



# E4421A Analog RF Signal Generator, 250 kHz to 3000 MHz (Discontinued - Support Information Only)

## Data Sheet

### Frequency Specifications

**Frequency Range** Agilent ESG-3000A: 250 kHz to 3000 MHz

**Resolution:** 0.01 Hz

**Switching Speed** Modulation On: <45 ms, typical Modulation Off: <35 ms, typical

**Accuracy:** Same as timebase Sweep Modes

**Operating modes** Step: frequency & power, and arbitrary list

**Dwell Time:** 2 ms to 60 sec

**Number of Points:** 2 to 401 Internal Reference Oscillator

**Stability Standard (typical) High Stability (Opt 1E5) Aging Rate**  $\leq \pm 2$  ppm/yr  $\leq \pm 0.1$  ppm/yr or  $\leq \pm 0.0005$  ppm/day after 45 days

**Temperature**  $\leq \pm 1$  ppm  $\leq \pm 0.05$  ppm, typical ( $0^\circ$  to  $55^\circ$  C)

**Line Voltage**  $\leq \pm 0.1$  ppm  $\leq \pm 0.002$  ppm, typical (+5%, -10%) (+5%, -10%)

**Timebase Reference Output** Frequency: 10 MHz Amplitude:  $>0.35 V_{\text{rms}}$  into 50 ohm load

**External Reference Input** Frequency: 1, 2, 5, 10 MHz  $\pm$  typ. 10 ppm Option 1E5: 1 ppm, typical Amplitude:  $>0.15 V_{\text{rms}}$  Input Impedance: 50 ohm Output

**Range** 250 kHz to 1000 MHz: +13 to -136 dBm  $>1000$  MHz to 3000 MHz: +10 to -136 dBm

**Resolution** 0.02dB

**Level Accuracy<sup>1</sup> (at  $23 \pm 5^\circ$  C)** +7 to -127 dBm  $< -127$  dBm 250 kHz to 2 GHz:  $\pm 0.5$  dB  $\pm 1.5$  dB

2 GHz to 3 GHz:  $\pm 0.9$  dB  $\pm 2.5$  dB

**Attenuator Hold Level Range:**  $>17$  dB

**Switching Speed:**  $<25$  ms typical With Power Search Mode:  $<210$  ms typical

**Reverse Power Protection:** 250 kHz to 2000 MHz: 50 Watts  $>2000$  MHz to 3000 MHz: 25 Watts Max DC Voltage: 50 V

**SWR (typical)** 250 kHz to 2000 MHz:  $<1.4:1$   $>2000$  to 3000 MHz:  $<1.9:1$

**Output Impedance:** 50 ohms <sup>1</sup>Accuracy degrades by 0.02 dB/ $^\circ$ C over full temperature range and by 0.3 dB above +7 dBm.

### Frequency Bands

**Band Frequency Range** N# 1 250 kHz to  $\leq 249.999$  MHz 1 2  $>249.999$  to  $\leq 500$  MHz 0.5 3  $>500$  MHz to  $\leq 1$  GHz 1 4  $>1$  to  $\leq 2$  GHz 2 5  $>2$  to 3 GHz 4

### Spectral Purity

**SSB Phase Noise (typical, at 20 kHz offset)** at 500 MHz:  $< -120$  dBc/Hz at 1000 MHz:  $< -116$  dBc/Hz at 2000 MHz:  $< -110$  dBc/Hz at 3000 MHz:  $< -104$  dBc/Hz

**Residual FM (CWmode, 0.3-3 kHz BW, CCITT, rms):** Phase Noise Mode 1:  $< N \times 2$  Hz Phase Noise Mode 2:  $< N \times 4$  Hz

**Harmonics**  $\leq +4$  dBm output level:  $< -30$  dBc



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**Nonharmonics (>3 kHz offset, <+7dBm output level)** 250 kHz to 1000 MHz: <-65 dBc >1000 MHz to 2000 MHz: <-59 dBc >2000 MHz: <-53 dBc  
**Subharmonics** <=1000 MHz: None >1000 MHz: <-40 dBc

