# Agilent
# E4428C ESG
# Analog Signal Generator

Data sheet




All specifications apply over a 0 to 55 °C range (unless otherwise stated) and apply after a 45 minute warm-up time. Supplemental characteristics, denoted as typical, nominal, or measured, provide additional (non-warranted) information at 25 °C, which may be useful in the application of the product.

## Definitions

**Specifications:** Represents warranted performance.

**Typical:** Represents characteristic performance which is non-warranted. Describes performance that will be met by a minimum of 80% of all products. All typical values are indicated by parenthesis.

**Nominal:** Represents characteristic performance which is non-warranted. Represents the value of a parameter that is most likely to occur; the expected mean or average.

**Measured:** Represents characteristic performance which is non-warranted. Represents the value of a parameter measured on an instrument during design stage.

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# Key Features

## Key standard features

- Industry-leading spectral purity
- Superior level accuracy
- High output power
- High-stability timebase
- Wideband FM and ΦM
- Excellent modulation accuracy and stability
- Step and list sweep, both frequency and power
- Built-in function generator
- Lightweight, rack-mountable
- 2-year calibration cycle

## Optional performance

- Option 503, frequency range from 250 kHz to 3 GHz (electronic attenuator standard)
- Option 506, frequency range from 250 kHz to 6 GHz (mechanical attenuator only)
- Option UNB, higher output with mechanical attenuator
  ***Note:*** *Option 506 is standard with the high power mechanical attenuator used in Option UNB, and therefore, both options cannot be ordered together.*
- Option 1EM, move all front panel connectors to rear panel

# Specifications for Frequency and Power

## Frequency

**Frequency range**

| *Option* | |
|---|---|
| 503 | 250 kHz to 3 GHz [electronic attenuator standard] |
| 506 | 250 kHz to 6 GHz [mechanical attenuator only] |

| | |
|---|---|
| **Frequency minimum** | 100 kHz[1] |
| **Frequency resolution** | 0.01 Hz |

**Frequency switching speed**

| | *Option 503* | | *Option 506* | |
|---|---|---|---|---|
| | Freq.[2] | Freq./Amp.[3] | Freq.[2] | Freq./Amp.[3] |
| | (< 9 ms) | (< 9 ms) | (< 16 ms) | (< 17 ms) |
| [For hops < 5 MHz within a band] | | | | |
| | (< 9 ms) | (< 9 ms) | (< 12 ms) | (< 14 ms) |

| | |
|---|---|
| **Phase offset** | Phase is adjustable remotely [LAN, GPIB, RS-232] or via front panel in nominal 0.1 ° increments |

## Sweep modes

| | |
|---|---|
| **Operating modes** | Frequency step, amplitude step and arbitrary list |
| **Dwell time** | 1 ms to 60 s |
| **Number of points** | 2 to 65,535 (Step)<br>2 to 1601 (List) |

## Internal reference oscillator

**Stability**

| | |
|---|---|
| Aging rate | < ±0.1 ppm/yr or<br>< ±0.0005 ppm/day after 45 days |
| Temp [0 to 55 °C] | (< ±0.05 ppm) |
| Line voltage | (< ±0.002 ppm) |
| Line voltage range | (+5% to –10%) |

**RF reference input requirements**

| | |
|---|---|
| Frequency | 1, 2, 5, 10 MHz ±0.2 ppm |

**RF reference output**

| | |
|---|---|
| Frequency | 10 MHz |
| Amplitude | 4 dBm ±2 dB |

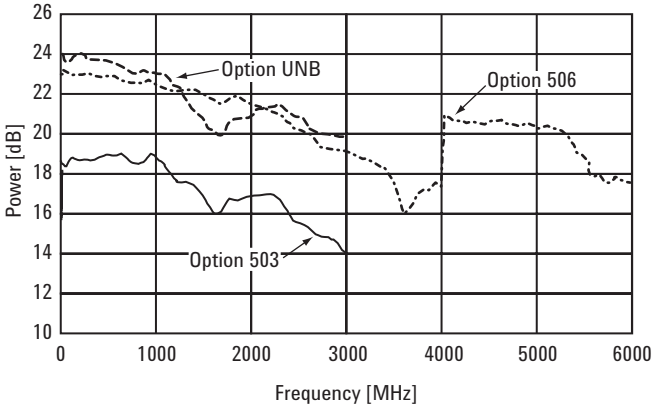
1. Performance below 250 kHz not guaranteed.
2. To within 0.1 ppm of final frequency above 250 MHz or within 100 Hz below 250 MHz.
3. Frequency switching time with the amplitude settled within ±0.1 dB.

# Specifications for Frequency and Power

## Output power

| **Power** | | *Option UNB* | |
|---|---|---|---|
| | *Option 503* | *Option 503* | *Option 506* |
| 250 kHz to 250 MHz | +11 to –136 dBm | +15 to –136 dBm | +12 to –136 dBm |
| > 250 MHz to 1 GHz | +13 to –136 dBm | +17 to –136 dBm | +14 to –136 dBm |
| > 1 to 3 GHz | +10 to –136 dBm | +16 to –136 dBm | +13 to –136 dBm |
| > 3 to 6 GHz | N/A | N/A | +10 to –136 dBm |

**Maximum available power (measured)**




| **Level resolution** | 0.02 dB |
|---|---|

**Level range with *Attenuator Hold* active**

| | | *Option UNB* | |
|---|---|---|---|
| | *Option 503* | *Option 503* | *Option 506* |
| 250 kHz to 1 GHz | 23 dB | 27 dB | 24 dB |
| > 1 to 3 GHz | 20 dB | 26 dB | 23 dB |
| > 3 to 6 GHz | N/A | N/A | 20 dB |

