



Single Channel Wideband RF Capture and Record

Features

- + Single channel, very wide bandwidth RF Recorder
- + 20Hz–26.5 GHz Tuning Range
- + 765 MHz Maximum Record Bandwidth

Applications

- + Demodulation Algorithm R&D
- + Radar Signal Capture
- + Electronic Warfare Research
- + Next Generation PHY Standards R&D

Benefits

- + Capture wide swaths of spectrum for subsequent analysis, review and replay
- + Record RF signals with no acquisition dead time and guaranteed capture of the shortest duration events
- + Record multiple RF services & channel assignments simultaneously
- + Build an RF Capture library of high fidelity field test reference signals for future regression tests in a laboratory environment
- + Capture transient field test events



Instrument Overview

Instrument Function	Single channel, very wide bandwidth RF Capture
Instrument Architecture	Instrument Architecture National Instruments Modular RF Instruments in PXI Express Form Factor High Speed Disk Storage Subsystem High Performance Quad-Core Embedded CPU with Windows 7 O.S.

Signal Acquisition Characteristics

Acquisition Channel	1
Inter-Channel Electrical Relationships	Downconverted, Contiguous, Baseband IQ Data Stream
Tuning Range	20Hz – 14GHz (Standard) 20Hz – 26.5GHz (Option 202)
Tuning Resolution	1Hz
Signal Capture Modes	100kHz minimum 320MHz maximum (Standard) 200MHz maximum (Option 302) 80MHz maximum (Option 301)
Digital Sample Resolution	1Hz Sample rate automatically adjusts for user selected capture bandwidth, where Sample Rate = Selected BW / 0.8 (e.g. 100MHz RF BW = 125MS/s)
Modulation Quality (Representative)	-149dBm/Hz to +30dBm (Pre-amplifier disabled) -163dBm/Hz to -30dBm (Pre-amplifier enabled)
ADC SFDR	Software controlled electrical & mechanical attenuators operating in one of two modes: + Manual Gain Control + Assisted Gain Control (Set & Hold)
Equalization	1dB electrical & mechanical (20Hz to 3.6GHz) 5dB mechanical (3.6GHz to 14GHz)
SSB Phase Noise	Fixed Record Duration Indefinite Record Duration Fill to Disk Capacity Record Duration

Additional acquisition performance specifications per National Instruments PXIe-5663E Device Specifications document

Signal Storage

High-Speed Non-Volatile Storage Capacity & Type	Qty=1, 15TB RAID, spinning disks (Additional options available)
Duration of Stored Signal(s)	2 hrs 30 min at 320MHz signal bandwidth See charts below for storage durations at lesser signal bandwidths
High-Speed Non-Volatile Storage Filesystem	Microsoft NTFS (Direct plug-in compatibility with MS Windows)
High-Speed Native Record File Formats	SL Standard 002, Raw Binary Essence for BW <= 50MHz SL Standard 003, National Instruments TDMS for BW > 50MHz
Off-Line Storage Types	Export to external storage devices (e.g. HDD, memory stick) using USB 2.0 or USB 3.0 interface. Export to any network file share, SAN storage, or FTP server using standard Windows networking technologies and tools.
File Formats Exported To Off-Line Storage	SL Standard 001, Raw Binary Essence (any bandwidth) SL Standard 002, Raw Binary Essence (any bandwidth) SL Standard 003, National Instruments TDMS (any bandwidth)

Signal Acquisition Fidelity

Digital Sample Resolution	24-bits per IQ sample pair (12-bit I, 12-bit Q)
Modulation Quality (Representative)	57dB MER (64-QAM; 6MHz BW; 825MHz CF) 41dB MER (64-QAM; 50MHz BW; 825MHz CF)
ADC SFDR	-80dBc or -75dBc (dependent on RF Center Freq & IF Center Freq)
Equalization	Real-time, linear equalization (EQ) of full signal acquisition bandwidth for optimized frequency response and group delay +/- 0.15dB amplitude ripple (typ); 25MHz BW; 23 deg C +/- 5C
SSB Phase Noise	-129dBc/Hz @ 10kHz Offset @ 800MHz CF; 23 deg C +/- 5C

Additional acquisition performance specifications per National Instruments PXIe-5668R Device Specifications document

Software Functionality

Spectrum Defender® Reviewer Module Software Features

Waveform File Spectrum Analyzer

Select a waveform file and review it on-screen in a Spectrum Analyzer style user interface. Apply averaging, peak-detection and resolution bandwidth adjustments on a previously recorded/imported waveform.

Freeze-Frame, Slow-Motion, High-Speed Waveform File View Modes

Freeze and manually step through the selected waveform file in time. Review the waveform file on-screen in either slow motion, normal speed or high-speed. Quickly scan through long signal waveforms, or perform a slow-motion deep dive observation of short duration signal events.

Import Waveform Files

Import files from external storage or network sources for subsequent analysis.

Trim and Export Waveform Files

Trim a long duration waveform into shorter component parts. Export either the trimmed waveform(s) or the entire original waveform. Convert waveform to alternate file formats on export.

Spectrum Defender Recorder Module Software Features

Contiguous RF Signal Recording

Capture RF signals with high fidelity and outstanding accuracy. Save downconverted IQ baseband data stream to storage subsystem with no dropped samples or acquisition dead time.

Long Duration Recording

Flawlessly capture and record RF signals for minutes, hours or days. Record duration is limited only by size of attached RAID storage system.

Preview Signals Prior to Record

Use an on-screen spectrum analyzer style display to search for RF signals of interest and optimize amplitude, center frequency, and bandwidth settings prior to recording. Apply averaging & peak detection processing in the frequency domain. Adjust resolution bandwidth settings & display averaging to pull signals out of the noise floor.

