# Agilent
# N8201A Performance Downconverter
# Synthetic Instrument Module
# 3 Hz to 26.5 GHz

Data Sheet


The Agilent Technologies N8201A performance downconverter synthetic instrument module down converts a microwave signal to an IF signal providing IF output frequencies of 7.5, 21.4, and 321.4 MHz to offer three different signal bandwidth capabilities. External mixing can be utilized to downconvert microwave signals up to 110 GHz. The N8201A is based upon the industry's most accurate spectrum analyzer, the PSA Series spectrum analyzer.

Agilent's synthetic instrument family offers the highest-performing RF/MW LAN-based modular instrumentation and the smallest footprint for automated test systems (ATSs); providing the maximum flexibility and minimizing the cost of an ATS over its lifetime.

- LXI Class-A compliant
- Microwave performance similar to the E4440A PSA Series high-performance spectrum analyzer
- Coherent LO input/output port allowing a common LO signal to drive multiple downconverters
- 200 MHz wide modulation bandwidth with pre-selector off

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## Definitions and Conditions

**Specifications (spec):** Specifications describe the performance of parameters covered by the product warranty and apply over 0 to 55 °C temperature range unless otherwise noted.

**Typical (typ):** Typical describes additional product performance information that is not covered by the product warranty. It is performance beyond specifications that 80 percent of the units exhibit with a 95 percent confidence level over the temperature range of 20 to 30 °C. Typical performance does not include measurement uncertainty.

**Nominal (nom):** Nominal values indicate expected performance, or describe product performance that is useful in the application of the product, but is not covered by the product warranty. Nominal values represent the value of a parameter that is most likely to occur; they represent the expected mean or average.

The N8201A performance downconverter will meet its specifications when:

- Stored a minimum of two hours within the operating temperature range and turned on for at least 30 minutes with Auto Align On selected.
- The instrument is within its one-year calibration cycle.
- Align All Now has been performed within the past 24 hours or when the temperature changes 3 °C.
- Front panel 1st LO OUT connector terminated in 50 Ω.
- DC coupling applied if RF frequency is < 20 MHz.
- Front panel 1st and 2nd LO jumpers must be installed.

## Frequency

### Frequency range[1]

| | |
|---|---|
| DC coupled | 3 Hz to 26.5 GHz |
| AC coupled | 20 MHz to 26.5 GHz |

**Internal mixing bands preamp off**

| Internal mixing band | Specification | Harmonic mixing mode (N)[2] |
|---|---|---|
| 0 | 3 Hz to 3.045 GHz (DC coupled) | 1– |
| 0 | 20 MHz to 3.045 GHz (AC coupled) | 1– |
| 1 | 3.045 to 6.6 GHz | 1– |
| 2 | 6.6 to 13.2 GHz | 2– |
| 3 | 13.2 to 19.2 GHz | 4– |
| 4 | 19.2 to 26.5 GHz | 4– |

**Internal mixing bands preamp on (Option 1DS)**

| Internal mixing band | Specification | Harmonic mixing mode (N)[2] |
|---|---|---|
| 0 | 100 kHz to 3.045 GHz (DC coupled) | 1– |
| 0 | 20 MHz to 3.045 GHz (AC coupled) | 1– |

**Internal mixing bands preamp on (Option 110)**

| Internal mixing band | Specification | Harmonic mixing mode (N)[2] |
|---|---|---|
| 0 | 10 MHz to 3.045 GHz (DC coupled) | 1– |
| 0 | 20 MHz to 3.045 GHz (AC coupled) | 1– |
| 1 | 3.045 to 6.6 GHz | 1– |
| 2 | 6.6 to 13.2 GHz | 2– |
| 3 | 13.2 to 19.2 GHz | 4– |
| 4 | 19.2 to 26.5 GHz | 4– |

**Internal mixing bands preselector bypassed (Option 123)**

| Internal mixing band | Specification | Harmonic mixing mode (N)[2] |
|---|---|---|
| 1 | 3.055 to 6.6 GHz | 1– |
| 2 | 6.6 to 13.2 GHz | 2– |
| 3 | 13.2 to 19.2 GHz | 4– |
| 4 | 19.2 to 26.5 GHz | 4– |

**Frequency range for external mixing (Option AYZ)**

| Band | Harmonic mixing mode (N)[1] | |
|---|---|---|
| | Preselected | Preselector bypassed |
| K (18.0 to 26.5 GHz) | N/A | 6– |
| A (26.5 to 40.0 GHz) | 8+ | 8– |
| Q (33.0 to 50.0 GHz) | 10+ | 10– |
| U (40.0 to 60.0 GHz) | 10+ | 10– |
| V (50.0 to 75.0 GHz) | 14+ | 14– |
| E (60.0 to 90.0 GHz) | N/A | 16– |
| W (75.0 to 110.0 GHz) | N/A | 18– |
| F (90.0 to 140.0 GHz) | N/A | 22– |
| D (110.0 to 170.0 GHz) | N/A | 26– |
| G (140.0 to 220.0 GHz) | N/A | 32– |
| Y (170.0 to 260.0 GHz) | N/A | 38– |
| J (220.0 to 325.0 GHz) | N/A | 48– |



1. Up to 325 GHz down conversion capability with external mixers.
2. N is the harmonic mixing mode. All mixing modes are negative (as indicated by the '–'), where the desired first LO harmonic is higher than the tuned frequency by the first IF (3.9214 GHz for the 3 Hz to 3.0 GHz band, 321.4 MHz for all other bands).

## Frequency reference (internal)

| | | |
|---|---|---|
| **Accuracy** | ± [(time since last adjustment x aging rate) + temperature stability + calibration accuracy[1]] | |
| **Temperature stability** | 20 to 30 °C | ± 1 x $10^{-8}$ |
| | 0 to 55 °C | ± 5 x $10^{-8}$ |
| **Aging rate** | ±1 x $10^{-7}$/year[2] | |
| | ±5 x $10^{-10}$/day (nominal) | |
| **Settability** | ±2 x $10^{-9}$ | |
| **Warm-up and retrace[3]** | 300 s after turn on | ±1 x $10^{-7}$ of final frequency (nominal) |
| | 900 s after turn on | ±5 x $10^{-8}$ of final frequency (nominal) |
| **Achievable initial calibration accuracy[4]** | ±7 x $10^{-8}$ | |

## Frequency accuracy

±(Input RF frequency x frequency reference accuracy)

## IF output bandwidth (nominal)

| IF output | 3 dB bandwidth | Center frequency |
|---|---|---|
| 7.5 MHz | 9.25 MHz | 7.5 MHz |
| 21.4 MHz | 11 MHz | 21.4 MHz |
| 321.4 MHz | | |
| 50 MHz to 3.045 GHz | 100 MHz[5] | 300 MHz |
| 3.045 to 26.5 GHz | 40 to 80 MHz[6] | 321.4 MHz |
| Preselector bypassed (Option 123) | | |
| 3.055 to 26.5 GHz | 240 MHz | 321.4 MHz |
| External mixing | 240 MHz | 321.4 MHz |

