

LNS ultra low phase noise Synthesizer

8 MHz to 18 GHz

Datasheet

NOISE XT



The LNS is an easy to use 18 GHz synthesizer that exhibits outstanding phase noise and jitter performance in a 3U rack mountable chassis.

With -130 dBc/Hz phase noise at 10kHz offset for a 10 GHz output frequency, the LNS is the lowest phase noise synthesizer of the industry that can help you challenge tomorrow's requirements for high speed, high bandwidth Software Defined Radio applications (SDR) and low phase noise PLL and DDS synthesis.

Its high power output is ideal to drive mixers' LO inputs or high-speed digital clocks. Its very low jitter profile makes ADC and DAC testing more accurate. This source is often cleaner than a crystal oscillator and can offer a high SNR, up to 147 dB.

Ethernet control helps you seamlessly integrate this tool in your test project or Local Oscillator distribution architecture. When coherent signals are required, the LNS can be use an external 10 MHz reference signal instead of the internal one. This optional ultra low phase noise 10 MHz OCXO allows the synthesizer to reach its best specification.

Specifications below describe the RF inputs and Outputs for the synthesizer.

RF Output Specifications

| Description | Specification |
|--------------------------|---|
| Output Frequency | 8 MHz or 2 GHz to 4 GHz (options) 4 GHz to 9 GHz (model LNS-9) 4 GHz to 18 GHz (model LNS-18) |
| Frequency Resolution | 0.1 Hz |
| Frequency Switching time | < 5 s |
| Output Level | +12 dBm (+/-2 dB) optional 15dB per 1dB step attenuator (IS 1dB) |
| Level Resolution | Fixed or optional 1 dB |
| Non-Harmonic spurious | -70 dBc above 1 kHz offset (-90dBc typ) at 9GHz |
| Modulation | DC coupled FM (50Hz if 10MHz with option, 1kHz BW max otherwise) |
| Output connector | N-type female, 50 Ohms |

Phase Noise performance

Typical Phase Noise with standard phase noise installed (no internal 10 MHz OCXO).

