



SIGNAL GENERATORS

Solid-State Microwave Signal Generators

Models 8683A, 8683B, 8684A, 8684B

- Spectrally pure signals, 2.3–6.5 GHz; 5.4–12.5 GHz
- +10 to –130 dBm calibrated output
- Calibrated AM, FM and Pulse Modulation
- Communications and radar versions
- 2 kW reverse power protection (optional)
- Internal service diagnostic



8684B



8680 Microwave Signal Generators

The 8683 and 8684 are rugged, portable signal generators which provide similar capabilities in two overlapping frequency ranges. Each is available as a communications version (8683/84A) or a more versatile radar/communications version (8683/84B).

| Freq. Band | Communication Appl. | Radar/Comm. Appl. |
|--------------|---------------------|-------------------|
| 2.3–6.5 GHz | 8683A | 8683B |
| 5.4–12.5 GHz | 8684A | 8684B |

The “B” versions differ from the “A” versions by offering higher maximum leveled output power and high performance internal pulse modulation.

Clean, Stable Cavity-Tuned Oscillator

At the heart of the signal generators is their mechanically tuned-cavity oscillators. The oscillators are the result of coupling state-of-the-art electronics with sophisticated mechanical design and precision manufacturing techniques. Mechanical cavity-tuning is chosen

for its excellent frequency stability and spectral purity. The oscillators' active elements (bipolar transistors in the 8683 and GaAs FET's in the 8684) help attain the impressive residual FM and spurious response specifications of the generators. Refinements in both the electronic and mechanical designs stretch this performance over the broad frequency ranges.

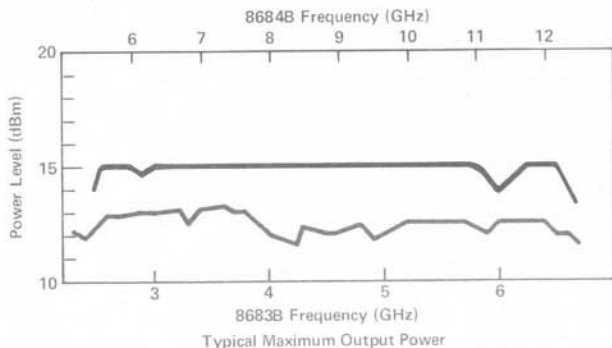
Microprocessor Enhancements

A microprocessor has been incorporated into the design of these manually tuned generators. Many microwave component characteristics vary with frequency necessitating some form of compensation to ensure optimal accuracy. The microprocessor provides an effective and economical means for this compensation. It is responsible for the specified 1% frequency accuracy as well as the ± 2 dB output level accuracy.

The microprocessor also makes possible convenience features such as displaying output level in absolute dBm, dB relative to a user-selected power level, or with a specified Cable Offset. When Cable Offset is selected, the output level display indicates the power level at the end of a user-selected length of RG-214 cable rather than the level at the generator's output connector.

8683B, 8684B

These generators offer the advantage of extremely wide dynamic range coupled with excellent level accuracy. Output level ranges from –130 to +10 dBm. The versatility of the “B” models is expanded with the inclusion of six modulation modes, including internal and external AM, FM and pulse modulation. Low distortion coupled with display accuracy provides the AM and FM performance required for communications applications. The internal FM sawtooth with variable deviation is well suited for narrow-band swept measurements. Pulse performance is particularly noteworthy with modulation specifications of >80 dB on/off ratio, and rise/fall times <10 ns. The internal pulse generator offers pulse widths from 100 ms. to less than 100 ns., rates from 10 Hz to 1 MHz, and delays from 100 ms. to less than 50 ns. Pulsed-power is leveled to within 0.5 dB of the level set in CW mode. This performance level is especially important for modern radar system measurements.





8683A



8683A, 8684A

These generators also offer impressive performance. Spectral purity and stability are identical to the "B" models. They provide 130 dB of dynamic range (-130 to 0 dBm) with ± 2 dB level accuracy. Their modulation section is well suited for communications applications with built-in, calibrated AM and FM capabilities. Limited external pulse modulation has been included, optimizing the value of the "A" model in communications systems.

Capabilities for Specific Microwave Measurements

The 8683 and 8684 were designed to meet the requirements of major microwave systems applications. In making out-of-channel communications receiver measurements, wide frequency range, low spurious, and a low noise floor are imperative. Receiver sensitivity measurements require excellent signal generator performance at low signal levels. These performance features are built into the 8683 and 8684. In addition, convenience features such as Cable Offset can significantly simplify the measurement of communication system parameters.

The features included in the "B" models provide the capability to handle advanced radar applications. With the addition of the high performance pulse modulator and internal pulse generator, simulation of a wide variety of radar transmissions is possible. 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 easily be made.

