



"Results You Can Count On"

Model 4902 Universal G.fast Noise Generator



20 kHz to 300 MHz Noise Generator for Realistic Gfast Testing

Up to 24 Independent Noise Ports

AWGN Dynamic Range-90 dBm/Hz to -160 dBm/Hz in 1dB steps*

Gfast technology promises to bring a wealth of new opportunities to Service Providers as well as manufacturers of DPUs, CPE Modems and Chipsets. This exciting new technology allows for a more efficient use of existing copper infrastructure by utilizing the spectrum above 30 MHz and by cancelling the crosstalk between pairs within a cable. This increases data rates far beyond current levels, making bandwidth-intensive applications such as IPTV and Triple Play available in many areas where it was not possible before.

The Model 4902 Universal Gfast Noise Generator is available in two versions – portable and rack-mountable. The portable unit provides 2 to 16 independent Arbitrary Waveform Generator (AWG) outputs and includes a keyboard and built-in display. The higher-density version is rack-mountable and may be configured for 2 to 24 independent AWG outputs.

*when using low noise mode injector

User-friendly configuration software allows the user to select and build impairment models common to DSL network implementations using ADSL2+, VDSL2, VDSL2 vectoring and Gfast. A generous assortment of custom crosstalk as well as impulse noises (e.g., REIN, SHINE and PEIN) can be created. It can also generate a wide variety of interferences above 30 MHz that may impact Gfast deployments. These include background Gaussian noise, high frequency impulse noise from the AC electrical wiring (REIN) and other types of impulse noise (PEIN, SHINE & WHINE), FM radio, Broadcast TV, Spark Plug Ignition noise, PLC noise, Reverse Power Feed noise and more. In addition, user-defined files in several formats (such as MATLAB, CSV and Excel) may be imported. Optional noise modules automatically setup standards-based testing for TR-114, TR-105, TR-115, TR-100 and more.

**Used by the UNH-IOL
(University of New Hampshire Interoperability
Laboratory) for Broadband Forum Gfast
Certification Program testing.**

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Highlights

- Bandwidth 20 kHz to 300 MHz
- Suitable for wide range of applications including VDSL2 Vectoring and Gfast testing
- Crest Factor greater than 5
- High degree of accuracy
- Expandable, modular design
 - High-density version holds up to 6 (2 or 4-port) AWG cards for a maximum of 24 AWG outputs
 - Portable version holds up to 4 (2 or 4-port) AWG cards for a maximum of 16 AWG outputs
- Inject crosstalk and impulse noise combined
- Noise Floor below -166dBm/Hz (when using low noise mode injector)
- Independent control of each AWG output
- Select from common crosstalk types such as ADSL, VDSL2, and Gfast
- Standardized Impulse noises such as REIN, SHINE, PEIN, and Switching Power Supply noise
- Real World Measured Impulse Noises for Gfast
- Specify NEXT, FEXT and number of disturbers
- Add in RFI and AWGN (at variable levels)
- Specify impedance, sampling rate and DUT location
- Optional Noise Modules setup and run all tests in standard automatically
- Design custom loops with Loop Configuration Editor
- Save custom noise files or entire configurations to repeat tests with ease and accuracy
- Import MATLAB (.mat), CSV, or Excel (.xls) noise files
- Remote control via Ethernet
- Adjust Amplitude of Crosstalk and Impulse noise
- Gfast Specific Noise
 - Background Gaussian Noise (Piecewise Flat, Colored)
 - High Frequency Impulse Noise (PEIN, SHINE)
 - PLC Noise
 - RFI (FM, Broadcast TV)
 - Spark Plug Ignition Noise
 - Reverse Power Feed Noise