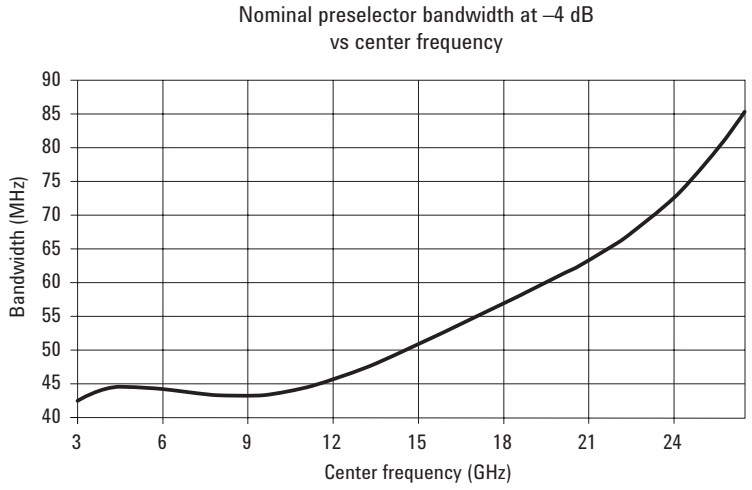



**Figure 1. Nominal preselector bandwidth at –4 dB vs center frequency**

1. Calibration accuracy depends on how accurately the frequency standard was adjusted to 10 MHz. If the calibration procedure is followed, the calibration accuracy is given by the specification "Achievable initial calibration accuracy."
2. For periods of one year or more.
3. Applies only when power is disconnected from instrument. Does not apply when instrument is in standby mode.
4. The achievable calibration accuracy at the beginning of the calibration cycle includes these effects:
   a) The temperature difference between the calibration environment and the use environment
   b) The orientation relative to the gravitation field changing between the calibration environment and the use environment
   c) Retrace effects in both the calibration environment and the use environment due to unplugging the instrument
   d) Settability
5. The IF bandwidth is 60 MHz if used at a center frequency of 321.4 MHz.
6. See figure above for nominal 4 dB IF bandwidth of preselector.

## Stability phase noise (center frequency = 1 GHz[1], best case optimization[2])

| Offset | 20 to 30 °C | 0 to 55 °C | Typical | Nominal |
|---|---|---|---|---|
| 100 Hz | –91 dBc/Hz | –90 dBc/Hz | –96 dBc/Hz | |
| 1 kHz | –103 dBc/Hz | –100 dBc/Hz | –108 dBc/Hz | |
| 10 kHz | –116 dBc/Hz | –115 dBc/Hz | –118 dBc/Hz | |
| 30 kHz | –116 dBc/Hz | –115 dBc/Hz | –118 dBc/Hz | |
| 100 kHz | –122 dBc/Hz | –121 dBc/Hz | –124 dBc/Hz | |
| 1 MHz | –145 dBc/Hz | –144 dBc/Hz | –147 dBc/Hz | –148 dBc/Hz |
| 6 MHz | –154 dBc/Hz | –154 dBc/Hz | –156 dBc/Hz | –156.5 dBc/Hz |
| 10 MHz | –156 dBc/Hz | –156 dBc/Hz | –157.5 dBc/Hz | –158 dBc/Hz |

## Nominal phase noise of different LO optimizations

Trace A: Optimize £(f) for f < 50 kHz; Dual loop wideband
Trace B: Optimize £(f) for f > 50 kHz; Dual loop narrowband
Trace C: Optimize LO for fast tuning; Single loop wideband

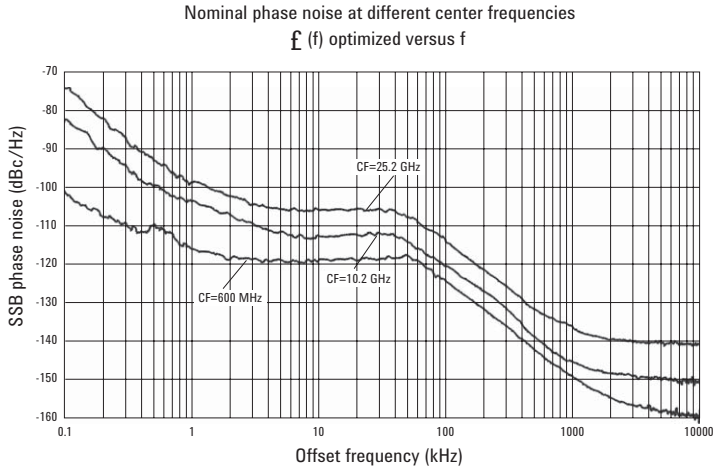



**Figure 2. Nominal phase noise at diffferent center frequencies**

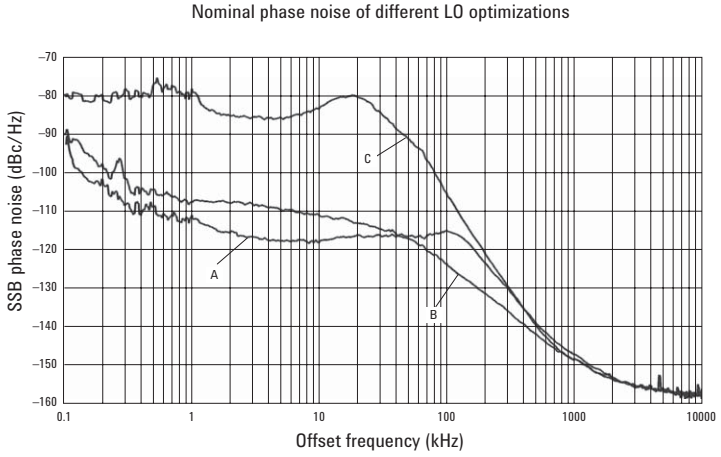





**Figure 3. Nominal phase noise at diffferent LO center frequencies**

1. Nominal changes of phase noise sidebands with other center frequencies are shown by some examples in the graphs that follow. To predict the phase noise for other center frequencies, note that phase noise at offsets above approximately 1 kHz increases nominally as 20 x log N, where N is the harmonic mixer mode. For offsets below 1 kHz, and center frequencies above 1 GHz, the phase noise increases nominally as 20 log CF, where CF is the center frequency in GHz.
2. Noise sidebands for offsets of 30 kHz and below are shown for phase noise optimization set to optimize £(f) for f < 50 kHz; for offsets of 100 kHz and above, the optimization is set for f > 50 kHz.