Reliability and Serviceability

The 8683 and 8684 were designed with reliability and serviceability as major considerations. The instruments were type tested to rigorous military specifications (MIL-T-28800 Class IV) for operating and non-operating temperature, humidity, condensation, shock and vibration, and EMI. The instruments' success in these tests is an indication of their ruggedness. Confidence that a desired output signal has been accurately generated is derived, in part, from a diagnostic test which is automatically executed on turn-on. These tests monitor most critical circuit nodes within the generator locating possible problem areas prior to the generator entering its operating mode. Reliability is further enhanced with optional low-cost reverse power protection.

Excellent serviceability results from the combination of accessibility to components, completeness of service manuals, and internal diagnostic capability. In the diagnostic mode, failures can be isolated to at least circuit function level with the aid of the front panel display or a computer terminal.

8683A/B, 8684A/B Specifications

(See technical data sheet for complete specifications.)

Frequency Characteristics

Frequency range: 8683, 2.3–6.5 GHz; 8684, 5.4–12.5 GHz.

Frequency resolution: 8683, 5 MHz using a 4 digit LED display; 8684, 10 MHz using a 3½ digit LED display.

Calibration accuracy: $\pm 1\%$.

Stability,

vs. time (20 min. after turn-on): < 30 kHz/min.

vs. time (60 min. after turn-on): < 100 kHz/hr.

vs. temperature: 8683, < 20 MHz; 8684, < 35 MHz from 0 to 55°C.

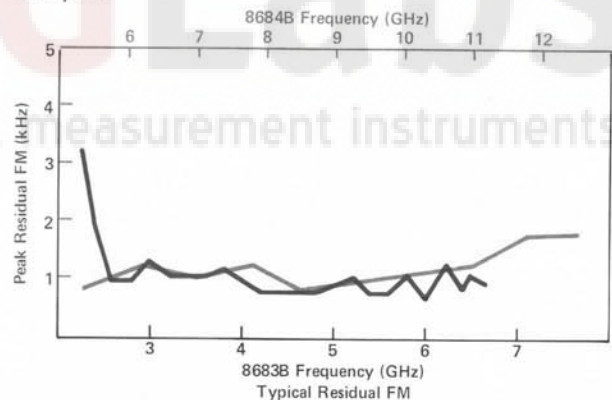
vs. line voltage (transients of +5%/-10%): < 30 ppm.

Spectral Purity

Harmonics (< 18 GHz, at specified maximum output): < -25 dBc.

Spurious (non-harmonically related): < 80 dBc. Typically, < -90 dBc.

Residual FM (50 Hz to 15 kHz post detection bandwidth): < 5 kHz peak.



Single-sideband phase noise (avg. rms, 1 Hz BW, 10 kHz offset from carrier, typical): 8683, < -74 dBc; 8684, < -65 dBc.

Residual AM (avg. rms, 300 Hz to 15 kHz post detection bandwidth): < -65 dBc.

Output Characteristics

Level range (leveled into 50 Ω): 8683/84A, 0 to -130 dBm; 8683/84A opt. 001 and 8683/84B, +10 to -130 dBm.

Resolution: 0.1 dB using a 3½ digit LED display.

Level Accuracy: ± 2.0 dB from maximum specified output to -110 dBm. ± 3.0 dB from -110 to -120 dBm. Option 002, reverse power protection, affects level accuracy $< \pm 0.5$ dB.

Level flatness (power level > -10 dBm): ± 1.0 dB.

Reverse power protection: The generators will typically accept 1 watt avg. or 100 watts peak power with no damage resulting. Option 002 increases this protection to approx. 10 watts avg. or 2 kilowatt peak.

Typical output impedance: 50 Ω nominal. 8683 SWR < 2.0 ; 8684 SWR < 2.5 on +10 and 0 dBm ranges, < 2.0 for -10 dBm and below.

Auxiliary output: rear panel Type N output is typically > -15 dBm into 50 Ω , being derived prior to AM or pulse modulation. Source impedance is approximately 50 Ω .

SIGNAL GENERATORS

Models 8683A, 8683B, 8684A, 8684B (Cont.)

8683A/B, 8684A/B Specifications (Cont.)

Modulation Characteristics

Types: Internal AM (1 kHz square wave)

Internal FM (1 kHz Sawtooth)

Internal Pulse (8683/84B only)

External AM; FM; Pulse

Simultaneous AM/FM, AM/Pulse, FM/Pulse, AM/FM/Pulse.

Metering: single 3-digit LED display. Selectable indication of AM depth or FM deviation.

Amplitude Modulation

AM specifications are valid for an output vernier range 5 to 15 dB below maximum vernier and for output levels at least 5 db below the specified maximum.

Depth: 0-70%.