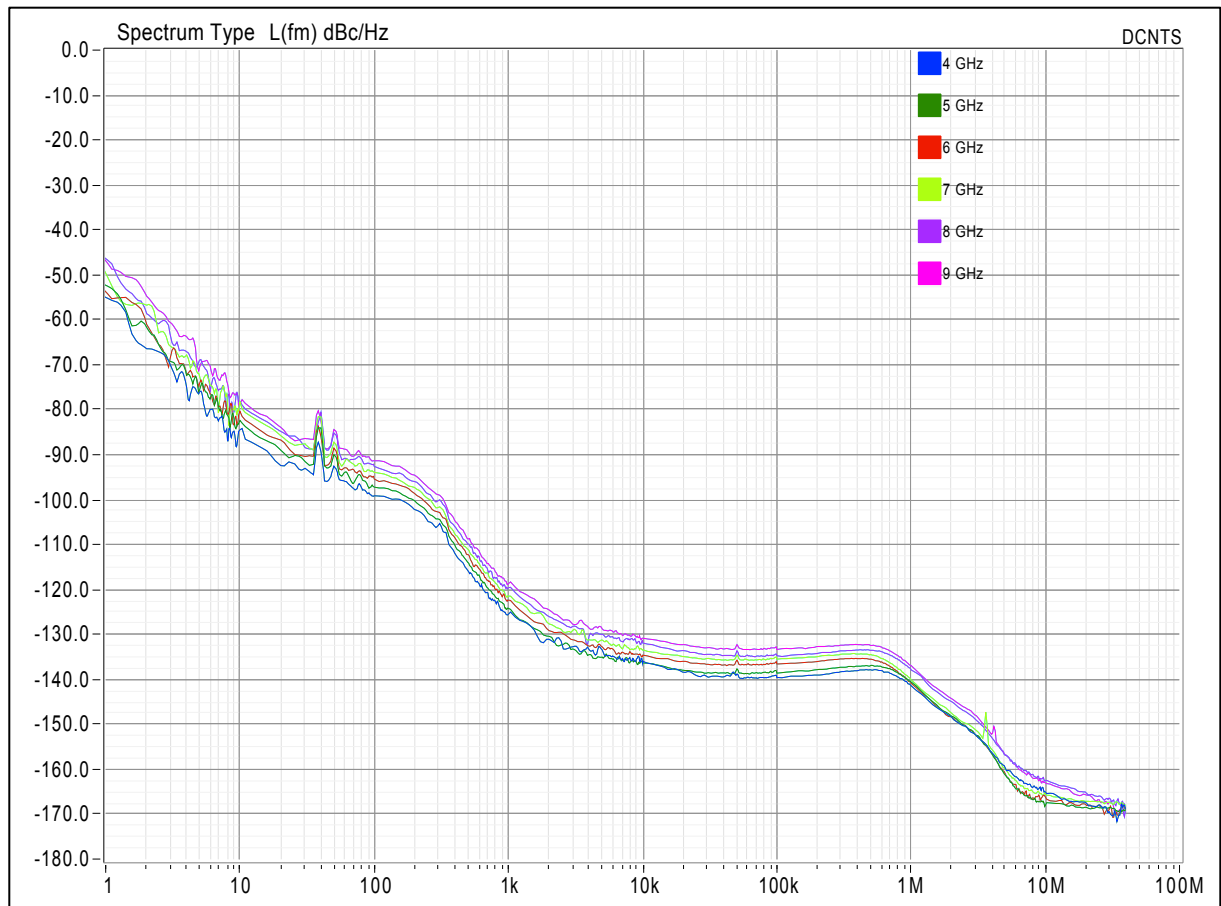
| dBc/Hz vs offset (Hz) | 100 | 1k | 10k | 100k | 1M | Floor |
|-----------------------|------|------|------|------|------|-------|
| 10 MHz | -145 | -167 | -173 | -174 | -175 | -175 |
| 100 MHz | -126 | -156 | -161 | -164 | -166 | -170 |
| 1 GHz | -106 | -138 | -148 | -149 | -151 | -158 |
| 2 GHz | -100 | -131 | -141 | -143 | -146 | -153 |
| 4 GHz | -94 | -125 | -137 | -139 | -142 | -168 |
| 8 GHz | -88 | -120 | -132 | -135 | -137 | -167 |
| 9 GHz | -86 | -119 | -131 | -133 | -137 | -167 |
| 10 GHz | -87 | -118 | -130 | -132 | -135 | -162 |
| 12 GHz | -85 | -116 | -129 | -131 | -135 | -161 |
| 14 GHz | -83 | -115 | -128 | -130 | -135 | -161 |
| 16 GHz | -82 | -114 | -126 | -129 | -132 | -160 |
| 18 GHz | -80 | -112 | -125 | -127 | -131 | -160 |

