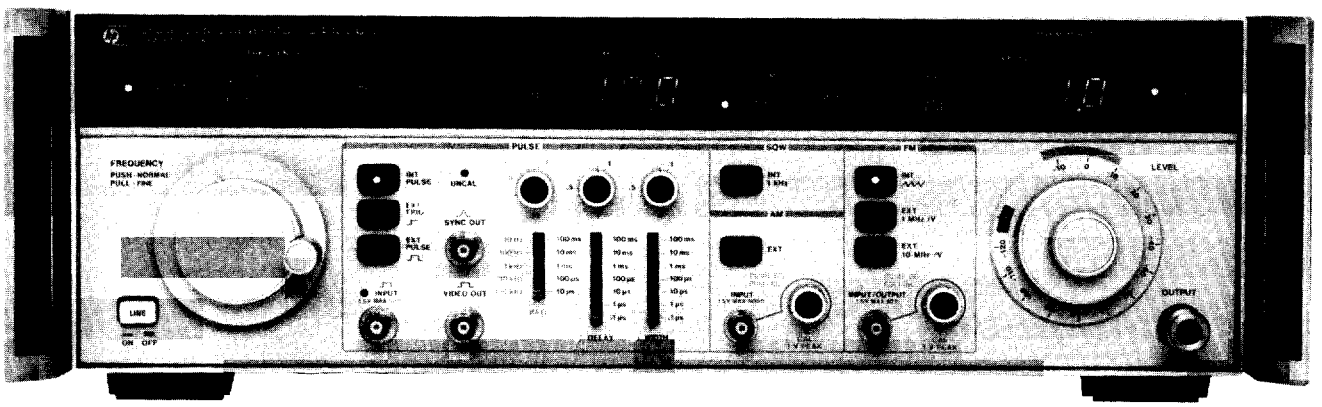
# SIGNAL GENERATORS

## Solid-State Microwave Signal Generators

### Models 8683/8684A,B,D

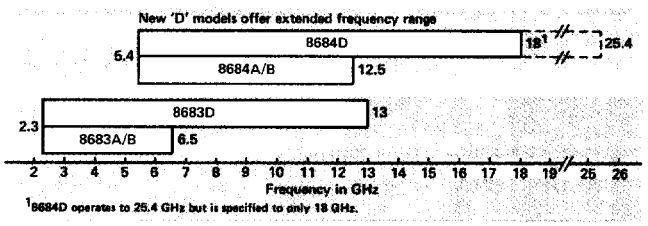
- Portable signal generators with high performance modulation
- Wide frequency ranges from 2.3-18 GHz
- Wideband FM for satellite video ±10 MHz peak deviation
- dc-10 MHz rates



HP 8684D

## HP 8683/8684 Microwave Signal Generators

The HP 8683 and 8684 are rugged portable signal generators designed for demanding benchtop and field maintenance environments. Operating in four overlapping frequency ranges, with a choice of features including a high performance internal pulse generator, the family provides a wide range of benefits for various radar, communications and electronic warfare applications.




### Clean, Stable, Cavity-Tuned Oscillator

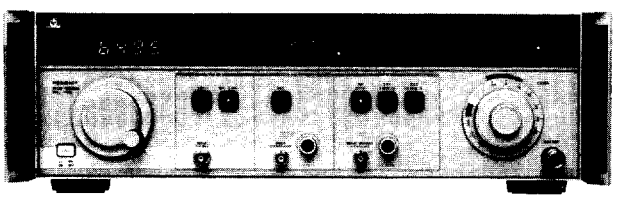
At the heart of each signal generator is a mechanically tuned cavity oscillator. State-of-the-art electronics teamed with sophisticated mechanical design provide excellent frequency stability, spectral purity and quick warm-up times necessary for accurate measurements. With low spurious outputs and a low noise floor, the HP 8683 and 8684 are excellent for receiver sensitivity measurements and out-of-channel communications receiver measurements where high performance at low signal levels is required.

### Microprocessor-Enhanced Measurement Accuracy

Characteristics of microwave components such as oscillators, amplifiers, and attenuators vary considerably with frequency and power level. An internal microprocessor effectively compensates for these variations, providing accurate output level in dBm, dB relative to a user-selected power level, or power level with a specified cable offset. These conveniences translate to faster measurements and reduced possibility of operator error in interpreting observations.

### Reliability and Serviceability

The HP 8683 and 8684 were designed with high reliability and serviceability as major considerations. The instruments exceed rigorous military specifications (MIL-T-28800C Class V) for operating and non-operating temperature, humidity, condensation, shock and vibration, and EMI. The instruments success in these tests is an indication that they are rugged enough to provide accurate, reliable measurements in environments where many instruments would fail. For added reliability in the A and B models Option 002 may be selected for reverse power protection. With this option the possibility of instrument failure due to operator error is substantially reduced, allowing for as much as 10 watts average or 2000 watts peak reverse power with no damage to the instrument. The reliability of these generators is reflected in a demonstrated MTBF in excess of 20,000 hours.



