

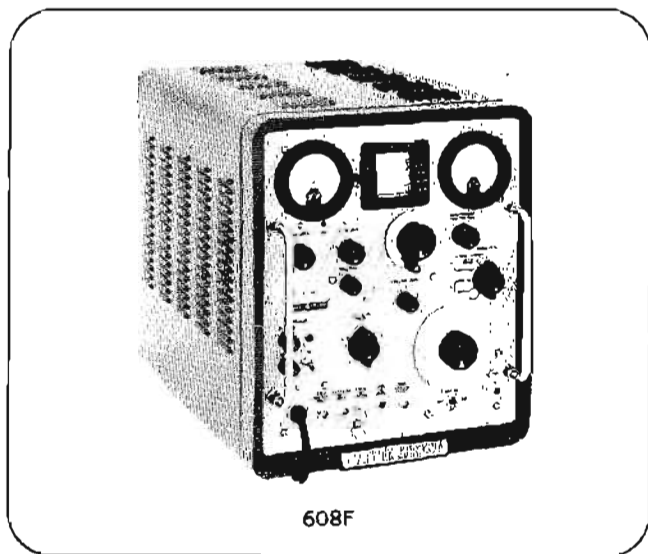
SIGNAL GENERATORS



VHF SIGNAL GENERATORS

Versatility and value 10-480 MHz

Models 608E/F; 8708A



Description

Models 608E and 608F provide high-quality, versatile performance with distinctive ease of operation. The 608E provides an output of up to 1 volt over the range from 10 to 480 MHz, and the 608F provides an output of up to 0.5 volt from 10 to 455 MHz.

The 608E is an improved version of the popular and time-proven HP 608C/D Signal Generators. The instrument is a master oscillator-power amplifier (MOPA) type with a broadband buffer amplifier stage between the oscillator and power amplifier circuits for isolation. The MOPA design permits optimization of the oscillator stage for high stability of 0.005% per 10 minutes, minimum residual FM, and low harmonics without restricting the modulation characteristics. Modulation is applied to the power amplifier stage with negligible effect on the oscillator frequency.

Modulation capability

The use of feedback in the power amplifier section yields excellent amplitude modulation characteristics. Up to 95% modulation can be achieved with modulating frequencies ranging from 20 Hz to 20 kHz. Envelope distortion is very low, less than 2% at 30% AM and less than 5% at 70% AM; thus you can make more accurate measurements of the distortion characteristics on receivers or detectors. Internal modulation oscillators of 400 Hz and 1000 Hz are provided, and the modulation percentage can be set and read directly on the accurate front panel modulation meter. The buffer amplifier stage between the master oscillator and power amplifier holds incidental FM with AM to a minimum, ensuring accurate measurements.

Accurate output level

Output levels of the Models 608E/F are accurately attenuated to provide continuously adjustable calibrated output from 0.1 microvolt to 1 volt rms (608E) or 0.5 volt rms (608F) into a 50-ohm load. Direct calibration is provided in both volts and dBm (to -127 dBm) and the output calibration is accurate within 1 dB at any frequency or level setting. The output system of the 608E/F is a well matched 50-ohm circuit which

minimizes mismatch ambiguities as a factor in overall measurement accuracy. The extremely wide range of output amplitude control makes the 608E/F very useful for driving bridges and filters as well as complete receiver measurements including sensitivity, selectivity, and image rejection.

Models 608E/F provide an auxiliary RF output; this fixed level (180 millivolts rms minimum) CW signal is for use with an HP 5245L Counter for very accurate indication of carrier frequency. On the 608F, this output is also for use with the 8708A Synchronizer. Using the auxiliary RF output does not place any restriction on the modulation capabilities nor on the main RF output level. The units also contain a crystal calibrator to provide frequency checkpoints at every 1 or 5 MHz throughout the frequency range.

High settability

The fine frequency vernier is an electronic fine tuning adjustment of the output frequency. Frequency settability with better than 10 ppm resolution is possible to obtain precise settings for critical tests. When used with the internal crystal calibrator, 608E frequency accuracy can be increased by a factor of 50 (factor of 100 for the 608F) over the main dial calibration of 1% without the use of an external frequency meter.