# Specifications for Frequency and Power

**Level accuracy** [dB]

*Option 503*[1]

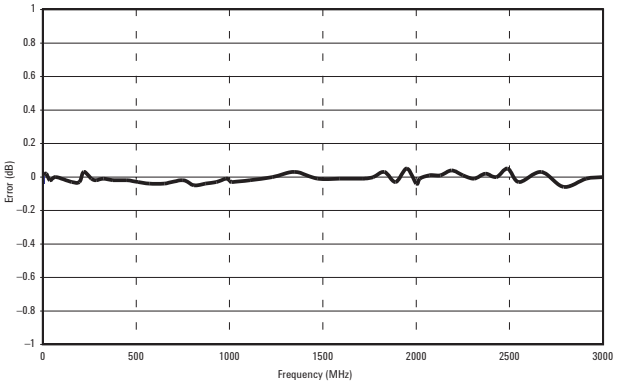
| | *Power level* | | | |
|---|---|---|---|---|
| | +7 to –50 dBm | –50 to –110 dBm | –110 to –127 dBm | < –127 dBm |
| 250 kHz to 2.0 GHz | ±0.5 | ±0.5 | ±0.7 | (±1.5) |
| 2.0 to 3 GHz | ±0.6 | ±0.6 | ±0.8 | (±2.5) |

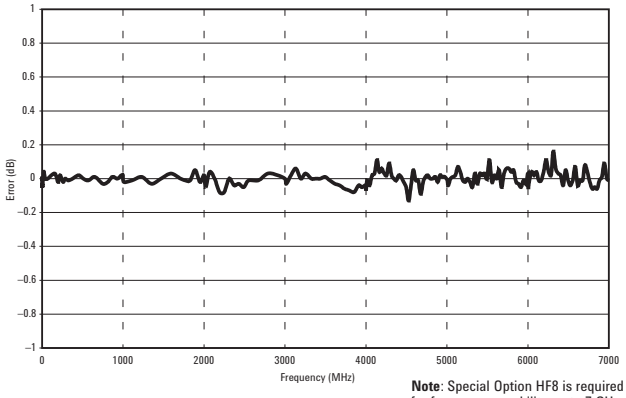
*Option UNB*[2]

| | *Power level* | | | |
|---|---|---|---|---|
| | +10 to –50 dBm | –50 to –110 dBm | –110 to –127 dBm | < –127 dBm |
| 250 kHz to 2.0 GHz | ±0.5 | ±0.7 | ±0.8 | (±1.5) |
| 2.0 to 3 GHz | ±0.6 | ±0.8 | ±1.0 | (±2.5) |

*Option 506*[3]

| | *Power level* | | | |
|---|---|---|---|---|
| | +7 to –50 dBm | –50 to –110 dBm | –110 to –127 dBm | < –127 dBm |
| 250 kHz to 2.0 GHz | ±0.6 | ±0.8 | ±0.8 | (±1.5) |
| 2.0 to 3 GHz | ±0.6 | ±0.8 | ±1.0 | (±2.5) |
| 3 to 4 GHz | ±0.8 | ±0.9 | ±1.5 | (±2.5) |
| 4 to 6 GHz | ±0.8 | ±0.9 | (±1.5) | |




**Note**: Special Option HF8 is required for frequency capability up to 7 GHz

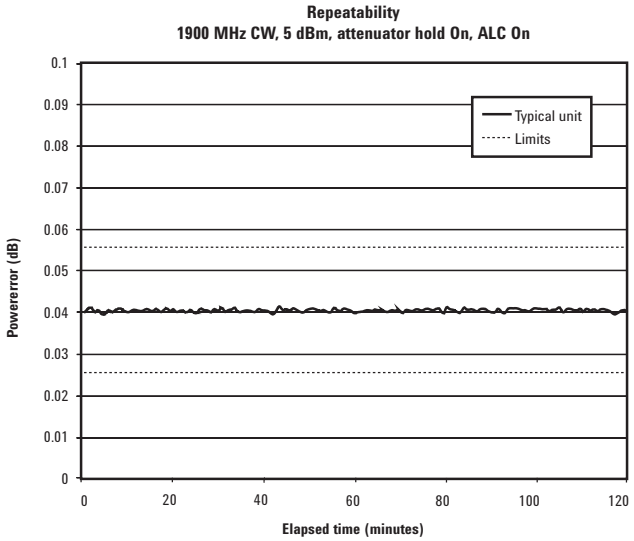
**Level accuracy with ALC off** (±0.15 dB) [relative to ALC on]
Conditions: After power search is executed.

