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UFX-\(E_bN_0\) Series Precision Generators

Count on the Noise Leader. Count on Noise Com.
UFX-EbN₀ Series Precision E_b/N₀ (C/N) Generators

The UFX-EbN₀ is a fully automated instrument that sets and maintains a highly accurate ratio between a user-supplied carrier and internally generated noise, over a wide range of signal power levels and frequencies.

The UFX-EbN₀ gives system, design, and test engineers in the cellular/PCS, satellite and military communication industries a cost-effective means of obtaining higher yield through automated testing, plus increased confidence from repeatable, accurate test results.

Features

Multiple Operating Modes
The UFX-EbN₀ provides five operating modes: carrier-to-noise (C/N), carrier-to-noise density (C/No), bit energy-to-noise density (E_b/N₀), carrier-to-interferer (C/I), and power meter. The instrument can also be used as a precision noise generator.

Custom Configurations
The UFX-EbN₀ is available in a variety of configurations to meet your specific testing needs. Applications include: military communications, WCDMA, SATCOM, NASA TDRSS, CableTV, HDTV, IS-95, CDMA, TDMA, UMTS, GPRS L-band modems, Milstar, Inmarsat, Intelsat, and general purpose.

Direct Display of E_b/N₀, C/N, C/I, or C/No
The 4 x 20 VFD screen provides simultaneous readout of all significant input and output signal levels relating to the chosen operating mode, including carrier-to-noise ratios.

Accuracy of 0.2 dB RSS
A special, large-dynamic-range power meter measures both the signal and the noise, which allows the UFX-EbN₀ to set the desired ratio to within ±0.2 dB. Special configurations can provide improved accuracy.

Bit Rate Entry of 1 bps to 999 Mbps and above
In bit energy-to-noise density testing (E_b/N₀), the instrument automatically calculates noise density based on the userspecified bit rate.

Variable Output Power
Output power is user-specified and can be set within the range of −55 dBm to +5 dBm.

True RMS Power Meter
The digital power meter is custom designed to cover the frequency range of the particular instrument. It can measure signals and noise accurately with Gaussian Noise crest factors up to 18 db.

Direct Testing at both RF and Microwave Frequencies
In configurations that cover two separate frequency ranges, measurements can be made directly with out the need for special conversion circuitry.

Optional Tracking Feature
This function is intended for users with an unstable input signal source who wish to perform accurate long-term testing at a specified E_b/N₀ ratio. The tracking option works as an automated gain control (AGC) device, correction for input signal drift up to 0.2 dB resolution. The carrier output level is kept constant and, therefore, so is the E_b/N₀ ratio.

Setting Precision C/N Ratios
The UFX-EbN₀ accurately sets carrier-to-noise ratios using the substitution calibration method. This method eliminates the effects of any non-linearity in the measuring device, in this case the power meter, by setting the signal and the noise to the same power level at the power meter input. (See the functional block diagram). The noise power is then offset by the desired ratio. The primary source of inaccuracy within the unit is the attenuator that varies the noise power, and Noise Com uses the most accurate components available. Secondary effects such as thermal drift are negligible since the noise and the power are measured within a very short time frame.
Active components in the instrument that could be attributed to long-term drift are common to both the signal and noise path, so variations in these components do not affect the calibrated ratio. The unit's linear phase and amplitude signal path ensures that the desired signal passes through undistorted.

Since the UFX-\(E_b/N_0\) automatically compensates for parameters like bit rates and bandwidth, taking measurement is as simple as pressing a button. Operating modes, function and parameters are set using the front panel controls.

**Meter** – In this mode, the instrument functions as a true RMS power meter, and uses various averaging methods to ensure more accurate readings.

Measurements are made through couplers, allowing the signal to pass through to the output connector unaltered by the meter circuitry.

\(E_b/N_0\) – The instrument automatically sets up a desired \(Eb/No\) quickly and accurately. Based on the user-specified carrier output level, output \(E_b/N_0\) ratio, and bit rate, the instrument automatically calculates the required noise density.

**C/N** – This mode sets the specified carrier output level and the total noise power in the system bandwidth to the desired ratio.

**C/N_0** – To obtain a specific \(C/N_0\) ratio, set the instrument to \(E_b/N_0\) mode and enter zero for the bit rate. All other functions are the same as the \(E_b/N_0\) mode.

**GEN** – The instrument can also function as a precision noise generator. Simply select the mode and enter the required noise density. The unit’s internal noise source provides the desired signal.

**Status Indicators and Display Screen** – Front panel indicators and the 4 x 20 VFD display provide constant feedback on the instrument state and settings.

**Data Entry and Function Selection** – Instructions and data are easily entered through the front panel keypad. The instrument can also be controlled through the standard rear panel IEEE-488-2, optional Ethernet, TCP/IP, or optional RS-232C, RS-422 or RS-423 interfaces.