608F/8708A combination

The Model 8708A Synchronizer is an easy-to-use frequency stabilizer that allows the 608F to be phase-locked from 50 kHz to 430 MHz. Full AM and output level features of the 608F are retained during phase-lock. The 8708A increases frequency stability by a factor of 250 with the extra benefit of 8708A precise tuning resolution for settability to 2 parts in 10^7 . The 608F/8708A combination also permits narrowband frequency and phase modulation to be applied with very low distortion.

Specifications, 608E/F

Frequency characteristics

Range: 608E: 10 - 480 MHz in 5 bands (10-21, 21-43, 43-95, 95-215, and 215-480 MHz). 608F: 10 - 455 MHz in 5 bands (10-21, 21-44, 44-95, 95-210, and 210-455 MHz).

Accuracy: 608E: $\pm 0.5\%$. 608F: $\pm 1\%$.

Drift: 608E: less than 50 parts in 10^6 per 10 minute period after one hour warmup. 608F: less than 50 parts in 10^6 per 10 minute period after one hour warmup; stability when used with 8708A Synchronizer: 5×10^{-8} /minute; 2×10^{-7} /10 minutes; 2×10^{-6} /day; $2 \times 10^{-7}/^{\circ}\text{C}$ (0° to 55°C); $2 \times 10^{-7}/10\%$ line voltage change.

Frequency control input (608F ONLY): BNC female connector for "Frequency Control Output" from 8708A Synchronizer can also be used for external frequency control; voltage change from -2 to -32 volts changes frequency more than 0.2% at low end of each band and more than 1% at high end; nominal 4 k Ω input impedance, direct-coupled; voltage limits, 0 to -50 V.

Resettability: 608E: main frequency control resettability better than $\pm 0.1\%$ after initial warmup; Fine Frequency Adjust provides approximately 25 kHz settability at 480

MHz (proportionately finer adjustment at lower frequencies). 608E: main frequency control resettability better than $\pm 0.1\%$ after initial warmup; Fine Frequency Adjust provides approximately 25 kHz settability at 455 MHz (proportionately finer adjustment at lower frequencies).

Tuning control: frequency control mechanism provides a main dial calibrated in megahertz and a vernier dial for interpolation purposes; total scale length, approximately 45 inches; calibration, every other megahertz 130 to 270 MHz; every 5 MHz above 270 MHz.

Crystal calibrator: provides frequency check points every 1 MHz up to 270 MHz or every 5 MHz over the range of the instrument; headphone jack provided for audio frequency output (headphones not included); crystal frequency accuracy better than 0.01% at normal room temperatures; cursor on frequency dial adjustable over small range to aid in interpolation adjustment; calibrator may be turned off when not in use.

Residual FM: less than ± 5 parts in 10^7 peak.

Harmonic output: at least 35 dB below the carrier for harmonic frequencies below 500 MHz.

Output characteristics

Output level: 608E: continuously adjustable from 0.1 μ V to 1.0 volt into a 50-ohm resistive load; output attenuator calibrated in volts and dBm (0 dBm = 1 mW in 50 ohms).

608F: continuously adjustable from 0.1 μ V to 0.5 volt into a 50-ohm resistive load; output attenuator calibrated in volts and dBm (0 dBm = 1 mW in 50 ohms).

Accuracy: within ± 1 dB of attenuator dial reading at any frequency when RF Output Meter indicates "ATTENUATOR CALIBRATED."

Leveling: internal feedback circuit retains "ATTENUATOR CALIBRATED" reference on RF Output Meter over wide frequency ranges (typically octave bands); adjustment of front panel AMP. TRIMMER control (only) for maximum RF output indication automatically restores initial carrier level for greater frequency changes.

Impedance: 50 Ω with a maximum SWR of 1.2 for attenuator setting below -7 dBm.

RFI: meets all conditions specified in MIL-I-6181D; permits receiver sensitivity measurements down to at least 1.0 μ V.