## Amplitude

### Maximum safe input level

| | |
|---|---|
| **Preamp off** | +30 dBm (1W) |
| **Preamp on (Option 1DS)** | +30 dBm (1W) |
| **Preamp on (Option 110)** | +25 dBm (1W) |
| **Microwave preselector bypass (Option 123)** | +10 dBm (1W)[1] |
| **Peak pulse power**<br>< 10 µs pulse width, < 1% duty cycle<br>and input attenuation ≥ 30 dB | +50 dBm (100 W) |
| **DC volts:** | |
| DC coupled | < ±0.2 Vdc |
| AC coupled | ±100 Vdc |

### Input attenuator range

0 to 70 dB in 2 dB steps

### Input attenuation switching uncertainty (nominal)

| Frequency | 0 to 40 dB attenuation range | 0 to 70 dB attenuation range |
|---|---|---|
| DC to 6.5 GHz | ±0.3 dB | ±0.4 dB |
| 6.5 to 13 GHz | ±0.4 dB | ±0.5 dB |
| 13 to 19 GHz | ±0.6 dB | ±0.7 dB |
| 19 to 26.5 GHz | ±0.7 dB | ±0.9 dB |



1. Adding 20 dB of input attenuation will increase the maximum input power to +30 dBm.

## Gain compression[1]

**1 dB gain compression point (two-tone)[2]**

| RF input frequency | Maximum power at mixer[3] | Nominal power at mixer |
|---|---|---|
| Preamp off | | |
| 20 to 200 MHz | 0 dBm | +3 dBm |
| 200 MHz to 3.0 GHz | +3 dBm | +7 dBm |
| 3.0 to 6.6 GHz | +3 dBm | +4 dBm |
| 6.6 to 26.5 GHz | –2 dBm | 0 dBm |
| Preselector bypassed (Option 123) | | |
| 3.045 to 26.5 GHz | | +8 dBm |
| Preamp on (Option 1DS) | | Nominal power at preamp |
| 10 to 200 MHz | | –30 dBm |
| 200 MHz to 3 GHz | | –25 dBm |
| Preamp on (Option 110) | | |
| 10 to 200 MHz | | –24 dBm |
| 200 MHz to 3 GHz | | –20 dBm |
| 3.0 to 6.6 GHz | | –23 dBm |
| 6.6 to 26.5 GHz | | –27 dBm |

**Gain compression (two-tone) (typical)[2]**

| RF input frequency | Mixer level[3] | Compression |
|---|---|---|
| 20 to 200 MHz | 0 dBm | < 0.5 dB |
| 200 MHz to 6.6 GHz | +3 dBm | < 0.5 dB |
| 6.6 to 26.5 GHz | –2 dBm | < 0.4 dB |

## Noise figure

(Input terminated, 0 dB input attenuation)

| Frequency | Noise figure | Noise figure (typical) | Input referred noise density[4] (typical) |
|---|---|---|---|
| Preamp off (Option 110 not installed) | | | |
| 10 to 100 kHz | 38 dB | 34 dB | –139 (dBm/Hz) |
| 100 kHz to 1 MHz | 30 dB | 26 dB | –147 (dBm/Hz) |
| 1 to 10 MHz | 25 dB | 22 dB | –151 (dBm/Hz) |
| 10 MHz to 1.2 GHz | 22 dB | 20 dB | –153 (dBm/Hz) |
| 1.2 to 2.1 GHz | 23 dB | 21 dB | –152 (dBm/Hz) |
| 2.1 to 6.6 GHz | 24 dB | 22 dB | –151 (dBm/Hz) |
| 6.6 to 13.2 GHz | 26 dB | 21 dB | –152 (dBm/Hz) |
| 13.2 to 20 GHz | 29 dB | 26 dB | –147 (dBm/Hz) |
| 20 to 26.5 GHz | 33 dB | 30 dB | –143 (dBm/Hz) |

1. Gain compression is described by a level/compression pair where for every mixer level there is a different amount of compression. The first table labeled "1 dB compression point" indicates the signal level where you will see 1 dB of compression, where as the second table indicates the amount of compression to expect at a given signal level.
2. Large signals, even at frequencies not within the IF bandwidth, can cause in-band signals to be compressed because of two-tone gain compression. This specification tells how large an interfering signal must be in order to cause a 1 dB change in an in-band signal.
3. Mixer power level (dBm) = input power (dBm) – input attenuation (dB).
4. Input referred noise density (dBm/Hz) = thermal noise at +55 °C (dBm) + noise figure of the downconverter (dB). The noise measured at the IF output's of the downconverter will be higher due to the Conversion gain, the measurable noise density is not diminished due to this gain.