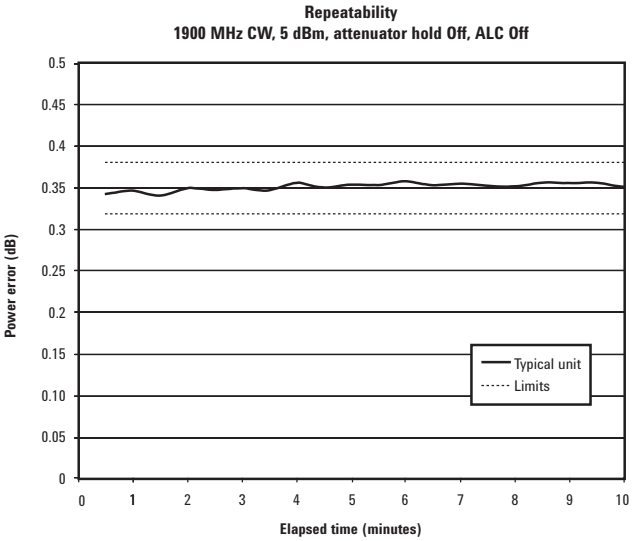
| **Level switching speed** | *Option 503* | *Option UNB* *Option 503* | *Option 506* |
|---|---|---|---|
| Normal operation [ALC on] | (< 15 ms) | (< 21 ms) | (< 21 ms) |
| When using power search manual | (< 83 ms) | (< 95 ms) | (< 95 ms) |
| When using power search auto | (< 103 ms) | (< 119 ms) | (< 119 ms) |

1. Quoted specifications for 23 °C ±5 °C. Accuracy degrades by less than 0.03 dB/°C over full temperature range. Accuracy degrades by 0.3 dB above +7 dBm, and by 0.8 dB above +10 dBm.
2. Quoted specifications for 23 °C ±5 °C. Accuracy degrades by less than 0.03 dB/°C over full temperature range. Accuracy degrades by 0.2 dB above +10 dBm, and by 0.8 dB above +13 dBm.
3. Quoted specifications for 23 °C ±5 °C. Accuracy degrades by less than 0.02 dB/°C over full temperature range. Accuracy degrades by 0.2 dB above +7 dBm.

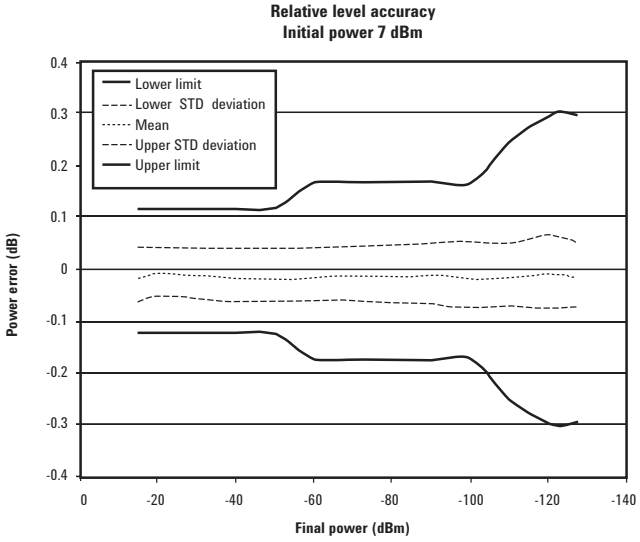
# Specifications for Frequency and Power

## Repeatability and linearity




**Repeatability measures the ability of the instrument to return to a given power setting after a random excursion to any other frequency and power setting. It is a relative measurement that reflects the difference in dB between the maximum and minimum power readings for a given setting over a specific time interval. It should not be confused with absolute power accuracy, which is measured in dBm.**[1]

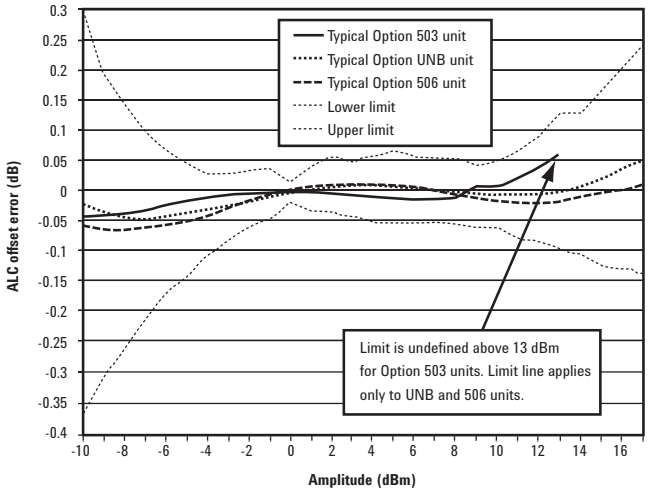



**Relative level accuracy measures the accuracy of a step change from any power level to any other power level. This is useful for large changes (i.e. 5 dB steps).**[1]

1. Repeatability and relative level accuracy are typical for all frequency ranges.

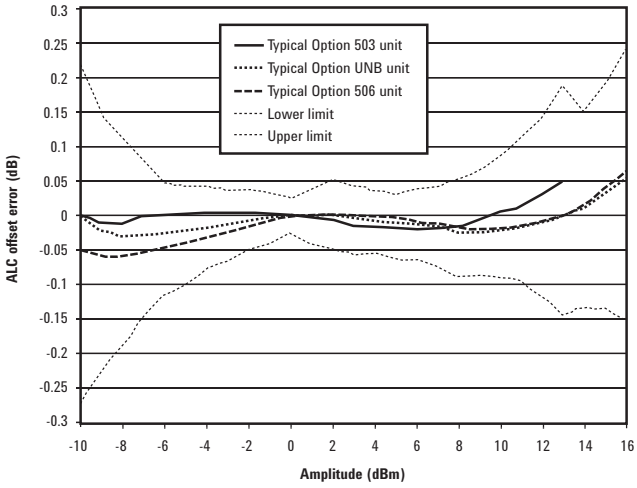
# Specifications for Frequency and Power