HP 8683A

Confidence in signal generator performance is provided by diagnostic tests which automatically execute at turn-on and monitor most critical nodes prior to entering the operation mode. If a failure is detected, in most cases it can be isolated to at least the circuit function level with the aid of the front panel display. The generators' open, accessible internal design and complete service manuals result in excellent serviceability, minimizing repair time if a failure should occur.

### HP 8683/8684 A,B,D Features

A variety of modulation capabilities, frequency ranges, and power specifications are available in the HP 8683/8684 Microwave Signal Generator family.

Sharing the same rugged dependable design with the rest of the family, the A models provide AM and FM for conventional communications applications in an affordable package. All A models are specified to have maximum output power of 0 dBm throughout their frequency range; however, if required, Option 001 may be selected to provide +10 dBm output power.

The B and D models add a high performance pulse modulator and internal pulse generator for the simulation of a wide variety of sophisticated radar transmissions. Simultaneous FM and pulse allow chirping, while simultaneous AM and pulse allow simulation of antenna scan patterns. Of course, basic receiver sensitivity and AGC measurements can also be made easily.

For users with multi-band, broadband or general purpose applications, the D models, with twice the frequency coverage of the A and B models, offer exceptional performance, versatility and economy in a single box. Not only is frequency coverage increased, but in doubled mode, FM peak deviation is also doubled to 10 MHz at dc to 10 MHz rates making possible the direct test of satellite video receivers. If required, the high-power Option 001 may be selected to boost maximum output power in the frequency-doubled bands from −3 dBm to the +10 dBm level already provided in the main bands. By combining

proven, rugged, dependable design with the versatility of twice the frequency coverage and wideband FM, the D models offer cost-effective, high performance solutions to radar and communications receiver test problems.

| Distinguishing features of the A, B, & D models | | | |
|---|---|---|---|
| | A | B | D |
| Output Power | 0 dBm | +10 dBm | +10 dBm,–3 dBm[1] |
| Opt 001 Power | +10 dBm | N/A | +10 dBm[1] |
| Internal Pulse Generator/Modulator | No | Yes | Yes |
| FM Deviation (DC To 10MHz Rate) | 5 MHz | 5 MHz | 10 MHz[1] |
| [1] These specifications for the doubled mode | | | |

## HP 8683A/B/D, HP 8684A/B/D Specifications

### Frequency Specifications

**Range**

**HP 8683A/B:** 2.3–6.5 GHz.
**HP 8683D:** 2.3–13.0 GHz.
**HP 8684A/B:** 5.4–12.5 GHz.
**HP 8684D:** 5.4–18.0 GHz.

**Resolution:** HP 8683, 5 MHz using a 4 digit LED display; HP 8684, 10 MHz using a 3 ½ digit LED display.

**Calibration accuracy:** HP 8683A/B/D, ±1.25% <4.0 GHz, ±0.75% 4.0 to 6.5 GHz; HP 8683D x2 band, ±1.25% 6.5 to 8.0 GHz, ±0.75% >8 GHz; HP 8684A/B/D, ±1.25% 5.4 to 9.0 GHz, ±0.75% 9.0 to 12.5 GHz; HP 8684D x2 band, ±1.25% 12.5 to 18.0 GHz.

***Stability (typical)***

***vs. time (20 min. after turn-on):*** *<30 kHz/min.*
***vs. time (60 min. after turn-on):*** *<100 kHz/hr.*
***vs. temperature (0 to 55° C):*** *HP 8683, <15 MHz; HP 8684, <30 MHz.*
***vs. line voltage (transients of +5%/–10%):*** *<20 ppm.*

### Spectral Purity

**Harmonics (<18GHz, at specified max output):** <–25 dBc. HP 8683/84D harmonics are unspecified in x2 frequency band.
**Fundamental feedthrough (at specified max. output):** HP 8683D, <–25 dBc 6.5–9.5 GHz; HP 8684D, <–25 dBc 12.5–18.0 GHz. Not specified for D models with Option 001.
**Spurious (non-harmonically related):** <–80 dBc; typ, <–90 dBc.
**Residual FM (50 Hz to 15 kHz post detection BW):** <5 kHz peak. HP 8683/84D in doubled band: <10 kHz peak.
***Single-sideband phase noise (avg. rms, 1 Hz BW, 10 kHz offset from carrier, typical):*** *HP 8683A/B, <–72 dBc; HP 8683D, <–66 dBc; HP 8684A/B, <–65 dBc; HP 8684D, <–59 dBc.*
**Residual AM (avg. rms, 300 Hz to 15 kHz post detection BW):** <0.15%.