please add +5dB for guaranteed performance

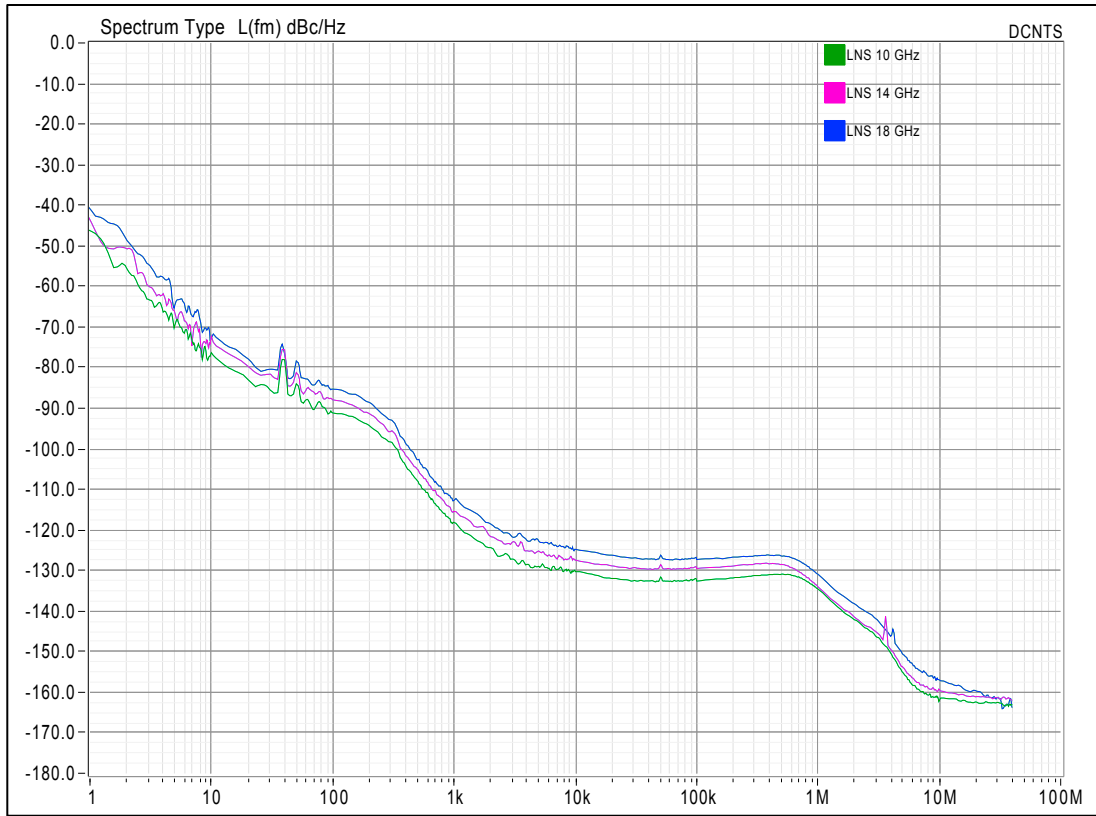
Typical Phase Noise with Low Noise phase noise option installed (with internal 10 MHz OCXO).

| dBc/Hz vs offset (Hz) | 10 | 100 | 1k | 10k | 100k | 1M | Floor |
|-----------------------|------|------|------|------|------|------|-------|
| 10 MHz | -137 | -150 | -167 | -173 | -174 | -175 | -175 |
| 100 MHz | -116 | -130 | -156 | -161 | -164 | -166 | -170 |
| 1 GHz | -96 | -110 | -138 | -148 | -149 | -151 | -158 |
| 2 GHz | -89 | -104 | -131 | -141 | -143 | -146 | -153 |
| 4 GHz | -86 | -98 | -125 | -137 | -139 | -142 | -168 |
| 8 GHz | -79 | -92 | -120 | -132 | -135 | -137 | -167 |
| 9 GHz | -78 | -91 | -119 | -131 | -133 | -137 | -167 |
| 10 GHz | -78 | -91 | -118 | -130 | -132 | -135 | -162 |
| 12 GHz | -76 | -89 | -116 | -129 | -131 | -135 | -161 |
| 14 GHz | -74 | -88 | -115 | -128 | -130 | -135 | -161 |
| 16 GHz | -72 | -86 | -114 | -126 | -129 | -132 | -160 |
| 18 GHz | -71 | -85 | -112 | -125 | -127 | -131 | -160 |