Auxiliary RF output: 608E: fixed level CW signal from RF Oscillator (minimum amplitude 180 mV rms into 50 ohms) provided at front panel BNC female connector for use with external equipment (e.g., frequency counter).

608F: fixed level CW signal from RF Oscillator provided at front panel BNC female connector for use with HP 8708A Synchronizer or other external equipment (e.g., frequency counter). Power levels into 50 Ω are: 10 to 215 MHz, -1.8 to +7 dBm; 215 to 400 MHz, +2.0 to +6 dBm; 400 to 430 MHz +1.0 to +5 dBm.

Modulation characteristics

(Front panel AMP TRIMMER control adjusted for maximum indication on RF Output Meter and RF Output Meter set to "ATTENUATOR CALIBRATED.")

Internal AM

Frequency: 400 and 1000 Hz, $\pm 10\%$; modulation signal available at front panel BNC female connector for synchronization of external equipment.

Modulation level: 608E: 0 to 95%, modulation at carrier

levels 0.5 volt and below; continuously adjustable with front panel MOD LEVEL control.

608F: 0 to 95% modulation with Output Attenuator at 0.224 volt (1 mW) or below; continuously adjustable with front panel MOD LEVEL control.

Carrier envelope distortion: less than 2% at 30% AM and less than 5% at 70% AM.

External AM

Frequency: 20 Hz to 20 kHz.

Modulation level: 608E: 0 to 95% modulation at carrier levels of 0.5 volt and below; continuously adjustable with front panel MOD LEVEL control; input required, 1-10 volts, rms (1000 Ω input impedance).

608F: 0 to 95% modulation with Output Attenuator at 0.224 volt (1 mW) or below; continuously adjustable with front panel MOD LEVEL control; input required, 1-10 volts, rms (1000 Ω input impedance).

Carrier envelope distortion: less than 2% at 30% AM, less than 5% at 70% AM (modulation source distortion less than 0.5%).

External control of carrier level can be achieved through application of dc voltage in EXT AM mode.

Modulation meter accuracy: $\pm 5\%$ of full scale 0 to 80%, $\pm 10\%$ from 80% to 95% (for INT AM or 20 Hz to 20 kHz EXT AM).

Incidental frequency modulation (at 400 and 1000 Hz modulation): less than 1000 Hz peak at 50% AM for frequencies above 100 MHz; for frequencies below 100 MHz, less than 0.001% at 30% AM.

External pulse modulation:

Rise and decay time: from 40 MHz to 220 MHz, combined rise and decay time less than 4 μ s; above 220 MHz combined rise and decay time less than 2.5 μ s.

On-off ratio: at least 20 dB for pulsed carrier levels of 0.5 volt and above.

Input required: positive pulse, 10-50 volts peak, input impedance 2000 Ω .

General:

Power: 115 or 230 V $\pm 10\%$, 50 to 400 Hz; approximately 220 W.

Dimensions: cabinet: 13 $\frac{3}{4}$ " wide, 16 $\frac{3}{8}$ " high, 21" deep (337 x 416 x 533 mm); rack mount: 19" wide, 13-31/32" high, 18 $\frac{3}{8}$ " deep behind panel (483 x 335 x 467 mm).

Weight:

Cabinet mount: net, 62 lb (28 kg); shipping, 74 lb (33.4 kg).

Rack mount: net, 62 lb (28 kg); shipping, 83 lb (37.4 kg).

Accessories available:

11508A output cable provides 50 ohms termination and standard binding posts at the end of a 24-inch (610 mm) length of cable; allows direct connection of the signal generator to high impedance circuits. \$18.

11509A Fuse Holder provides protection for the output attenuator when the Model 608E/F is used for transmitter tests. See page 294.

10514A Mixer for use as nanosecond pulse modulator or balanced modulator. Price, \$95.

Price: Model 608E (cabinet), \$1500, Model 608ER (rack mount), \$1680; Model 608F (cabinet), \$1800, Model 608FR (rack mount), \$1840.