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Ordering Information

Model Number	Description
4902-Portable	<ul style="list-style-type: none"> • Telebyte Portable computer w/built-in display & keyboard. • Includes Noise Generation Software. • Accepts 1-4, 4902-AWGx cards.
4902-HD	<ul style="list-style-type: none"> • Telebyte High-Density, rack-mountable computer. • Includes Noise Generation Software. • Accepts 1-6, 4902-AWGx cards.
4902-AWG2-300	2-Port AWG Card - 600 MS/s, supports 1 kHz to 300MHZ
4902-AWG4-300	4-Port AWG Card - 600 MS/s, supports 1 kHz to 300MHZ
4902-AWG2-30	2-Port AWG Card – 60 MS/s, supports 1 kHz to 30 MHz
4902-AWG4-30	4-Port AWG Card – 60 MS/s, supports 1 kHz to 30 MHz
4902-D4-120	4-Channel Differential Mode Noise Injector (20 kHz to 120 MHz) Plus Micro Interrupts and Distributed Noise
4902-2-300-COAX	2-Channel Coax Cable Noise Injector (20 kHz to 300 MHz) for Coaxial Cable. Interface is Coax F-Type Connector
4902-2-300L-TPD	2-Channel Differential Mode Noise Injector (20 kHz to 300 MHz) for Twisted Pair Cable. Interface is CAT6 RJ45 Connector. Included low noise mode.
4901-D1-30-TPD	1-Channel Differential Mode Noise Injector (1 kHz to 30 MHz) Plus Micro Interrupts
VxT-N48*	48-Channel AWGN Generator/Injector (20 kHz to 30 MHz)
4902-N6	Optional Noise Module for TR-067
4902-N10	Optional Noise Module for TR-100
4902-N11	Optional Noise Module for TR-114
4902-N12	Optional Japanese Noise Library – Including TCM-ISDN Noise Files, SHDSL NTT Noise Files; Half, Single & Double ADSL Disturbors NTT Noise Files; 3-Band, 4-Band & 6-Band VDSL NTT Noise Files
4902-N16	Optional Noise Module for TR-105
4902-N17	Optional Noise Module for TR-115
4902-N18	Optional Noise Module for G.SHDSL
4902-N21	Optional Noise Module for Gfast ID-337 Issue 1
4902-N22	Optional Noise Module for Gfast WT-380

Impulse and crosstalk noises must be carried out on two different AWG cards. 4902-AWGx card types may be combined on one 4902 computer. Please consult a Telebyte sales representative for more information. *See separate Model VxT-N48 datasheet for more information.



4902-2-300-COAX
2-Channel 300 MHz COAX Noise Injector



4902-D4-120
4 channels of independent differential mode noise injection, distributed noise, micro-interrupts and integrated noise combining



4902-2-300L-TPD - 2-Channel 300 MHz Twisted Pair Noise Injector with Low Noise Mode



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Specifications

4902-Portable Specifications	
Remote Commands	Telnet
Included Software	Telebyte Universal Gfast Noise Generator Software
Power supply	AC 90 V to 264 V, 47 to 63 Hz
Operating Temperature Range	0 to 50 °C
Operating Relative Humidity	5% - 95% non-condensing
Mechanical Dimensions	DxWxH: 9.5" D x 13.5" W x 17.5" H
Weight	32 lbs.
Connectors	10 USB 3.0 Ports, 4 USB 2.0 Ports (2 front), 2 RJ-45 Gigabit LAN
Display	Integrated 17.3-in WUXGA+ (1920 x 1080) display

4902-HD Specifications	
Remote Commands	Telnet
Included Software	Telebyte Universal Gfast Noise Generator Software
Power supply	AC 90 V to 264 V, 47 to 63 Hz
Operating Temperature Range	0 to 50 °C
Operating Relative Humidity	5% - 95% non-condensing
Mechanical Dimensions	DxWxH: 19.5" D x 16.8" W x 7.0" H
Weight	32 lbs.
Connectors	10 USB 3.0 Ports, 2 eSATA Ports, 2 RJ-45 Gigabit LAN

4902-AWGx-30 Specifications	
Bandwidth	1 kHz to 30 MHz
Noise Outputs	4902-AWG2-30: 2 4902-AWG4-30: 4
Interference Profile Accuracy	≤ 0.5 dB mean absolute error (MAE) for Crosstalk PSD
AWGN Crest Factor	> 5
AWGN Gap	< 10%
Output Impedance	50Ω unbalanced
SMB Connectors	4902-AWG2-30: 2 4902-AWG4-30: 4