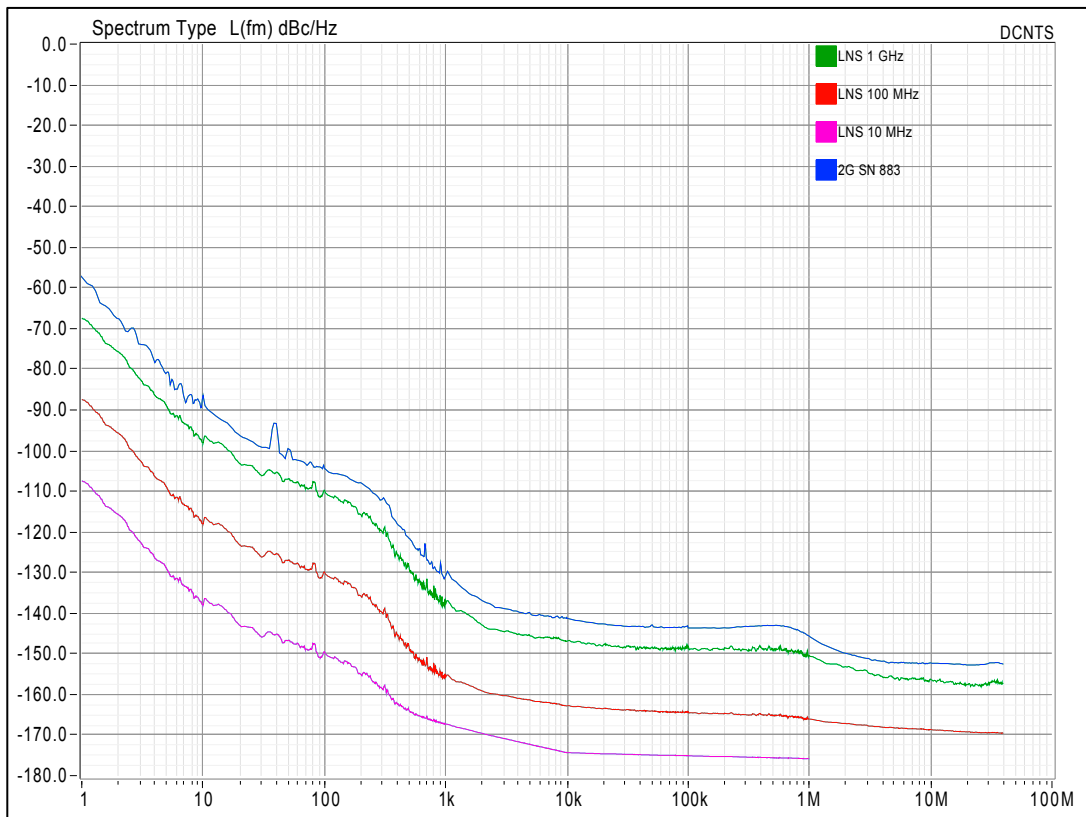
please add +5dB for guaranteed performance



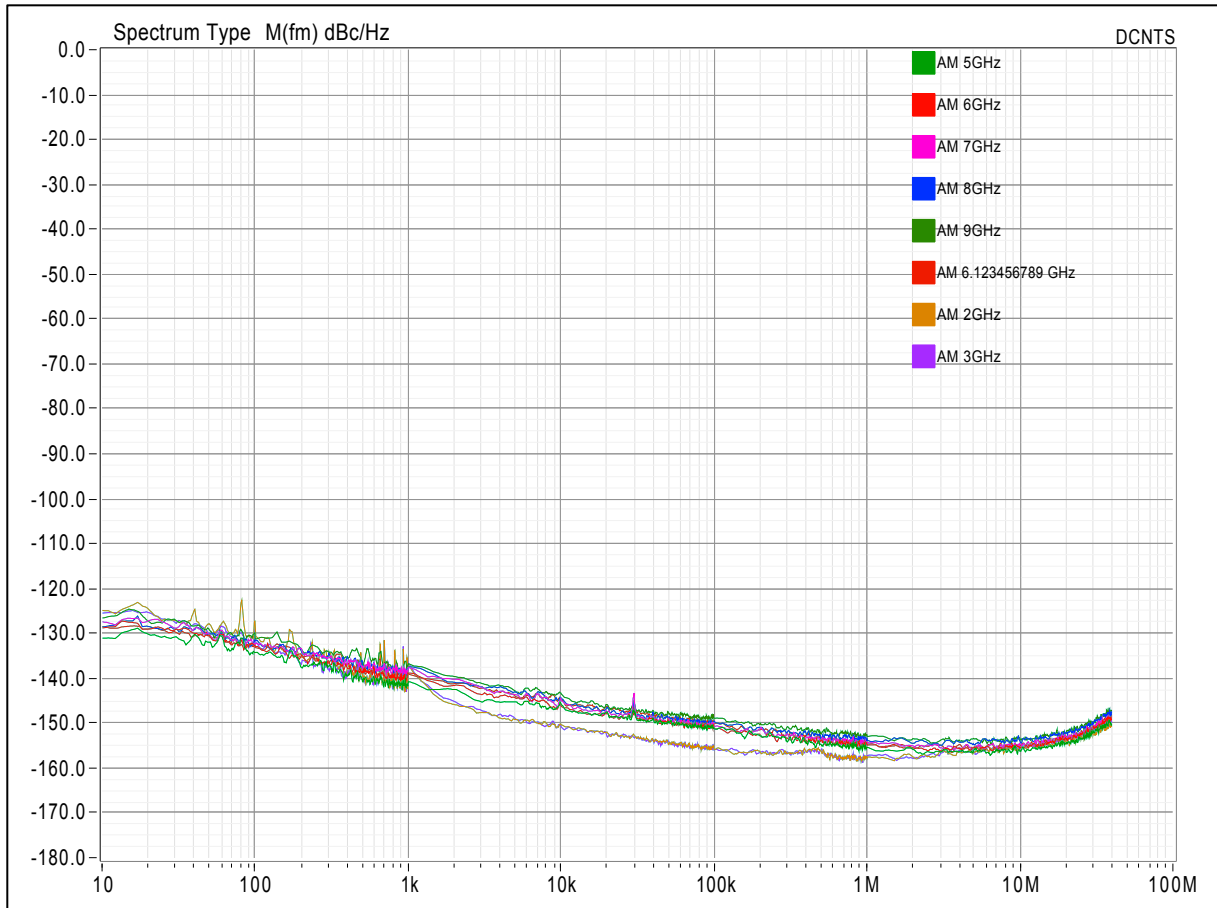
Typical Phase Noise plots at core frequencies with ultra low phase noise OCXO option