## Noise figure (continued)

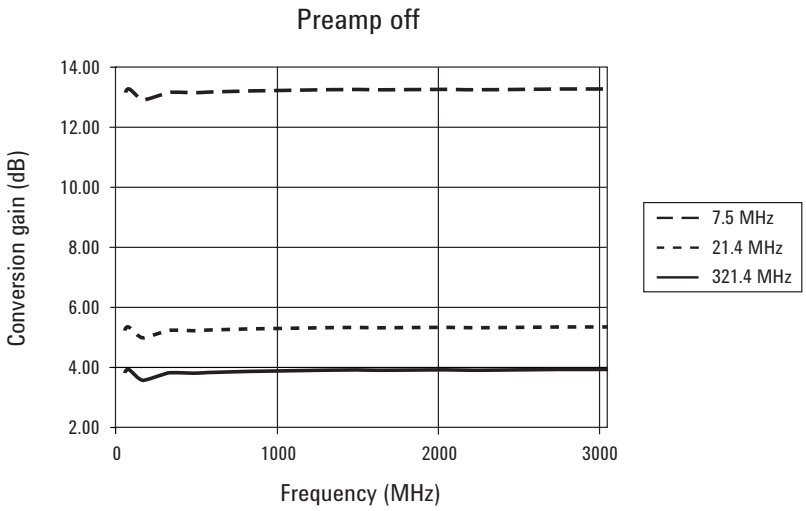
| Frequency | Noise figure | Noise figure (typical) | Input referred noise density[1] (typical) |
|---|---|---|---|
| Preamp off (Option 110 installed) | | | |
| 10 to 100 kHz | 38 dB | 34 dB | –139 (dBm/Hz) |
| 100 kHz to 1 MHz | 30 dB | 26 dB | –147 (dBm/Hz) |
| 1 to 10 MHz | 25 dB | 22 dB | –151 (dBm/Hz) |
| 10 MHz to 1.2 GHz | 23 dB | 20 dB | –153 (dBm/Hz) |
| 1.2 to 2.1 GHz | 24 dB | 21 dB | –152 (dBm/Hz) |
| 2.1 to 6.6 GHz | 25 dB | 22 dB | –151 (dBm/Hz) |
| 6.6 to 13.2 GHz | 27 dB | 25 dB | –146 (dBm/Hz) |
| 13.2 to 16 GHz | 30 dB | 28 dB | –143 (dBm/Hz |
| 16 to 19 GHz | 30 dB | 27 dB | –144 (dBm/Hz) |
| 19 to 26.5 GHz | 34 dB | 31 dB | –140 (dBm/Hz) |
| Preamp on (Option 1DS) | | | |
| 100 to 500 kHz | 18 dB | 13 dB | –160 (dBm/Hz) |
| 500 kHz to 1 MHz | 15 dB | 10 dB | –163 (dBm/Hz) |
| 1 to 10 MHz | 12 dB | 7 dB | –166 (dBm/Hz) |
| 10 to 500 MHz | 7 dB | 5 dB | –168 (dBm/Hz) |
| 500 MHz to 1.1 GHz | 8 dB | 6 dB | –167 (dBm/Hz) |
| 1.1 to 2.1 GHz | 9 dB | 7 dB | –166 (dBm/Hz) |
| 2.1 to 3.0 GHz | 10 dB | 9 dB | –164 (dBm/Hz) |
| Preamp on (Option 110) | | | |
| 10 to 50 MHz | 28 dB | 21 dB | –152 (dBm/Hz) |
| 50 to 500 MHz | 23 dB | 11 dB | –162 (dBm/Hz) |
| 500 MHz to 3 GHz | 10 dB | 7 dB | –166 (dBm/Hz) |
| 3 to 6.6 GHz | 11 dB | 9 dB | –164 (dBm/Hz) |
| 6.6 to 13.2 GHz | 13 dB | 10 dB | –163 (dBm/Hz) |
| 13.2 to 16 GHz | 14 dB | 10 dB | –163 (dBm/Hz) |
| 16 to 19 GHz | 16 dB | 11 dB | –162 (dBm/Hz) |
| 19 to 26.5 GHz | 19 dB | 14 dB | –159 (dBm/Hz) |
| Preselector bypassed (Option123) (Option 110 not installed) | | | |
| > 3.05 to 6.6 GHz | 25 dB | 22 dB | –151 (dBm/Hz) |
| 6.6 to 13.2 GHz | 33 dB | 29 dB | –144 (dBm/Hz) |
| 13.2 to 19.2 GHz | 38 dB | 35 dB | –138 (dBm/Hz) |
| 19.2 to 26.5 GHz | 44 dB | 41 dB | –132 (dBm/Hz) |
| Preselector bypassed (Option123) (Option 110 installed) | | | |
| > 3.05 to 6.6 GHz | 28 dB | 24 dB | –149 (dBm/Hz) |
| 6.6 to 13.2 GHz | 36 dB | 33 dB | –140 (dBm/Hz) |
| 13.2 to 16 GHz | 40 dB | 36 dB | –137 (dBm/Hz) |
| 16 to 19.2 GHz | 40 dB | 37 dB | –136 (dBm/Hz) |
| 19.2 to 26.5 GHz | 47 dB | 46 dB | –127 (dBm/Hz) |
| Preselector bypassed (Option 123) Preamp on (Option 110) | | | |
| > 3.05 to 6.6 GHz | 16 dB | 13 dB | –160 (dBm/Hz) |
| 6.6 to 13.2 GHz | 25 dB | 22 dB | –151 (dBm/Hz) |
| 13.2 to 16 GHz | 29 dB | 28 dB | –145 (dBm/Hz) |
| 16 to 19.2 GHz | 33 dB | 32 dB | –141 (dBm/Hz) |
| 19.2 to 26.5 GHz | 40 dB | 38 dB | –135 (dBm/Hz) |



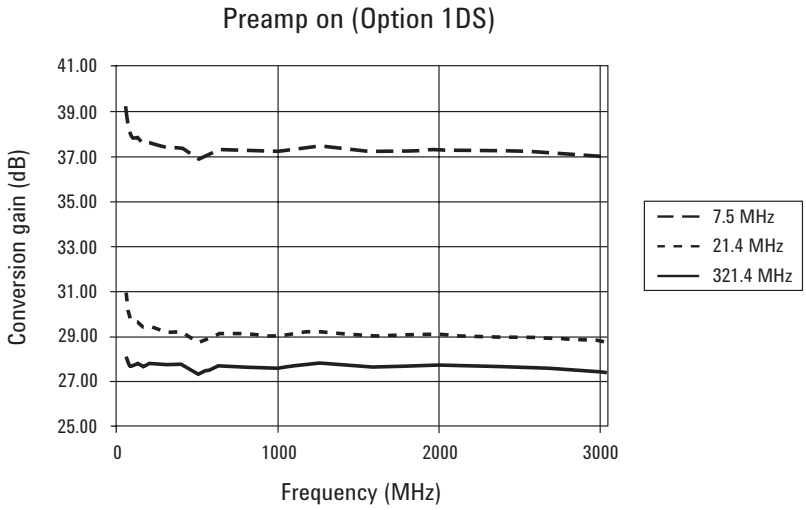
1. Input referred noise density (dBm/Hz) = thermal noise at +55 °C (dBm) + noise figure of the downconverter (dB). The noise measured at the IF output's of the downconverter will be higher due to the Conversion gain, the measurable noise density is not diminished due to this gain.

**Conversion gain**

The nominal downconverter conversion gain versus frequency for the 7.5 MHz, 21.4 MHz, and 321.4 MHz IF outputs is shown in the following graphs. All curves have 0 dB input attenuation.