**Linearity**
**CW, 850 MHz, attenuator hold On, ALC On**

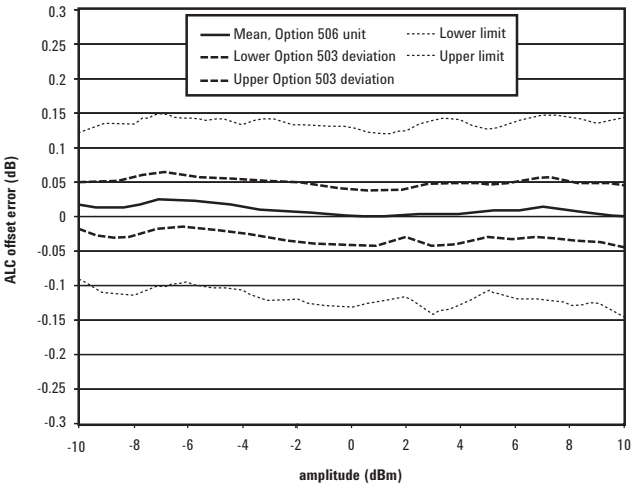



**Linearity measures the accuracy of small changes while the attenuator is held in a steady state (to avoid power glitches). This is useful for fine resolution changes.[1]**

**Linearity**
**CW, 1900 MHz, attenuator hold On, ALC On**




**Linearity**
**CW 5750 MHz, attenuator hold On, ALC On**




1. Repeatability and relative level accuracy are typical for all frequency ranges.

# Specifications for Frequency and Power

## Spectral purity

**SSB Phase noise** [at 20 kHz offset]

| | |
|---|---|
| at 500 MHz | < –135 dBc/Hz, (< –138 dBc/Hz) |
| at 1 GHz | < –130 dBc/Hz, (< –134 dBc/Hz) |
| at 2 GHz | < –124 dBc/Hz, (< –128 dBc/Hz) |
| at 3 GHz | < –121 dBc/Hz, (< –125 dBc/Hz) |
| at 4 GHz | < –118 dBc/Hz, (< –122 dBc/Hz) |
| at 6 GHz | < –113 dBc/Hz, (< –117 dBc/Hz) |

**Residual FM** [CW mode, 0.3 to 3 kHz BW, CCITT, rms]
< N x 1 Hz (< N x 0.5 Hz)[1]

**Harmonics**[2] [output level ≤ +4 dBm Option 503, ≤ +7.5 dBm Option UNB, ≤ +4.5 dBm Option 506] < –30 dBc above 1 GHz, (< –30 dBc 1 GHz and below)

**Nonharmonics**[3] [≤ +7 dBm output level decreases, ≤ +4 dBm Option 506][4]

| | > 3 kHz offset | > 10kHz offset |
|---|---|---|
| 250 kHz to 250 MHz | < –65 dBc | (< –58 dBc) |
| 250 MHz to 500 MHz | < –80 dBc | < –80 dBc |
| 500 MHz to 1 GHz | < –80 dBc | < –80 dBc |
| 1 to 2 GHz | < –74 dBc | < –74 dBc |
| 2 to 4 GHz | < –68 dBc | < –68 dBc |
| 4 to 6 GHz | < –62 dBc | < –62 dBc |

**Subharmonics**

| | |
|---|---|
| ≤ 1 GHz | None |
| > 1 GHz | None |

**Jitter in µUI**[5,6]

| *Carrier frequency* | *SONET/SDH data rates* | *rms jitter bandwidth* | *(µUI rms)* |
|---|---|---|---|
| 155 MHz | 155 MB/s | 100 Hz to 1.5 MHz | (78) |
| 622 MHz | 622 MB/s | 1 kHz to 5 MHz | (46) |
| 2.488 GHz | 2488 MB/s | 5 kHz to 15 MHz | (74) |

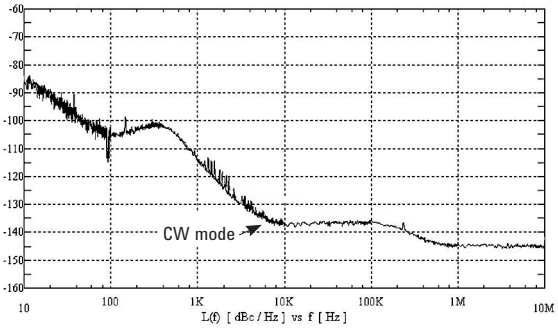
**Jitter in seconds**

| *Carrier frequency* | *SONET/SDH data rates* | *rms jitter bandwidth* | |
|---|---|---|---|
| 155 MHz | 155 MB/s | 100 Hz to 1.5 MHz | (0.6 ps) |
| 622 MHz | 622 MB/s | 1 kHz to 5 MHz | (74 fs) |
| 2.488 GHz | 2488 MB/s | 5 kHz to 15 MHz | (30 fs) |

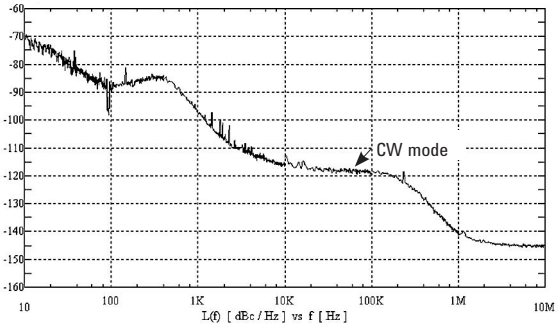
1. Refer to frequency bands on page 11 for N values.
2. Harmonic performance outside the operating range of the instrument is typical.
3. Spurs outside the operating range of the instrument are not specified.
4. Specifications apply for CW mode only.
5. Calculated from phase noise performance in CW mode only at -2.5 dBm for Option 503 instruments, -0.5 dBm with Option 506, and +2.5 dBm with Option UNB.
6. For other frequencies, data rates, or bandwidths, wplease contact your sales representative.