Typical Phase Noise plots at high frequencies with ultra low phase noise OCXO option



Typical Phase Noise plots at divided frequencies with ultra low phase noise OCXO option



Typical Amplitude Noise plots at various frequencies

Typical Residual FM Computation

The Residual FM can be computed from the Phase Noise plots with various un-weighted bandwidth.

| RMS FM (Hz) vs carrier (MHz) | 10 | 100 | 1000 | 4000 | 10000 | 18000 |
|------------------------------------|--------|-------|-------|-------|-------|-------|
| 50 - 3k Hz | 0.0005 | 0.002 | 0.014 | 0.056 | 0.127 | 0.246 |
| 300 - 3.4k Hz | 0.0005 | 0.002 | 0.013 | 0.051 | 0.109 | 0.212 |
| 20 - 15k Hz | 0.003 | 0.011 | 0.068 | 0.215 | 0.426 | 0.812 |

Typical RMS Jitter Computation

Based on the spectral purity of the Clock, the Jitter can be extracted

| jitter RMS (fs) vs carrier (MHz) | 10 | 100 | 1000 | 4000 | 10000 | 18000 |
|--|----|-----|------|------|-------|-------|
| 10k-1MHz | 38 | 13 | 8 | 7 | 7 | 6 |
| 10k-10MHz | | 30 | 14 | 8 | 7 | 6 |
| 10k-40MHz | | 52 | 22 | 8 | 7 | 6 |
| 10k-100MHz | | | 33 | 8 | 7 | 6 |

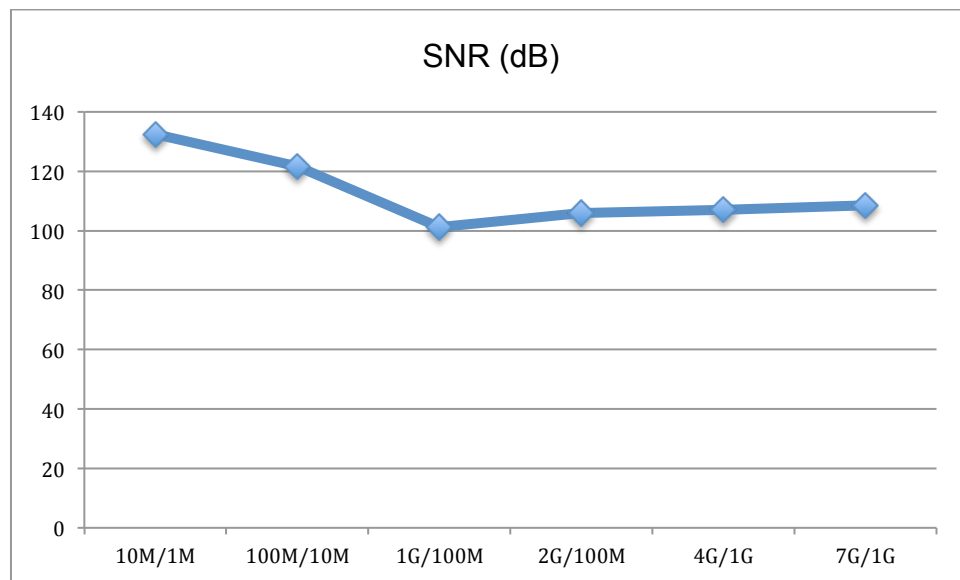
For some specific clock frequencies, the following table is obtained