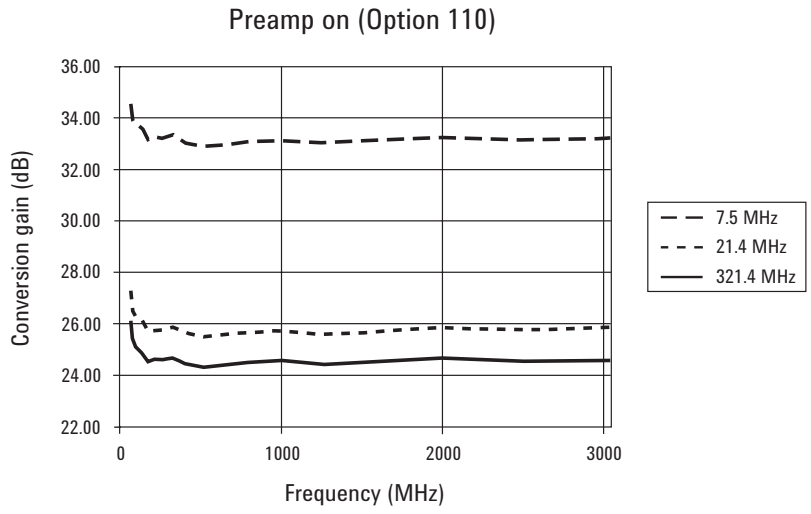



**(4a)**

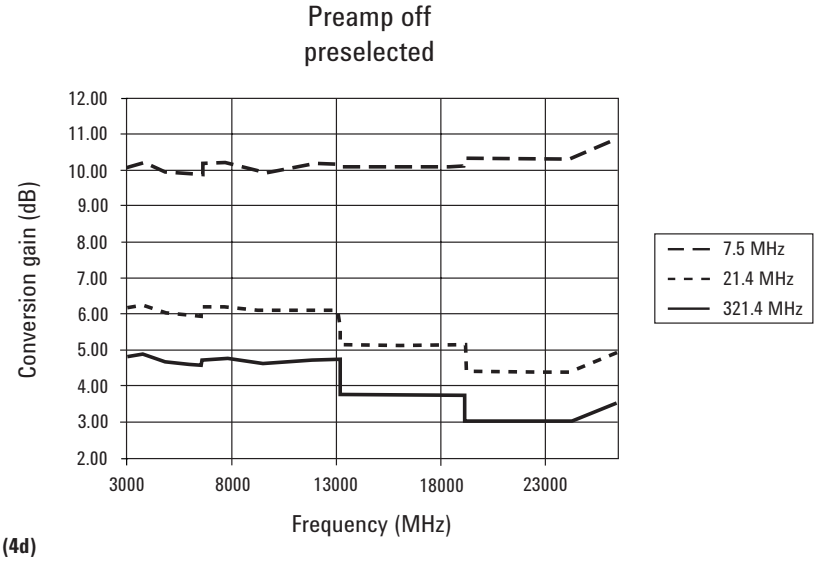



**(4b)**

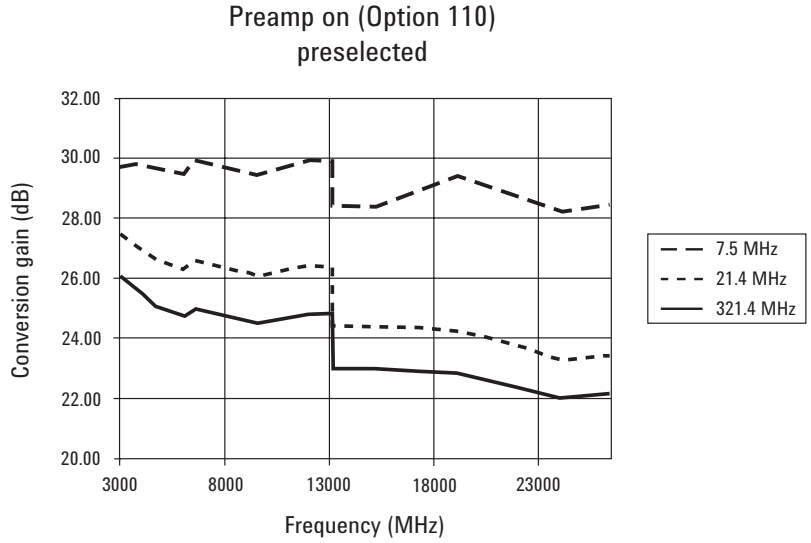
**Figure 4. Conversion gain curves (nominal)**




**(4c)**



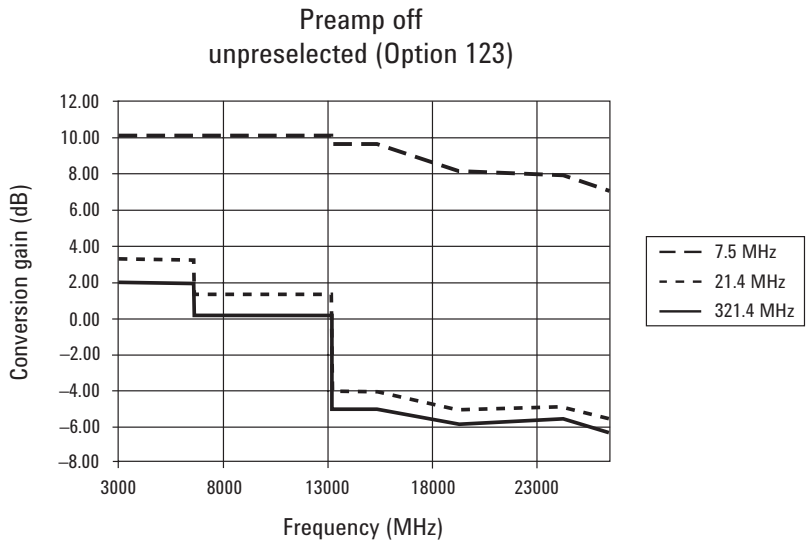

**(4d)**



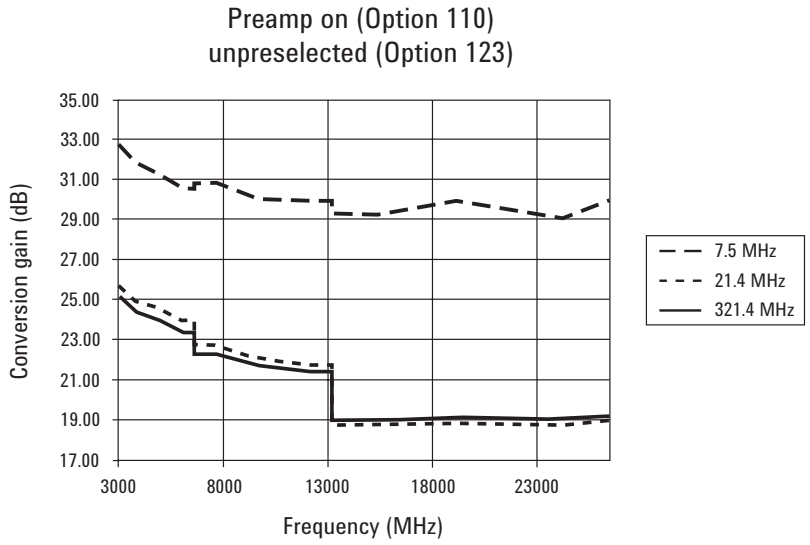



**(4e)**

**Figure 4, continued. Conversion gain curves (nominal)**




**(4f)**




**(4g)**

**Figure 4, continued. Conversion gain curves (nominal)**

### RF input VSWR at tuned frequency (nominal)

| Condition | VSWR |
|---|---|
| 10 dB attenuation, 50 MHz | < 1.07:1 |
| ≥ 8 dB input attenuation | |
| 50 MHz to 3 GHz | < 1.2:1 |
| 3 to 18 GHz | < 1.6:1 |
| 18 to 26.5 GHz | < 1.9:1 |
| 2 to 6 dB input attenuation | |
| 50 MHz to 3 GHz | < 1.6:1 |
| 3 to 26.5 GHz | < 1.9:1 |
| 0 dB input attenuation | |
| 50 MHz to 3 GHz | < 1.9:1 |
| 3 to 26.5 GHz | < 1.9:1 |
| Preamp on (Option 1DS) | |
| < 10 dB input attenuation | |
| 50 MHz to 3 GHz | < 1.5:1 |
| ≥ 10 dB input attenuation | |
| 50 MHz to 3 GHz | < 1.2:1 |
| Preamp on (Option 110) | |
| < 10 dB input attenuation | |
| 200 MHz to 6.6 GHz | < 1.5:1 |
| 6.6 to 26.5 GHz | < 1.9:1 |
| ≥ 10 dB input attenuation | |
| 200 MHz to 6.6 GHz | < 1.4:1 |
| 6.6 to 13.2 GHz | < 1.7:1 |
| 13.2 to 19.2 GHz | < 1.5:1 |
| 19.2 to 26.5 GHz | < 1.8:1 |
| Internal 50 MHz calibrator is on | Open input |
| Alignments running | Open input |