# Specifications for Frequency and Power

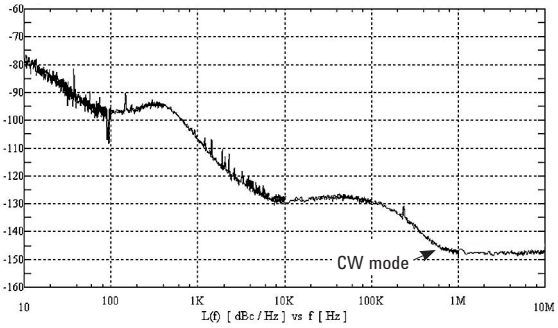
**Characteristic SSB phase noise (measured)**



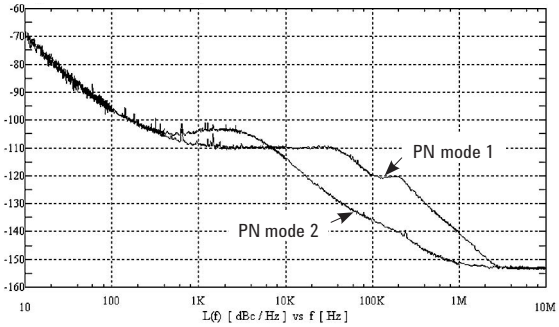

**fc = 850 MHz**



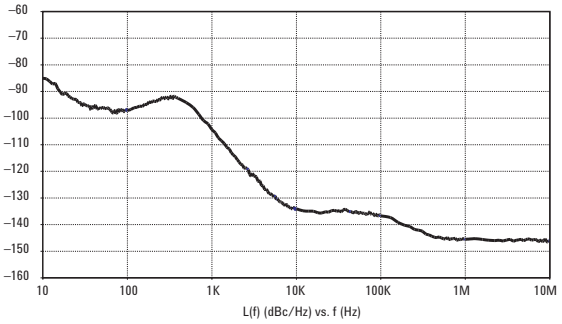

**fc = 5.7 GHz [Option 506]**



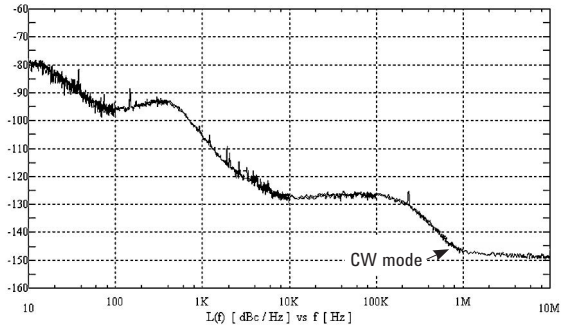

**fc = 1900 MHz**




**Phase noise modes 1 and 2 at fc = 900 MHz**




**fc = 1000 MHz**




**fc = 2200 MHz**

# Specifications for Analog Modulation

## Frequency bands

| *Band* | *Frequency range* | *N number* |
|---|---|---|
| 1 | 250 kHz to ≤ 250 MHz | 1 |
| 2 | > 250 MHz to ≤ 500 MHz | 0.5 |
| 3 | > 500 MHz to ≤ 1GHz | 1 |
| 4 | > 1 to ≤ 2 GHz | 2 |
| 5 | > 2 to ≤ 4 GHz | 4 |
| 6 | > 4 to ≤ 6 GHz | 8 |

## Frequency modulation[1]

**Maximum deviation**[2]

N x 1 MHz

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

**Modulation frequency rate** [deviation = 100 kHz]

| *Coupling* | *1 dB bandwidth* | *3 dB bandwidth* |
|---|---|---|
| FM path 1[DC] | DC to 100 kHz | (DC to 10 MHz) |
| FM path 2 [DC] | DC to 100 kHz | (DC to 0.9 MHz) |
| FM path 1 [AC] | 20 Hz to 100 kHz | (5 Hz to 10 MHz) |
| FM path 2 [AC] | 20 Hz to 100 kHz | (5 Hz to 0.9 MHz) |

**Deviation accuracy**[2] [1 kHz rate, deviation < N x 100 kHz]

< ± 3.5% of FM deviation + 20 Hz

**Carrier frequency accuracy relative to CW in DCFM**[2,3]

±0.1% of set deviation + (N x 1 Hz)

**Distortion**[2] [1 kHz rate, dev.= N x 100 kHz]

< 1%

**FM using external inputs 1 or 2**

Sensitivity 1 $V_{peak}$ for indicated deviation

Input impedance 50 Ω, nominal

FM path 1 and FM path 2 are summed internally for composite modulation. The FM 2 path is limited to a maximum rate of 1 MHz. The FM 2 path must be set to a deviation less than FM 1 path.

1. All analog performance above 3 GHz is typical.
2. Refer to frequency bands on this page to compute specifications.
3. At the calibrated deviation and carrier frequency, within 5 °C of ambient temperature at time of calibration.