4902-AWGx-300 Specifications	
Bandwidth	1 kHz to 300 MHz
Noise Outputs	4902-AWG2-300: 2 4902-AWG4-300: 4
Interference Profile Accuracy	≤ 0.5 dB mean absolute error (MAE) for Crosstalk PSD
AWGN Crest Factor	> 5
AWGN Gap	< 10%
Output Impedance	50Ω unbalanced
SMA Connectors	4902-AWG2-300: 2 4902-AWG4-300: 4



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Specifications (continued)

4902-D4-120 4-Channel Noise Injector Specifications	
Bandwidth	20 kHz to 120 MHz continuous frequency response of signal path
Injection Type	Differential Mode
Insertion Loss of Noise Injection Path	Differential Mode 0 dB ± 0.5dB
Maximum RMS Output	+5 dBm into 50 Ω
Crest Factor	Greater than 5
Noise Floor	Below -150 dBm/Hz as measured at the output of the noise injector
Connectors	<ul style="list-style-type: none"> • SMA: (2) Female Connectors per channel for Independent Differential Mode noise from 4902-Portable or 4902-HD; (2) for distributed noise • 8 Cat6 RJ-45 Connectors on front (2 Input/Outputs for each channel)
Micro Interruptions	<ul style="list-style-type: none"> • Location: On any single channel • Method: Type-1, Type-2, or Type-3 as defined in TR-249 Issue 1 • Interrupt Time: 5ms to 100ms in 1-ms increments

4901-D1-30-TPD 1-Channel Noise Injector Specifications	
Bandwidth	1 kHz to 30 MHz
Input Impedance	50Ω unbalanced (100Ω unbalanced*)
Output Mode	Differential, balanced
Noise Floor	Below -145 dBm/Hz as measured at the output of the noise injector
Insertion Loss	13.0/35 dB ± 0.5 dB
Connectors	SMB Female Connector for 4902-Portable or 4902-HD, RJ45 (2) Female Connectors for Loop Simulator (external cable provided) and for the modem.
Micro Interruptions	<ul style="list-style-type: none"> • Method: Type-1 as defined in TR-249 Issue 1 • Interrupt Time: 1ms to 250ms in 1-ms increments

4902-2-300-COAX 2-Channel Noise Injector Specifications	
Bandwidth	20 kHz to 300 MHz continuous frequency response of signal path
Injection Type	Single Ended
Insertion Loss of Noise Injection Path	0 dB ± 0.5dB
Maximum RMS Output	+5 dBm
Crest Factor	Greater than 5
Noise Floor	Below -150 dBm/Hz as measured at the output of the noise injector
Connectors	<ul style="list-style-type: none"> • SMA: (3) Female Connectors per channel for Independent Differential Mode noise from 4902-Portable or 4902-HD; • 4 F-Type Coax Connectors on front (2 Input/Outputs for each channel)



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Specifications (continued)

4902-2-300L-TPD 2-Channel Noise Injector Specifications	
Bandwidth	20 kHz to 300 MHz continuous frequency response of signal path
Injection Type	Differential Mode
Insertion Loss of Noise Injection Path	Differential Mode 0 dB \pm 0.5dB
Maximum RMS Output	+5 dBm
Crest Factor	Greater than 5
Noise Floor	Below -166 dBm/Hz as measured at the output of the noise injector (with the low noise mode enabled)
AWGN Dynamic Range	-90 dBm/Hz to -160 dBm/Hz in 1dB steps
Connectors	<ul style="list-style-type: none"> SMA: (3) Female Connectors per channel for Independent Differential Mode noise from 4902-Portable or 4902-HD; 4 Cat6 RJ-45 Connectors on front (2 Input/Outputs for each channel)