AM rates (3 dB BW at 50% depth): dc to 10 kHz (dc coupled); 20 Hz to 10kHz (ac coupled).

AM distortion: <5% at 50% depth and 10 kHz rate.

Indicated AM accuracy: ±5% of full scale depths up to 50% at a 10 kHz rate.

Incidental FM (30% AM depth): <10 kHz peak to peak.

Internal AM: Fixed 1 kHz square wave with a duty cycle of 50 ±5%. Square wave on/off ratio is identical to that specified for pulse modulation.

Frequency Modulation

Peak deviation: ±5 MHz.

FM rates: (3 dB BW): dc to 10 MHz (dc coupled), 50 Hz to 10 MHz (ac coupled).

FM distortion: <5% at 100 kHz rate and <1 MHz peak deviation.

Indicated FM accuracy: ±20% at a 100 kHz rate.

Incidental AM (rate <100 kHz, peak deviation <1 MHz): <5%.

Internal FM: FM sawtooth with a fixed sweep rate of 1 kHz and variable deviation up to specified maximum for external FM.

Phase lock input: rear panel BNC with typical sensitivity of -5 MHz/V. Input impedance is nominally >1 kΩ.

Pulse Modulation

8683/84A External Pulse Input Requirements

Rate: 0 to 10 kHz.

Width: >10 μs.

On level: >+3.0 V peak.

Off level: <+0.5 V peak.

8683/84A RF Pulse Characteristics

Rise time: <5 μs.

Fall time: <1 μs.

On/off ratio (at maximum leveled power): >30 dB.

8683/84B Internal pulse generator

Pulse repetition frequency: 10 Hz to 1 MHz in 5 ranges with continuous adjustment within ranges. Calibration accuracy is 20% of full scale.

Pulse width: 50 ns to 100 ms in 7 ranges with continuous adjustment within ranges. Calibration accuracy is 20% of full scale.

Pulse delay (time between sync out and video out): <30 ns to 100 ms in 7 ranges with continuous adjustment within ranges. Calibration accuracy is 20% of full scale. The range for <100 ns is uncalibrated.

Synchronizing Signals

Video out: >3 V peak positive replica of the selected RF pulse, delayed no more than 50 ns in advance of the RF pulse.

Sync out: >1 V peak positive pulse into 50 Ω with a nominal width of 20 ns. Sync out appears in advance of the RF pulse and video pulse according to the delay set with the pulse delay control.

External trigger: 0-1 MHz, dc coupled. On levels must be >0.8 V positive polarity and held >20 ns to affect trigger. Input impedance is approx. 50 Ω.

Pulse UNCAL indicator: Annunciator warns operator of improper setting of PRF, width, and delay controls.

8683/84B External Pulse Input Requirements

Rate: 0 to 1 MHz.

Width: >100 ns.

On level: >+3.0 V peak.

Off level: <+0.5 V peak.

8683/84B RF Pulse Characteristics

Rise or fall time: <10 ns.

On/off ratio: >80 dB.

Ring and overshoot: <20%.

Minimum pulse width: <100 ns.

Video feedthru: 25 mV max. (at 0 dB attenuation).

Maximum pulse repetition frequency: >1 MHz.

Pulse width compression: <50 ns.

Minimum duty cycle: 0.01% (may become unlevelled below 0.01%).

Peak pulse power: ±0.5 dB of level set in CW mode.

General

Operating temperature range: 0° to 55°C.

EMI: MIL-STD-461.

Environmental (operating and non-operating temperature, humidity, shock and vibration): type tested to MIL-T-28800B Class IV requirements.

Safety: meets the requirements of IEC 348.

Power: 100, 120, 220, or 240, +5%, -10%, for line frequencies of 48 to 66 Hz. Option 003 adds 400 Hz line frequency operation at 100 or 120 V. Power consumption is <200 VA.

Weight:

| Model | 8683 | 8684 |
|----------|------------------|------------------|
| Net | <17.3 kg (38 lb) | <15.9 kg (35 lb) |
| Shipping | <22.8 kg (50 lb) | <21.4 kg (47 lb) |

Dimensions: 145 H x 457 W x 472 mm D (5.7 x 18 x 18.6 in).

Ordering Information

8683A Microwave Signal Generator

8684A Microwave Signal Generator

8683B Microwave Signal Generator

8684B Microwave Signal Generator

Option 001: +10 dBm output power, 8683A, 8684A

Option 002: Reverse power protection, 8683A/B

Option 002: Reverse power protection, 8684A/B

Option 003: 400 Hz line frequency operation

Option 910: Extra operating and service manual

Option 913: Rack mounting flange kit

Price

\$12,000

\$12,000

\$15,000

\$15,000

add \$1,500

add \$100

add \$400

add \$180

add \$25

add \$31