# Specifications for Analog Modulations

## Phase modulation[1]

**Resolution** 0.1% of set deviation

**Modulation frequency response**[2]

| *Mode* | *Maximum deviation* | *Allowable rates [3 dB BW] ØM path 1* | *ØM path 2* |
|---|---|---|---|
| Normal BW | N x 10 radians | DC to 100 kHz | DC to 100 kHz |
| High BW | N x 1 radians | (DC to 1 MHz) | (DC to 0.9 MHz) |

**Deviation accuracy** [1 kHz rate, Normal BW mode]
< ±5% of deviation + 0.01 radians

**Distortion**[2] [1 kHz rate, deviation, < 10N radians, Normal BW mode]
< 1%

**ØM using external inputs 1 or 2**

| | |
|---|---|
| Sensitivity | 1 $V_{peak}$ for indicated deviation |
| Input impedance | 50 Ω, nominal |
| Paths | ØM path 1 and ØM path 2 are summed internally for composite modulation. The ØM 2 path is limited to a maximum rate of 1 MHz. ØM path 2 must be set to a deviation less than the ØM path 1. |

1. All analog performance above 3 GHz is typical.
2. Refer to frequency bands on page 11 for N.
3. Bandwidth is automatically selected based on deviation.

# Specifications for Analog Modulations

**Amplitude modulation**[1, 2]
[fc > 500 kHz]

| | | |
|---|---|---|
| **Range** | 0 to 100% | |
| **Resolution** | 0.1% | |
| **Rates** [3 dB bandwidth] | | |
| DC coupled | 0 to 10 kHz | |
| AC coupled | 10 Hz to 10 kHz | |
| **Accuracy**[2,3] | 1 kHz rate | < ±(6% of setting +1%) |
| **Distortion**[2,3] [1 kHz rate, THD] | | |
| | *Option 503* | *Option 506* |
| 30% AM | < 1.5% | < 1.5% |
| 90% AM | (< 4%) | (< 5%) |
| **AM using external inputs** 1 or 2 | | |
| Sensitivity | 1 $V_{peak}$ to achieve indicated depth | |
| Input impedance | 50 Ω, nominal | |
| Paths | AM path 1 and AM path 2 are summed internally for composite modulation. | |

1. All analog performance above 3 GHz is typical.
2. AM is typical above 3 GHz.
3. Peak envelope power of AM must be 3 dB less than maximum output power below 250 MHz.

# Specifications for Analog Modulation

## Pulse modulation

| | |
|---|---|
| **On/off ratio** | |
| ≤ 4 GHz | > 80 dB |
| > 4 GHz | (> 64 dB) |
| **Rise/fall times** | (150 ns) |
| **Minimum width** | |
| ALC on | (2 µs) |
| ALC off | (0.4 µs) |
| **Pulse repetition frequency** | |
| ALC on | (10 Hz to 250 kHz) |
| ALC off | (DC to 1.0 MHz) |
| **Level accuracy**[1] | [relative to CW at ≤ 4 dBm Option 503, ≤ 7.5 dBm Option UNB, ≤ 4.5 dBm Option 506] (< ±1 dB) |
| **Pulse modulation using external inputs** | |
| Input voltage | |
| RF on | > +0.5 V, nominal |
| RF off | < +0.5 V, nominal |
| Input impedance | 50 Ω, nominal |
| **Internal pulse generator** | |
| Square wave rate | 0.1 Hz to 20 kHz |
| Pulse | |
| Period | 8 µs to 30 seconds |
| Width | 4 µs to 30 seconds |
| Resolution | 2 µs |

1. With ALC off, specifications apply after the execution of power search. With ALC on, specifications apply for pulse repetition rates ≤ 10 kHz and pulse widths ≥ 5 µs.

# Specifications for Analog Modulation

**Internal analog modulation source**
[Provides FM, AM, pulse, and phase modulation signals and LF audio out]

| | |
|---|---|
| **Waveforms** | sine, square, ramp, triangle, pulse, noise |
| **Rate range** | |
| Sine | 0.1 Hz to 100 kHz |
| Square, ramp, triangle | 0.1 Hz to 20 kHz |
| **Resolution** | 0.1 Hz |
| **Frequency accuracy** | same as RF reference source |
| **Swept sine mode** [frequency, phase continuous] | |
| Operating modes | Triggered or continuous sweeps |
| Frequency range | 0.1 Hz to 100 kHz |
| Sweep time | 1 ms to 65 sec |
| Resolution | 1 ms |
| **Dual sinewave mode** | |
| Frequency range | 0.1 Hz to 100 kHz |
| Amplitude ratio | 0 to 100% |
| Amplitude ratio resolution | 0.1% |
| **LF audio out mode** | |
| Amplitude | 0 to 2.5 $V_{peak}$ into 50 Ω |
| Output impedance | 50 Ω nominal |
| **Noise** | |
| Noise with adjustable amplitude generated as a peak-to-peak value (RMS value is approximately 80% of displayed value) | |

**External modulation inputs**

| | |
|---|---|
| **Modulation types** | |
| Ext 1 | FM, ØM, AM, pulse |
| Ext 2 | FM, ØM, AM, and pulse |

High/Low Indicator [100 Hz to 10 MHz BW, AC coupled inputs only]. Activated when input level error exceeds 3% [nominal].

# Specifications for Analog Modulation

**Composite modulation**

AM, FM, and ØM each consist of two modulation paths which are summed internally for composite modulation. The modulation sources may be any two of the following: Internal, External 1, External 2.

**Simultaneous modulation**

Multiple modulation types may be simultaneously enabled. For example, AM, and FM can run concurrently and all will affect the output RF. This is useful for simulating signal impairments. There are some exceptions: FM and ØM cannot be combined. Two modulation types cannot be generated simultaneously by the same modulation source.