Vxt-N48 AWGN 48-Channel Generator/Injector Specifications	
Built-In AWGN Generator Specifications	
Simulation	Additive White Gaussian Noise (AWGN)
Bandwidth	Flat Power Spectral Density (PSD) over bandwidths from 20 kHz to 30 MHz
AWGN Crest Factor	≥ 5
White Noise (AWGN) Generator	-90 dBm/Hz to -143 dBm/Hz in 1 dBm increments
Maximum Voltage Tip-Ring	200 V
Output Mode	<ul style="list-style-type: none"> Differential, balanced 48 individually controllable, uncorrelated outputs
Differential Mode Noise Injection Specifications	
Bandwidth	20 kHz to 30 MHz
Output Impedance	4k Ω Minimum at point of injection (20 kHz to 30 MHz)
Input Impedance	50 Ω unbalanced
Output Mode	Differential, balanced
Noise Floor	Below -143 dBm/Hz as measured at the output of the noise injector
Insertion Loss	13.0 dB
System Specifications	
Remote Control	Ethernet, RS-232 and GPIB
Front Panel Control	LCD Display and keypad for setting AWGN levels and the IEEE-488 address, RS-232 or Ethernet communication parameters
Size	[2U] 19 in W x 22 in D x 3.47 in H (482.6 mm W x 558.8 mm D x 88.1 mm H)
Connectors	<ul style="list-style-type: none"> Uncorrelated Noise: 96 SMBs (2 per channel) Correlated Noise: 2 SMBs for all channels Modem/Crosstalk Emulator: 24 quad-channel high-speed CAT7 TERA connectors
Power Supply	AC 90 V to 264 V, 47 to 63 Hz, 100 W
Environmental	Operating: +32 F to +122 F (0 to +50 degrees C) Storage: 0 to 95% relative humidity (non-condensing)

Specifications are subject to change without notice. Made in USA.

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Additional Features Included in Base System

Crosstalk

Standard	Bandplans/Protocols
ADSL, ADSL2, ADSL2+	G.992.3 Annex A, B, I, J, L, M G.992.4 Annex A, I G.992.5 Annex A, B, I, J, M
VDSL2	G.993.2 Annex A (POTS) G.993.2 Annex A (ADL) G.993.2 Annex B7 (1-10), B8 (1-16)

Alien Crosstalk

Reference	Test System	Models
ETSI TS 101 388 §5.3.4.1.1	EC ADSL (POTS)	FA, FB, FC, FD
ETSI TS 101 388 §5.3.4.1.2	EC ADSL (ISDN)	FA, FB, FC, FD
ETSI TS 101 388 §5.3.4.1.3	FDD ADSL (POTS)	FA, FB, FC, FD
ETSI TS 101 388 §5.3.4.1.4	FDD ADSL (ISDN)	FA, FB, FC, FD
TR-100 Annex D.1	ADSL2 (TR-100 A.2)	FA, FB, FC, FD
TR-100 Annex D.1	ADSL2+ (TR-100 A.2)	FA, FB, FD, FD19
TR-100 Annex D.2	ADSL2+ (TR-100 A.3)	CAL=12, CAL=36, CAL=52
TR-100 Annex D.3	ADSL2+ (TR-100 B.3)	FA, FB, FD
TR-114 Appendix A	VDSL2	MD_EX, MD_CAB27, MD_CAB72

Other Crosstalk Features

- Fluctuating Crosstalk
- VDSL Power Back-Off
- Dynamic Noise Levels
- Variable AWGN
- RFI Tones
- Pre-Defined Spectra
 - ETSI A, ETSI B, EUROK
- Batch conversion of user-defined Crosstalk files for easy import

Impulse Noise

- High Frequency
- Low Frequency
- Single Shot
- Burst Pattern

Other

- Loop Editor
- Preconfigured Loops

Gfast Specific Noise

- Background Gaussian Noise (Piecewise Flat, Colored)
- High Frequency Impulse Noise (PEIN, SHINE)
- PLC Noise
- RFI (FM, Broadcast TV)
- Spark Plug Ignition Noise
- Reverse Power Feed Noise