### Output Specifications

**Range (leveled into 50Ω):** HP 8683/84A, 0 to –130 dBm; HP 8683/84A opt. 001 and HP 8683/84B, +10 to –130 dBm; HP 8683/84D, +10 to –130 dBm (main band), –3 to –130 dBm (x2 band), +10 dBm in x2 bands available with Option 001.
**Resolution:** 0.1 dB using a 3 ½ digit LED display.
**Accuracy:** ±2.5 dB from maximum specified output power to –110 dBm (to –100 dBm in x2 bands); ±3.5 dB to –120 dB. *Typ. <±0.9 dB at –100 dBm.* Option 002 affects level accuracy <±0.5 dB.
**Flatness (power level >–10 dBm):** ±1.0 dB.
***Reverse power protection:*** *the standard models typically accept 1 watt avg. or 100 watts peak power with no damage resulting.* Option 002 (on A and B models only) increases this protection to 10 watts avg. or 2kW peak.
***Auxiliary output:*** *rear panel, typically >–15 dBm into 50Ω, prior to AM, pulse, or frequency doubling; source impedance approx. 50Ω.*

### Modulation Specifications

**Types:** internal and external AM, FM, and Pulse (except HP 8683/84A). Simultaneous AM, FM, Pulse.
**Metering:** 3-digit LED, selectable for % AM or FM deviation.

### Amplitude Modulation

**Depth (1 kHz rate):** 0-70%.
**Rates (3 dB BW at 40% depth):** dc to 10 kHz (dc coupled); 50 Hz to 10 kHz (ac coupled).
**Distortion (THD):** <10% at 40% depth and 1 kHz rate.
***Indicated AM accuracy (depth 50%, 1 kHz rate):*** *±5% of full scale.*
**Incidental FM (30% AM depth):** <15 kHz peak to peak. (<30 kHz p-p in doubled band, HP 8683/84D.)
**Internal AM:** fixed 1 kHz nom. square wave with 50 ±5% duty cycle.

### Frequency Modulation

**Peak deviation:** HP 8683/84 A/B, ±5 MHz; HP 8683/84D, ±5 MHz (main); ±10 MHz (x2 band).
**Rates (3 dB BW):** dc to 10 MHz, 100 Hz to 10 MHz (ac coupled).
**Distortion:** <5% at 100 kHz rate and <1 MHz peak deviation.
***Indicated accuracy (typ., 10 MHz/V range):*** *±10% of full scale, deviations <5 MHz, 100 kHz rate.*
**Incidental AM (rate <100 kHz, peak deviation <1 MHz):** <6%.
**Internal FM:** FM sawtooth with a fixed sweep rate of 1 kHz nom. and variable deviation up to ±5 MHz (±10 MHz for D models, x2 bands).
**Phase lock input:** typical sensitivity of –5 MHz/V.

### Pulse Modulation

**HP 8683/84 B/D Internal Pulse Generator**

**Rate:** 10 Hz to 1 MHz continuously adjustable in 5 ranges.
**Width:** 50 ns to 100 ms continuously adjustable in 7 ranges.
**Delay (time between sync out and video out):** <50 ns to 100 ms in 7 ranges with continuous adjustment within ranges.
**Accuracy:** calibration accuracy is 20% of full scale.

**HP 8683/84 B/D External Pulse Input Requirements**

**Rate:** 0 to 1 MHz.
**Width:** >100 ns.
**Level:** on >+1.0 V peak; off <+0.4 V peak.

**HP 8683/84 B/D RF Pulse Specifications**

**Rise/fall time:** <10 ns.
**On/off ratio:** >80 dB.
**Minimum pulse width:** <100 ns.
**Maximum pulse repetition frequency:** >1 MHz.
**Peak pulse power:** ±0.5 dB of level set in CW mode.

### General

**Operating temperature range:** 0° to 55°C.
**EMI:** MIL-STD-461, VDE0871, CISPR Pub. 11.
**Safety:** meets the requirements of IEC 348.
**Power:** 100, 120, 220 or 240V, +5%, –10%; 48 to 66 Hz; (Opt. 003 adds 400 Hz operation at 100 or 120 V); <200 VA max.
**Dimensions:** 145 H x 457 W x 472 mm D (5.7″ x 18″ x 18.6″).
**Weight:** HP 8683, 17.9kg (39 lb) net, 23.4 kg (51 lb) shipping; HP 8684, 16.5 kg (36 lb) net, 22.0 kg (48 lb) shipping.

| Ordering Information | Price |
|---|---|
| **HP 8683A** Microwave Signal Generator | $12,030 |
| **HP 8684A** Microwave Signal Generator | $12,030 |
| **Option 001:** +10 dBm output power, HP 8683/84 A | add $1500 |
| **HP 8683B** Microwave Signal Generator | $15,030 |
| **HP 8684B** Microwave Signal Generator | $15,030 |
| **HP 8683D** Microwave Signal Generator | $19,000 |
| **Option 001** +10 dBm in x2 band, HP 8683D | add $3000 |
| **HP 8684D** Microwave Signal Generator | $19,000 |
| **Option 001:** +10 dBm in x2 band, HP 8684D | add $5000 |
| **Option 002:** Reverse power protection (except D models) | add $725 |
| **Option 003:** 400 Hz line frequency operation (all models) | add $180 |
| **Option 910:** Extra operating and service manual | add $25 |
| **Option 913:** Rack mounting flange kit | add $35 |
| **HP 11727A** Support kit | $475 |