| jitter RMS (fs) vs carrier | 155 MHz | 622 MHz | 2.488 GHz |
|----------------------------|---------|---------|-----------|
| 100 - 1.5M Hz | 17 | | |
| 1k - 5M Hz | | 12 | |
| 5k - 15M Hz | | | 16 |

Signal to Noise Ratio (SNR) when used as an ADC or DAC clock

The SNR can be computed for various analog sampled input frequencies (also called IF) and for various jitter integration bandwidths (depending on the application useful bandwidth)

For most common cases (F_{clk} / F_{IF}), the LNS signal generator will achieve the following performance.



However, a more detailed Signal to Noise Ratio can be computed as shown in the tables below.

SNR in dB for 80 MHz total bandwidth (10k-40MHz Jitter integration bandwidth)

| SNR dB vs Clock (MHz) | 10 | 100 | 1000 | 4000 | 10000 | 18000 |
|-----------------------|----|-----|------|------|-------|-------|
| IF= 1 MHz | | 130 | 137 | 146 | 147 | 148 |
| IF= 10 MHz | | 110 | 117 | 126 | 127 | 128 |
| IF= 100 MHz | | 90 | 97 | 106 | 107 | 108 |
| IF= 1 GHz | | 70 | 77 | 86 | 87 | 88 |

SNR in dB for 20 MHz total bandwidth (10k-10MHz Jitter integration bandwidth)

| SNR dB vs Clock (MHz) | 10 | 100 | 1000 | 4000 | 10000 | 18000 |
|-----------------------|----|-----|------|------|-------|-------|
| IF= 1 MHz | | 134 | 141 | 146 | 147 | 148 |
| IF= 10 MHz | | 114 | 121 | 126 | 127 | 128 |
| IF= 100 MHz | | 94 | 101 | 106 | 107 | 108 |
| IF= 1 GHz | | 74 | 81 | 86 | 87 | 88 |

SNR in dB for 2 MHz total bandwidth (10k-1MHz Jitter integration bandwidth)

| SNR dB vs Clock (MHz) | 10 | 100 | 1000 | 4000 | 10000 | 18000 |
|-----------------------|-----|-----|------|------|-------|-------|
| IF= 1 MHz | 132 | 142 | 146 | 147 | 147 | 148 |
| IF= 10 MHz | 112 | 122 | 126 | 127 | 127 | 128 |
| IF= 100 MHz | 92 | 102 | 106 | 107 | 107 | 108 |
| IF= 1 GHz | 72 | 82 | 86 | 87 | 87 | 88 |

Reference input

| Description | Specification |
|----------------|-----------------------|
| Frequency | 10 MHz |
| Level | +8 dBm (+/- 2 dB) |
| Loop Bandwidth | 50 Hz |
| Connector | BNC (female), 50 ohms |

Note: the BNC to BNC jumper cable must be installed between the Reference Input and Output if no external 10 MHz is injected into the Reference input port.