## Spurious responses

#### General spurious responses

| | |
|---|---|
| (Mixer level[1] = –40 dBm, N = LO mixing harmonic) | |
| f < 10 MHz from carrier | (–73 + 20 log N) dBc |
| f ≥ 10 MHz from carrier | (–80 + 20 log N) dBc |
| | (–90 + 20 log N) dBc typical |

#### Second harmonic distortion (SHI)

| Frequency | Mixer level[1] | Distortion | SHI |
|---|---|---|---|
| Preamp off | | | |
| 30 to 460 MHz –40 dBm | –82 dBc | +42 dBm | |
| 460 MHz to 1.18 GHz | –40 dBm | –92 dBc | +52 dBm |
| 1.18 to 1.5 GHz–40 dBm | –82 dBc | +42 dBm | |
| 1.5 to 2.0 GHz –10 dBm | –90 dBc | +80 dBm | |
| 2.0 to 13.25 GHz | –10 dBm | –100 dBc | +90 dBm |
| Preselector bypassed (Option 123) | | | |
| 10 MHz to 25 GHz | –40 dBm | –70 dBc (nominal) | +30 dBm (nominal) |
| Preamp on (Option 1DS) | Preamp level[2] | | |
| 10 MHz to 1.5 GHz | –45 dBm | –60 dBc (nominal) | +15 dBm (nominal) |
| Preamp on (Option 110) | | | |
| 10 MHz to 13.25 GHz | –45 dBm | –55 dBc (nominal) | +10 dBm (nominal) |



1. Mixer level (dBm) = input power (dBm) – input attenuation (dB).
2. Preamp level (dBm) = input power (dBm) – input attenuation (dB).

**Third-order intermodulation distortion (TOI) (nominal)**

| Frequency | Distortion | TOI[1] |
|---|---|---|
| Preamp off, preselected | Two –30 dBm tones | |
| 10 MHz to 3 GHz | –92 dBc | +16 dBm |
| 3 to 26.5 GHz | –100 dBc | +20 dBm |
| Preamp on (Option 1DS) | Two – 45 dBm tones | |
| 10 MHz to 3 GHz | –76 dBc | –7 dBm |
| Preamp on (Option 110) | Two – 45 dBm tones | |
| 10 MHz to 26.5 GHz | –74 dBc | –8 dBm |
| Preselector bypassed (Option 123) | Two –30 dBm tones | |
| 3.05 to 26.5 GHz | –100 dBc | +20 dBm |

**Other Input Related Spurious**

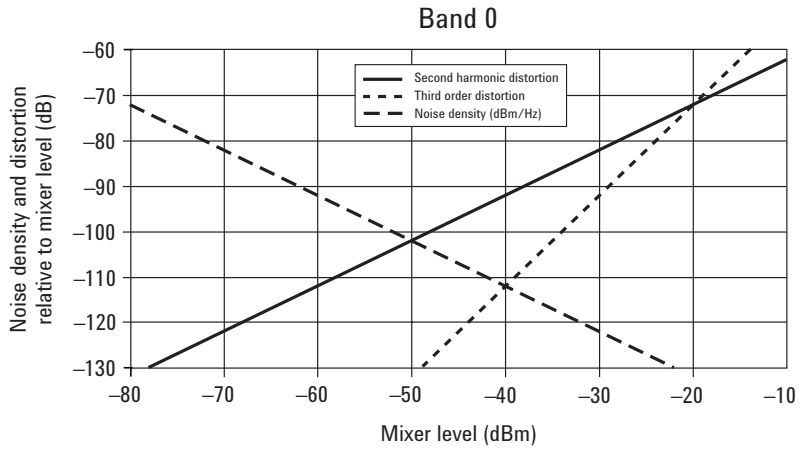
| Frequency | Mixer level[2] | Distortion |
|---|---|---|
| Images, multiples and out-of-band responses | | |
| 10 MHz to 26.5 GHz | –10 dBm | –80 dBc |

**Residual responses (nominal)**
(Input terminated and 0 dB attenuation)

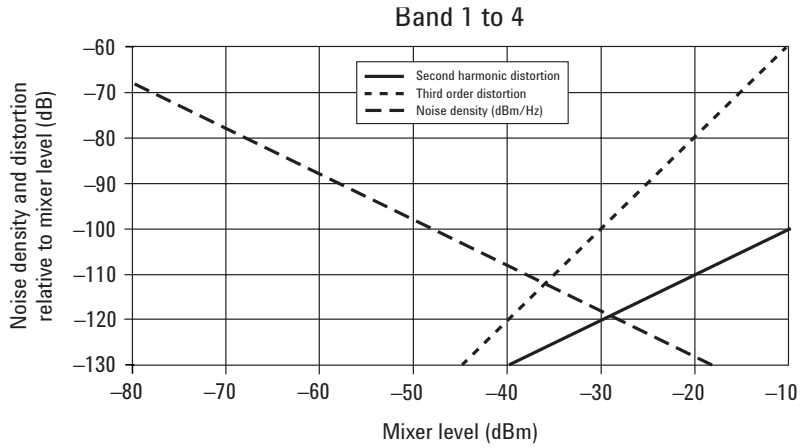
| | Input referred level (dBm)[3] | | |
|---|---|---|---|
| **Frequency Range** | **321.4 MHz IF out** | **21.4 MHz IF out** | **7.5 MHz IF out** |
| 50 MHz to 26.5 GHz | –75 | –100 | –100 |
| 50 MHz to 26.5 GHz Preamp on (Option 1DS or 110) | –90 | –100 | –100 |
| 3.045 to 26.5 GHz Preselector bypassed (Option 123) | –65 | –95 | –90 |



1. TOI = third order intercept. TOI = mixer tone level (dBm) - distortion (dBc) / 2, where distortion is the relative level of the distortion tones.
2. Mixer level (dBm) = input power (dBm) – input attenuation (dB).
3. Input referred level (dBm) = residual level at IF output (dBm) – conversion gain of downconverter (dB). This is the signal level which would be required at the input of the downconverter to create a signal at the IF output equal to the residual level.