# General Characteristics

## Operating characteristics

| | |
|---|---|
| **Power requirements** | 90 to 254 V; 50 or 60 Hz; 300 W maximum, power factor corrected. Not for 400 Hz use.[1] |
| **Operating temperature range**[2] | 0 to 55 °C |
| **Storage temperature range** | –40 to 70 °C |
| **Shock and vibration** | Meets MIL-STD-28800E Type III, Class 3. |
| **Leakage** | Conducted and radiated emissions conform to CISPR 11.<br><br>Leakage is typically < 1 µV [nominally 0.1 µV with a 2-turn loop] at ≤ 1000 MHz, measured with a resonant dipole antenna, one inch from any surface with output level < 0 dBm [all inputs/outputs properly terminated]. |
| **Storage registers** | Memory is shared by instrument states, user data files, sweep list files and waveform sequences. Depending on the number and size of these files, up to 100 storage registers and 1000 register sequences [10 per register] are available. |
| **Weight** | < 16 kg [35 lb.] net, < 23 kg [50 lb.] shipping |
| **Dimensions** | 133 mm H x 426 mm W x 432 mm D<br>[5.25 in H x 16.8 in W x 17 in D] |
| **Remote programming** | |
| Interface | GPIB [IEEE-488.2-1987] with listen and talk, RS-232, LAN [10BaseT]. |
| Control languages[3] | SCPI version 1996.0, also compatible with 8662A, 8663A, 8656B and 8657A/B/C/D/J1 mnemonics. |
| Functions controlled | All front panel functions except power switch and knob. |
| **ISO compliant** | The E4428C ESG is manufactured in an ISO-9001 registered facility in concurrence with Agilent Technologies commitment to quality. |

**Reverse power protection**

| | *Option 503* | *Option 506* |
|---|---|---|
| 250 kHz to 2 GHz | 47 dBm | 30 dBm |
| > 2 to 4 GHz | 44 dBm | 30 dBm |
| > 4 to 6 GHz | N/A | 30 dBm |
| Max DC voltage | 40 V | |

**SWR**

| | *Option 503* | *Option UNB* | *Option 506* |
|---|---|---|---|
| 250 kHz to 2.2 GHz | (< 1.5:1) | (< 1.5:1) | (< 1.6:1) |
| > 2.2 GHz to 3 GHz | (< 1.4:1) | (< 1.5:1) | (< 1.4:1) |
| > 3 GHz to 4 GHz | (< 1.5:1) | (< 1.7:1) | (< 1.7:1) |
| > 4 GHz to 6 GHz | N/A | N/A | (< 1.8:1) |

| | |
|---|---|
| **Output impedance** | 50 Ω nominal |

1. For 400 Hz systems, order transformer 70001-60066.
2. Save and recall of user files and instrument states from non-volatile storage is guaranteed only over the range 0 to 40 °C.
3. ESG series does not implement 8657A/B "Standby" or "On" [R0 or R1, respectively] mnemonics.

# General Characteristics

## Accessories

| | |
|---|---|
| **Transit case** | Part number 9211-1296 |

## Inputs and outputs

All front panel connectors can be moved to rear with Option 1EM.

| | |
|---|---|
| 10 MHz input | Accepts a 1, 2, 5, or 10 MHz ±0.2 ppm. Nominal input level –3.5 to +20 dBm, impedance 50 ohms. [BNC, rear panel] |
| 10 MHz output | Outputs the 10 MHz reference signal. Level nominally +3.9 dBm ±2 dB. Nominal output impedance 50 ohms. [BNC, rear panel] |
| External 1 input | This BNC input connector accepts a ±1 $V_{peak}$ signal for AM, FM, pulse, and phase modulation. For all these modulations, ±1 $V_{peak}$ produces the indicated deviation or depth. When ac-coupled inputs are selected for AM, FM, or phase modulation and the peak input voltage differs from 1 $V_{peak}$ by more than 3%, the hi/lo annunciator light on the display. The input impedance is 50 ohms and the damage levels are 5 $V_{rms}$ and 10 $V_{peak}$. If you configure your signal generator with Option 1EM, this input is relocated to a female BNC connector on the rear panel. |
| External 2 input | This BNC input connector accepts a ±1 $V_{peak}$ signal for AM, FM, phase modulation, and pulse modulation. With AM, FM, or phase modulation, ±1 $V_{peak}$ produces the indicated deviation or depth. With pulse modulation, +1 V is on and 0 V is off. When ac-coupled inputs are selected for AM, FM, or phase modulation, and the peak voltage differs from 1 $V_{peak}$ by more than 3%, the hi/lo annunciator light on the display. The input impedance is 50 ohms and the damage levels are 5 $V_{rms}$ and 10 $V_{peak}$ If you configure your signal generator with Option 1EM, this input is relocated to a female BNC connector on the rear panel. |
| GPIB | Allows communication with compatible devices. [rear panel] |
| LF output | Outputs the internally-generated LF source. Outputs 0 to 2.5 $V_{peak}$ into 50 ohms, or 0 to 5 $V_{peak}$ into high impedance. [BNC, front panel] |
| RF output | Nominal output impedance 50 ohms. [type-N female, front panel] |
| Sweep output | Generates output voltage, 0 to +10 V when signal generator is sweeping. Output impedance < 1 ohm, can drive 2000 ohms. [BNC, rear panel] |
| Trigger input | Accepts CMOS[1] signal for triggering point-to-point in manual sweep mode, or to trigger start of LF sweep. The damage levels are –0.5 to +5.5 V. [BNC, rear panel] |
| Trigger output | Outputs a TTL signal: high at start of dwell, or when waiting for point trigger in manual sweep mode; low when dwell is over or point trigger is received, high or low 2 µs pulse at start of LF sweep. [BNC, rear panel] |

1. Rear panel inputs and outputs are 3.3 V CMOS, unless indicated otherwise. CMOS inputs will accept 5 V CMOS, 3 V CMOS, or TTL voltage levels.