Reference output

| Description | Specification |
|-------------|-----------------------|
| Frequency | 10 MHz |
| Level | +8 dBm (+/- 2 dB) |
| Connector | BNC (female), 50 ohms |

EFC / DC-FM Control

| Description | Specification |
|-------------|--|
| Voltage | 0 to + 10V |
| Impedance | 2.2 kOhms |
| Bandwidth | 50 Hz max with 10MHz option, 1 kHz max otherwise |

Programming features

| Description | Supplemental information |
|-------------|--|
| Modes | CW (standard) and Gated CW (pulse) option |
| Interface | National Instruments LabView® examples for Ethernet programming Windows® OS compatible Graphical User Interface for Windows® |

General Information

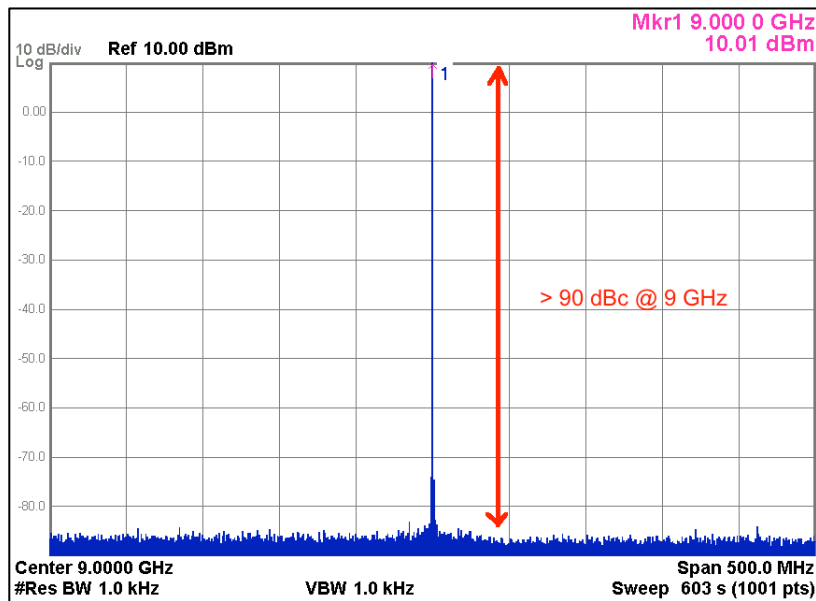
Rear panel information

| Description | Supplemental information |
|-------------|---|
| Ethernet | 1 ports (RJ45) |
| USB | Standard USB 2.0 port for mouse or keyboard |
| AC power | 100-240V Auto-switch input |
| Power | 90W max |
| FAN | Exhaust |

Synthesizer environment

| Description | Supplemental information |
|-----------------------------------|--|
| Operating environment | |
| Temperature | +10 degC to +30 degC |
| Humidity | RH 20% to 80% at wet bulb temp.<29 degC (non-condensing) |
| Altitude | 0 to +2 000 m |
| Non-operating storage environment | |
| Temperature | -10 degC to +60 degC |
| Humidity | RH 20% to 90% at wet bulb temp.<40 degC (non-condensing) |
| Altitude | -427 to +4 807 m |
| Vibration | 0.5 G maximum, 5 Hz to 500 Hz |
| Instrument dimensions | See figure below |
| Weight (NET) | < 10 kg depending on configuration |

RF Output Spectrum



LNS output spectrum at 9 GHz with 500 MHz span

Ordering Information

Ultra-low Noise Source Core

LNS-18 Base 4 GHz to 18 GHz

LNS-18

LNS-9 Base 4 GHz to 9 GHz

LNS-9

Output Frequency resolution

1 Hz frequency resolution (1mHz typ)

LNS-1HZ

Output Frequency range extension

Low frequency extension down-to 2 GHz

LNS-LF-2G

Low frequency extension down-to 1 GHz

LNS-LF-1G

Low frequency extension down-to 8 MHz

LNS-LF-8M

note: select only one low-frequency extension

Output Power range

15dB range / 1dB step Output attenuator

LNS-15DB

Output Modulation

Pulse Modulation, TTL 50 Ohms input

LNS-PULSE

note: LNS-LF-1G and LNS-LF-8M are not compatible with the pulse option

Close-in Phase Noise Improvement

10 MHz Timebase with IN/OUT ports

LNS-10M

Noise eXtended Technologies
An ISO 9001 : 2008 certified company

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