**(5a)**




**(5b)**

**Figure 5. Nominal dynamic range**

## Preamplifier specifications

**Option 1DS**

| | |
|---|---|
| Frequency range | 100 kHz to 3 GHz |
| Gain | +28 dB (nominal) |
| Noise figure | |
| 10 MHz to 1.5 GHz | 6 dB (nominal) |
| 1.5 to 3.0 MHz | 7 dB (nominal) |

**Option 110**

| | |
|---|---|
| Frequency range | 10 MHz to 26.5 GHz |
| Gain | +27 dB (nominal) |
| Noise figure | |
| 10 to 30 MHz | 12.5 dB (nominal) |
| 30 MHz to 3 GHz | 7.8 dB (nominal) |
| 3 to 26.5 GHz | 10.3 dB (nominal) |

**Hardware settling time (nominal)[1]**

| Affected hardware | Nominal settling time |
|---|---|
| Input attenuator | 65 ms |
| Preamp (Option 110 or 1DS) | 85 ms |
| Microwave preselector (Option 123) | 25 ms |
| AC/DC coupling | 90 ms |

| Tuning | Frequency range[2] | Average | Maximum |
|---|---|---|---|
| | 3 Hz to 3.05 GHz | 175 ms | 260 ms |
| | Tuning crosses 3.05 GHz | 200 ms | 280 ms |
| | 3.05 to 26.5 GHz | 240 ms | 320 ms |

# Regulatory Compliance

## EMC

Complies with European EMC Directive 89/336/EEC, amended by 93/68/EEC

- IEC/EN 61326
- CISPR Pub 11 Group 1, Class A
- AS/NZS CISPR 11:2002
- ICES/NMB-001

## Safety

Complies with European low voltage directive 73/23/EEC, amended by 93/68/EEC

- IEC/EN 61010-1
- Canada: CSA C22.2 No. 61010-1
- USA: UL 61010-1



1. Hardware settling time is the time required for the IVI-COM driver command to return.
2. This is the frequency range containing both the initial and final RF input tuning frequencies. Example, if the previous RF input frequency is 1 GHz and the final frequency is 3 GHz, then the nominal settling time will be 175 ms.

# General Specifications

## AC power

| | |
|---|---|
| Power requirements | 100 to 120 V 50/60/400 Hz |
| | 220 to 240 V 50/60 Hz |
| Power consumption | < 260 watts, no options, < 450 watts, all options<br>Standby < 20 watts (typical) |

## Environmental

Samples of this product have been type tested in accordance with the Agilent Environmental Test Manual and verified to be robust against the environmental stresses of storage, transportation and end-use; those stresses include, but are not limited to temperature, humidity, shock, vibration, altitude, and power line conditions. Test methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3.

| | |
|---|---|
| **Operating temperature range** | 0 to 55 °C |
| **Storage temperature range** | –40 to 70 °C |
| **Humidity** | Type tested: 0 to 95% at 40 °C |
| **Altitude** | Type tested: 0m to 4600 m above mean sea level (15,000 ft) |
| **Acoustic emissions** | Type tested: $L_{NPE}$ < 55 dB(A) at 25 °C tested according to ISO 7779 |

## Shock and vibration

| | |
|---|---|
| **Operating random** | Type tested: 5 to 500 Hz, 0.21 $g_{rms}$, close in phase noise may be significantly degraded due to microphonics. |
| **Survival random vibration** | Type tested: 5 to 500 Hz, 2.09 $g_{rms}$ |
| **Survival swept sine vibration** | Type tested: 5 to 500 Hz, 0.5 $g_{peak}$ |
| **Transportation shock** | Type tested: 50 G peak trapezoidal; 337 in/sec ΔV |

## Data storage

2 MB (nominal)

## Weight

| | |
|---|---|
| Net weight | 19.0 kg (42 lbs) (nominal) |
| Shipping weight | 25.9 kg (57 lbs) (nominal) |

## Dimensions

4U, 1/2 rack width LXI module

| | |
|---|---|
| Height | 17.7 cm (7.0 in) |
| Width | 21.2 cm (8.375 in) |
| Length | 65.0 cm (25.6 in) |

## Recommended calibration cycle

The recommended calibration cycle is 12 months. Calibration services are available through Agilent service centers.

## Security

All user data is stored in volatile memory. For additional information on instrument security issues, visit:
**www.agilent.com/find/security**

## ISO compliance

This modular instrument is manufactured in an ISO-9001 registered facility in concurrence with Agilent Technologies, Inc. commitment to quality.



## Warranty

This Agilent Technologies product is warranted against defects in materials and workmanship for a period of one year from date of shipment. During the warranty period, Agilent Technologies will, at its option, either repair or replace products that are defective.

# Input/Output Descriptions

## Front panel connectors

| | | |
|---|---|---|
| RF input | | |
| Connector type | 3.5 mm male precision connector | |
| Impedance | 50 Ω (nominal) (see RF input VSWR) | |
| First LO emission level[1] | Band 0: < –120 dBm | |
| | Bands ≥ 1: < –100 dBm | |
| Reference 1-30 MHz | | |
| Connector type | SMB male | |
| Impedance | 50 Ω (nominal) | |
| Input amplitude range | –5 to +10 dBm (nominal) | |
| Input frequency | 1 to 30 MHz (nominal), selectable to 1 Hz resolution | |
| Lock range | $\pm 5 \times 10^{-6}$ of selected external reference input frequency | |
| Reference 10 MHz out (switched) | | |
| Connector type | SMB male | |
| Impedance | 50 Ω (nominal) | |
| Output amplitude | ≥ 0 dBm (nominal) | |
| Frequency | 10 MHz ± (10 MHz x frequency reference accuracy) | |
| Trigger in | | |
| Connector type | SMB male | |
| Impedance | 4 kΩ (nominal) | |
| Trigger level range | LVTTL | |
| Trigger out | | |
| Connector type | SMB male | |
| External trigger input impedance | 50 Ω (nominal) | |
| Level | 5V TTL | |
| Low level | 100 mV (nominal) (high impedance load) | |
| High level | 4.9 V (nominal) (high impedance load) | |
| | 2.4 V (nominal) (50 Ω load) | |
| 321.4 MHz IF output | | |
| Connector type | SMB male | |
| Impedance | 50 Ω (nominal) | |
| 21.4 MHz IF output | | |
| Connector type SMB male | | |
| Impedance | 50 Ω (nominal) | |
| 7.5 MHz IF output | | |
| Connector type | SMB male | |
| Impedance | 50 Ω (nominal) | |
| Ext mixer pre-sel out | | |
| Connector | SMB male | |
| Load impedance (DC coupled) | 110 Ω (nominal) | |
| Range | 0 to 10 V (nominal) | |
| Sensitivity: | | |
| External mixer | 1.5 V/GHz of tuned LO frequency (nominal) | |
| Ext mixer IF in | | |
| Connector | SMA female | |
| Impedance | 50 Ω (nominal) | |
| Center frequency | 321.4 MHz | |
| 3 dB bandwidth | 60 MHz (nominal) | |
| Maximum safe input level | +10 dBm | |
| Absolute amplitude accuracy | 20 to 30 °C | 0 to 55 °C |
| | ±1.2 dB | ±2.5 dB |
| VSWR | < 1.5:1 (nominal) | |
| 1 dB gain compression | 0 dBm (nominal) | |