#### Frequency Modulation

**Maximum Deviation:**  $N \times 10$  MHz

**Resolution:** 0.1% of deviation or 1 Hz, whichever is greater

**Deviation Accuracy (1 kHz rate, dev. < $N \times 100$  kHz):**  $\pm(3.5\%$  of FM deviation + 20 Hz)

**Modulation Frequency Response(deviation = 100 kHz)**

**Path Rates 1 dB Bandwidth 3 dB Bandwidth, typical FM1** dc/20 Hz to 100kHz dc/5 Hz to 10 MHz

**FM2** dc/20Hz to 100 kHz dc/5 Hz to 1 MHz

**Distortion (1 kHz rate, THD, dev. =  $N \times 100$  kHz):** <1%

#### Phase Modulation

**Maximum Deviation:**  $N \times 90$  radians

**Resolution:** 0.1% of set deviation

**Deviation Accuracy (1 kHz rate):**  $\pm(5\%$  of deviation + 0.01 radians)

**Modulation Frequency Response**

**PM Mode Maximum Rates (3 dB BW) Deviation PM1 PM2 Normal BW**  $N \times 90$  rad dc to 100 kHz dc to 100 kHz

**High BW**  $N \times 2 \pi$  rad dc to 1.5 MHz (typ) dc to 1 MHz (typ)  $N \times \pi/2$  rad dc to 4 MHz (typ) dc to 0.9 MHz (typ)

**Distortion (1 kHz rate, THD, dev < $N \times 90$  rad):** <1% Amplitude Modulation  $f_c > 500$  kHz

**Range (envelope peak <=max specified power):** 0 to 100%

**Resolution:** 0.1%

**Rates (3 dB Bandwidth):** dc/10 Hz to 10 kHz

**Distortion(1 kHz rate, THD)** 30% AM: <1.5% 90% AM: <4%

**Accuracy(1 kHz rate):**  $\pm(5\%$  of setting + 1%)

#### Pulse Modulation

**On/Off Ratio** <=3 GHz: >80 dB

**Rise/Fall Times:** 150 ns, typical

**Minimum Width (typical) ALC On:** 2  $\mu$ s ALC Off: 0.4  $\mu$ s

**Pulse Repetition Frequency (typical) ALC On:** 10 Hz to 250 kHz ALC Off: DC to 1.0 MHz

**Level Accuracy (relative to CW):**  $\pm 0.5$  dB, typical

**Internal Pulse Generator (Squarewave only)** Squarewave Rate: 0.1 Hz to 50 kHz Pulse Period: 16  $\mu$ s to 30 seconds

Width: 8  $\mu$ s to 30 seconds Resolution: 4  $\mu$ s Internal Modulation Source Provides FM, PM, and AM Modulation Signals and LF Out **Waveforms:** sine, square, ramp, triangle, pulse, noise

**Rate Range** Sine: 0.1 Hz to 50 kHz Square, Ramp, Triangle: 0.1 Hz to 10 kHz

**Resolution:** 0.1 Hz

**Frequency Accuracy:** 0.005%

**Swept Sine Mode**(Frequency, Phase Continuous):

**Operating Modes:** Triggered or Continuous Sweeps

**Frequency Range:** 0.1 Hz to 50 kHz

**Sweep Time:** 1 ms to 65 seconds

**Resolution:** 1 ms

**Dual Sinewave Mode Frequency Range:** 0.1 Hz to 50 kHz

**Amplitude Ratio:** 0 to 100%

**Amplitude Resolution:** 0.1% LF Out (Internal Modulation Source)

**Amplitude:** 0 to 3  $V_{peak}$  into 50 ohms

**Output Impedance:** <1 ohm External Modulation Inputs

**Modulation Types:** Ext1: FM, PM, AM, and Burst Envelope Ext2: FM, PM, AM, and Pulse

**Simultaneous Modulation** All modulation types may be simultaneously enabled, except: FM with PM, AM with Burst envelope. AM, FM, and PM can sum simultaneous inputs from any two sources (INT, EXT1, and EXT2.) Any given source (INT, EXT1, or EXT2) may only be routed to one activated modulation type. Remote Programming

**Interface:** HP-IB (IEEE-488.2-1987) with Listen and Talk, RS-232

**Control Languages:** SCPI version 1992.0, also compatible with Agilent 8656B & 8657A/B/D/J mnemonics

**Functions Controlled:** All front panel functions except power switch and knobs

**IEEE-488 Functions:** SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E2



General Specifications

**Power Requirements:** 90 to 254 V; 50,60, or 400 Hz; 200 W maximum

**Operating Temperature Range:** 0 to 55° C

**Leakage:** Conducted and radiated interference meets MIL-STD-461B RE02 Part 2 and CISPR 11

**Storage Registers:** Up to 100 storage registers, up to 10 sequences available

**Weight:** <12.7 kg (28lb) net, <21 kg (46 lb.) shipping

**Dimensions:** 133 mm H x 426 mm W x 432 mm D (5.25 in H x 16.8 in W x 17 in D)