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**Simplified Functional Block Diagram**

The internal AWGN precision noise source is summed with the user supplied carrier signal. The unit generates extremely precise Eb/No signal over a broad range of input or output power.
Specifications

Operating modes
- Carrier-to-noise (C/N), carrier-to-noise density (C/N₀), bit energy-to-noise density (E_b/N₀), carrier-to-interferer (C/I), noise generator, power meter.

Carrier Path
- Input power range: -55 dBm to +5 dBm
- Maximum input power: +21 dBm (with no damage)
- Output power range: -55 dBm to +5 dBm
- Nominal gain: ±1.0 dB
- Gain resolution: 0 to -60 dB in 0.1 dB steps
- Gain flatness: ±0.2 dB for 70 MHz ±20 MHz
- ±0.3 dB for 140 MHz ±40 MHz
- ±0.4 dB for others
- Group delay: ±0.20 ns/40 MHz for frequencies above 20 MHz
- Third-order intercept point: +29 dBm typical
- Tracking range (Ubopt01): +4 dB to -4 dB
- Tracking update rate: 100 milliseconds, nominal

Noise path
- Output power range: -55 dBm to +5 dBm
- Flatness: ±0.2 dB/40 MHz
- ±0.3 dB/80 MHz
- ±0.4 dB/200 MHz
- ±0.5 dB/300 MHz
- Attenuation range: 60 dB in 0.25 dB steps (0.1 dB steps with Ubopt06)
- Ratio accuracy: ±0.2 dB RSS, ±0.3 dB WCU
- Power meter range: -55 dBm to +5 dBm
- Power meter accuracy: ±0.5 dB
- Power meter averaging: 10 to 65,535. Each sample requires approximately 2.2 milliseconds

Control
- Local and IEEE-488

Baud rate (Ubopt04)
- 150, 300, 600, 1200, 2400, 4800, and 9600 to be used with optional serial interface ports (8 data bits, no parity, 1 stop bit)

Interferer input
- -4 dBm ±2 dB. Frequency range is equal to the noise bandwidth.

RF connectors
- BNC-75ø below 800 MHz, N-type female 50ø above 800 MHz

DC on RF connectors
- 0 volts, maximum

Primary power
- Voltage: 85 to 264 VAC
- Frequency: 47 to 63 Hz
- Consumption: 2 amps, maximum
- Fuse: 2 A

Operating temperature
- 0° to 50° C

Dimensions
- 17” W x 5.25” H x 17.5” D

Specification values apply following a 30 minute warmup. Specifications subject to change without notice.

Ordering Information

Model Number* Frequency Range Applications
UFX-EbNo-45 5 to 90 MHz General Purpose
UFX-EbNo-70 50 to 90 MHz General Purpose/SATCOM
UFX-EbNo-IF1 50 to 90 MHz and 100 to 180 MHz Intelsat, SATCOM
UFX-EbNo-IBS/IDR 50 to 90 MHz, Intelsat, SATCOM 68 to 72 MHz, and 100 to 180 MHz
UFX-EbNo-255 240 to 270 MHz SATCOM
UFX-EbNo-370 350 to 390 MHz NASA TDRSS
UFX-EbNo-CATV 50 to 860 MHz Cable TV in 4 bands
UFX-EbNo-750 650 to 850 MHz Iridium
UFX-EbNo-892 822 to 962 MHz IS-95 (CDMA), IS-136 (TDMA)
UFX-EbNo-892/1850 822 to 962 MHz & 1710 to 1990 MHz Dual-band CDMA
UFX-EbNo-1200 950 to 1210 MHz & 1190 to 1450 MHz L-band modems
UFX-EbNo-1545 1530 to 1560 MHz Inmarsat
UFX-EbNo-1850 1710 to 1990 MHz J-STD-008 (CDMA)
UFX-EbNo-2050 1900 to 2200 MHz Wideband CDMA
UFX-EbNo-2442 2400 to 2484 MHz 802.11b Wireless LAN
UFX-EbNo-5500 5000 to 6000 MHz 802.11a Wireless LAN
UFX-EbNo-WiMAX 3,400 to 5800 MHz 802.16 WiMax
UFX-EbNo-20000 18 to 22 GHz Military
UFX-EbNo-5500 5000 to 6000 MHz 802.11a Wireless LAN
UFX-EbNo-WiMAX 3,400 to 5800 MHz 802.16 WiMax
UFX-EbNo-20000 18 to 22 GHz Military
Custom Frequency Ranges to 44GHz

Option Number Description
- UEopt01 Automatic gain control to maintain constant carrier power level (Tracking)
- UEopt03 50ø input and output impedance**
- UEopt04 RS-232C, RS-422, or RS-423 interface***
- UEopt05 230 VAC, 50 Hz
- UEopt06 0.1 dB/step on output noise and C/N
- UEopt09 Ethernet, TCP/IP remote interface

* Call Noise Com regarding custom configurations
** Below 800 MHz, standard impedance is 75ø. Above 800 MHz, 50ø is assumed.
*** In addition to standard IEEE-488-2

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