**LAN connector**

LAN communication is supported by the signal generator via the LAN connector. It is functionally equivalent to the GPIB connector. The LAN connector enables the signal generator to be remotely programmed by a LAN-connected computer. The distance between a computer and the signal generator is limited to 100 meters [10BaseT]. For more information about the LAN, refer to the *Getting Started* chapter in the *Programming Guide*.

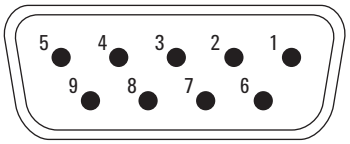
*Data transfer speeds*

| | | |
|---|---|---|
| LAN [FTP] | file transfer to volatile memory | (700 KB/sec) |
| | to hard drive | (500 KB/sec) |
| LAN [SCPI] | command transfer to volatile memory | (146 KB/sec) |
| | to hard drive | (128 KB/sec) |
| Internal file transfer from hard drive to volatile memory | | (1280 KB/sec) |

**RS-232 connector**

This male DB-9 connector is an RS-232 serial port that can be used for controlling the signal generator remotely. It is functionally equivalent to the GPIB connector. The following table shows the description of the pinouts. The pin configuration is shown below.

| *Pin number* | *Signal description* | *Signal name* |
|---|---|---|
| 1 | No connection | |
| 2 | Receive data | RECV |
| 3 | Transmit data | XMIT |
| 4 | +5 V | |
| 5 | Ground, 0 V | |
| 6 | No connection | |
| 7 | Request to send | RTS |
| 8 | Clear to send | CTS |
| 9 | No connection | |




**View looking into rear panel connector**

# Ordering Information[1]

### Frequency options

- E4428C-503 250 kHz to 3 GHz frequency range [electronic attenuator standard]
- E4428C-506 250 kHz to 6 GHz frequency range [mechanical attenuator only]

### Performance enhancement options

- E4428C-UNB High output power with mechanical attenuator
  ***Note:*** *Option 506 is standard with the high power mechanical attenuator used in Option UNB, and therefore, both options cannot be ordered together.*
- E4428C-1EM Moves all front panel connectors to rear

### Manual and accessories

- E4428C-1CM Rack mount kit without handles
- E4428C-1CP Rack mount kit with handles
- E4428C-1CN Front handle kit
- E4428C-CD1 CD-ROM of English user guide and assembly level service manual (standard with instrument)
- E4428C-ABA Printed English documentation set
- E4428C-0BW Service documentation, assembly level
- E4428C-UK6 Commercial calibrations certificate with test data

### Warranty and calibration plans

For more information, please visit: **www.agilent.com/find/removealldoubt**.

- Extended return-to-Agilent warranty and service
- Agilent calibration upfront plan
- Agilent calibration plus upfront plan
- Z540 calibration upfront plan

1. All options should be ordered using E4428C-xxx, where the xxx represents the option number.

# Related Literature

- *Signal Generator Spectral Purity Considerations in RF Communications Testing, Application Note 388*, Literature Number 5952-2019.
- *RF Source Basics, a self-paced tutorial (CD-ROM)*, Literature Number 5980-2060E.
- *IntuiLink Software, Data Sheet*, Literature Number 5980-3115EN.
- *Security of Agilent Signal Generators: Issues and Solutions, Application Note*, Literature Number 5989-1091EN.

## Additional Resources

**See the ESG Web page**
Get the latest news, product and support information, application literature, firmware upgrades and more. Agilent's Internet address for the ESG is:
**www.agilent.com/find/esg**

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**www.agilent.com/find/contactus**

**Americas**

| | |
|---|---|
| Canada | 877 894 4414 |
| Latin America | 305 269 7500 |
| United States | 800 829 4444 |

**Asia Pacific**

| | |
|---|---|
| Australia | 1 800 629 485 |
| China | 800 810 0189 |
| Hong Kong | 800 938 693 |
| India | 1 800 112 929 |
| Japan | 81 426 56 7832 |
| Korea | 080 769 0800 |
| Malaysia | 1 800 888 848 |
| Singapore | 1 800 375 8100 |
| Taiwan | 0800 047 866 |
| Thailand | 1 800 226 008 |

**Europe & Middle East**

| | |
|---|---|
| Austria | 0820 87 44 11 |
| Belgium | 32 (0) 2 404 93 40 |
| Denmark | 45 70 13 15 15 |
| Finland | 358 (0) 10 855 2100 |
| France | 0825 010 700*<br>*0.125 €/minute |
| Germany | 01805 24 6333*<br>*0.14 €/minute |
| Ireland | 1890 924 204 |
| Israel | 972 3 9288 504/544 |
| Italy | 39 02 92 60 8484 |
| Netherlands | 31 (0) 20 547 2111 |
| Spain | 34 (91) 631 3300 |
| Sweden | 0200-88 22 55 |
| Switzerland | 0800 80 53 53 |
| United Kingdom | 44 (0) 118 9276201 |

Other European Countries:
www.agilent.com/find/contactus
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The complete list is available at:
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