1. With 10 dB attenuation.

## Front panel connectors (continued)

| | | |
|---|---|---|
| Ext mixer IF in (continued) | | |
| Mixer bias current | | |
| Range | ±10 mA | |
| Resolution | 0.01 mA | |
| Accuracy | ±0.02 mA (nominal) | |
| Output impedance | 477 Ω (nominal) | |
| Mixer bias voltage | | |
| Range | ±3.7 V (measured in an open circuit) | |
| Ext mixer 1st LO out | | |
| Connector | SMA female | |
| Impedance | 50 Ω (nominal) | |
| Frequency range | 3.05 to 6.89 GHz | |
| VSWR | < 2.0:1 (nominal) | |
| Power output | 20 to 30 °C | 0 to 55 °C |
| 3.05 to 6.0 GHz | +14.5 to +18.5 dBm | +14.5 to +19.0 dBm |
| 6.0 to 6.89 GHz | +13.5 to +18.5 dBm | +13.5 to +19.0 dBm |
| Coherent carriers 3.6 GHz 2nd LO out | | |
| Connector type | SMA female | |
| Impedance | 50 Ω (nominal) | |
| Power output | +3 dBm | |
| Frequency | 3.6 GHz | |
| Coherent carriers 3 to 7 GHz 1st LO in | | |
| Connector type | SMA female | |
| Impedance | 50 Ω (nominal) | |
| Input power | +15 dBm | |
| Coherent carriers 3.6 GHz 2nd LO in | | |
| Connector type | SMA female | |
| Impedance | 50 O (nominal) | |
| Input power | +3 dBm | |
| Coherent carriers 3 to 7 GHz 1st LO out | | |
| Connector type | SMA female | |
| Impedance | 50 O (nominal) | |
| Power output | +15 dBm | |
| Frequency | 3.05 to 6.89 GHz | |
| VGA out | | |
| Connector | VGA compatible, 15-pin mini D-SUB | |
| Format | VGA (31.5 kHz horizontal, 60 Hz vertical sync rates, non-interlaced) Analog RGB | |
| Resolution | 640 x 480 | |
| Noise source +28 V (pulsed) (Option 219) | | |
| Connector | BNC female | |
| Output voltage | On 28.0 +/- 0.1 V (60 mA maximum) | |
| | Off < 1 V | |
| IF log video (Option V7L) | | |
| 321.4 MHz in | | |
| Connector | SMB male | |
| Impedance | 50 Ω (nominal) | |
| Video out | | |
| Connector | SMB male | |
| Impedance | 50 Ω (nominal) | |
| Maximum input power | +10 dBm | |

## Rear panel connectors



| | |
|---|---|
| LXI trigger bus in | |
| Connector type | 25-pin subminiature female connector |
| LXI trigger bus out | |
| Connector type | 25-pin subminiature female connector |
| LAN (10/100Base-T) | |
| Connector type | RJ45 |

## Ordering Information and Options

| Model/option | Description |
|---|---|
| N8201A | Performance downconverter 3 Hz to 26.5 GHz |
| N8201A-526 | Frequency range from 3 Hz to 26.5 GHz |
| N8201A-AYZ | External mixing capability |
| N8201A-B7J[1] | Digital demodulation hardware (Required for Agilent 89601A VSA software.) |
| N8201A-123 | Microwave pre-selector bypass |
| N8201A-1DS | Built-in preamplifier; 100 kHz to 3 GHz |
| N8201A-110 | Built-in preamplifier; 10 MHz to 26.5 GHz |
| N8201A-219[1] | Noise figure measurement personality |
| N8201A-226[1] | Phase noise measurement personality |
| N8201A-V7L[1] | Log video output on front panel |
| N8201A-H02 | Adds internal digitizer and SCPI capability |

## Glossary

| | |
|---|---|
| AC | Alternating current |
| DC | Direct current |
| k | Kilo, or 1000 |
| LAN | Local Area Network |
| ms | Milliseconds |
| s | Seconds |
| SHI | Second harmonic distortion |
| SMB | Sub-miniature bayonet |
| TOI | Third-order intermodulation distortion |
| LXI | LAN eXtensions for Instrumentation |



1. Requires Option H02.

# References

## Web resources

For additional information on synthetic instruments, visit:
**www.agilent.com/find/synthetic**

For additional information on instrument security issues, visit:
**www.agilent.com/find/security**

For information about renting, leasing, or financing Agilent's latest technology, visit:
**www.agilent.com/find/buy/alternatives**

For additional accessory information, visit:
**www.agilent.com/find/accessories**

For additional information about Agilent PSA Series spectrum analyzers, visit:
**www.agilent.com/find/psa**

## Related literature

**Synthetic instruments**

*N8201A Performance Downconverter Synthetic Instrument Module, 3 Hz to 26.5 GHz, Data Sheet*
Literature number 5989-5720EN

*N8201A Option 219 Performance Downconverter Synthetic Instrument Module 3 Hz to 26.5 GHz, Technical Overview and Self-Guided Tour for the Noise Figure Measurement Personality*
Literature number 5989-6747EN

*N8201A Option 226 Performance Downconverter Synthetic Instrument Module 3 Hz to 26.5 GHz, Technical Overview and Self-Guided Tour for the Phase Noise Measurement Personality*
Literature number 5989-6748EN

*N8201A Option V7L Performance Downconverter Synthetic Instrument Module 3 Hz to 26.5 GHz, Technical Overview and Self-Guided Tour for the Fast Rise Time Video Output*
Literature number 5989-6749EN

*N8211A Performance Analog Upconverter Synthetic Instrument Module, 250 kHz to 20/40 GHz, Data Sheet*
Literature number 5989-2592EN

*N8212A Performance Vector Upconverter Synthetic Instrument Module, 250 kHz to 20 GHz, Data Sheet*
Literature number 5989-2593EN

*N8221A IF Digitizer Synthetic Instrument Module, 30 MS/s, Data Sheet*
Literature number 5989-2594EN

*N8241A Arbitrary Waveform Generator Synthetic Instrument Module, 15-Bit, 1.25 GS/s or 625 MS/s, Technical Overview*
Literature number 5989-2595EN

*N8242A Arbitrary Waveform Generator Synthetic Instrument Module, 10-Bit, 1.25 GS/s or 625 MS/s, Technical Overview*
Literature number 5989-5010EN

*N8201A-H02 Compact Performance Spectrum Analyzer for ATE Applications,*
Literature number 5989-5721EN



**Spectrum analyzer literature**

*PSA Series High-Performance Spectrum Analyzer, Brochure*
Literature number 5980-1283E

*Agilent PSA Series Spectrum Analyzers, Data Sheet*
Literature number 5980-1284E

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