Spectrum Defender TCP Module Software Features

TCP/IP Remote Control

Remotely initiate and stop recording, set center frequency, amplitude, and record BW settings over a TCP/IP network connection. ASCII text command interface over TCP sockets. Programmer's Guide documentation included time".

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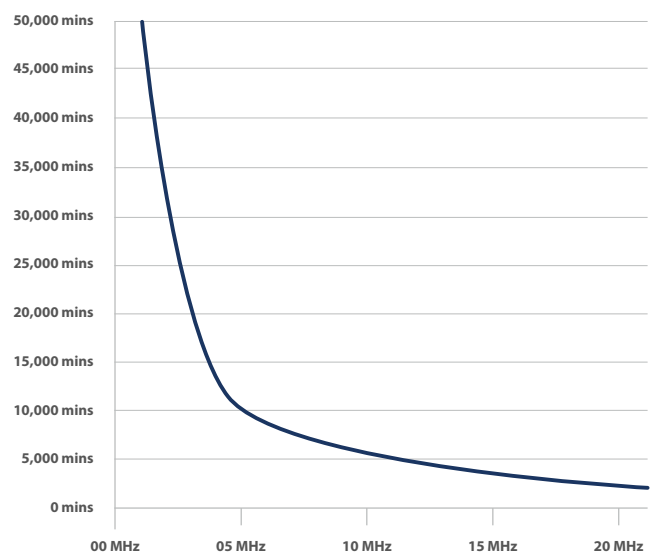
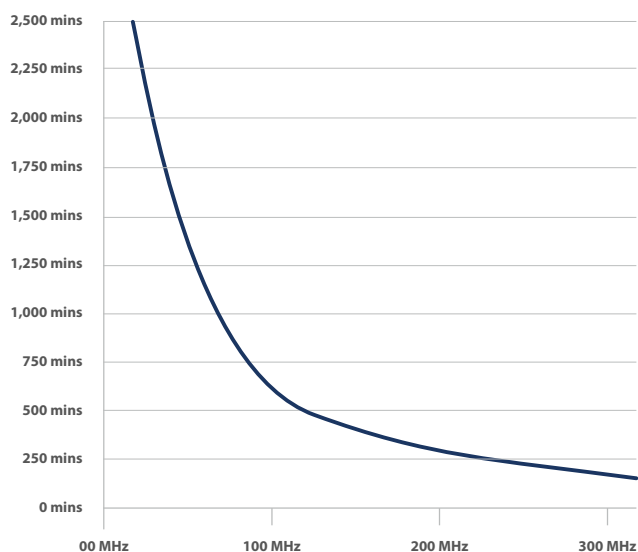
Instrument Control Interfaces

Primary User Interface	Microsoft Windows Desktop Application Accessible via locally attached Keyboard/Video/Mouse or remotely via Windows Remote Desktop Protocol (RDP) over Ethernet
Primary Programming Interface	Native LabVIEW Application Programming Interface (API)
Secondary Programming Interface	ASCII command/response protocol over TCP/IP Interacts with common terminal emulation software or may be automated using any TCP/IP capable programming language
Integrations	System may be integrated to function seamlessly with other manual and automated laboratory test systems via either the LabVIEW native API or the TCP/IP API.

Physical, Environmental, Power

Form Factor	19" rackmount with supplied brackets 4RU Instrumentation + 2RU Storage System
Intended Operating Environment	Office/Lab Environment
Weight	95 lbs. (estimated) Actual weight shall be stated at time of delivery
Power Source	110VAC/60Hz nominal
Power Consumption	Shall be stated at time of delivery

**Max Duration of Stored Signals as a Function of Signal Bandwidth
(15TB Storage Configuration)**



SD-BTO-3823 Configuration Matrix

Module	Description	
0101	Spectrum Defender® Recorder Module	Included
0102	Spectrum Defender® Recorder Module	Included
0103	Spectrum Defender® Surveyor Module	Optional
0104	Spectrum Defender® TCP Remote Control	Optional
0106	Spectrum Defender® Time & Navigation Module	Optional
0201	20Hz – 14GHz Tuning Range	Standard
0202	20Hz – 26.5GHz Tuning Range	Optional
0301	80MHz Acquisition Bandwidth	Optional
0302	200MHz Acquisition Bandwidth	Optional
0303	320MHz Acquisition Bandwidth	Standard
0304	765MHz Acquisition Bandwidth	Optional
0401	Primary Storage: 15TB, Spinning Disk, External Chassis	Optional
0402	Additional 15TB Secondary Storage As Additional 2U Chassis	Optional
0403	Additional 15TB Secondary Storage As Individual, Swappable Hard Drives in Shipping Kit (also includes 2 spare drives for maintenance)	Optional
0404	Storage Maintenance Kit Includes 2 spare drives + tools for field replacement in rugged shipping/carrying case	Optional
0405	Primary Storage: 4TB, SSD, Internal	Included
0406	Additional Storage: 4TB, SSD, Internal	Optional
0501	LNA to 3.6GHz	Included
0502	LNA Extension to 14GHz	Optional
0503	LNA Extension to 26.5GHz	Optional
0504	RF Pre-Selector Base Hardware with Integrated Software Control via TCP/IP (No Filters)	Optional
0505	Filter Set for use with RF Pre-Selector Base Hardware – 3.6GHz – 14GHz	Optional
0506	Filter Set for use with RF Pre-Selector Base Hardware – 3.6GHz – 26.5GHz	Optional
0601	GPS/IRIG-B/IEEE-1588/PPS Receiver	Optional
77XX	Custom File Format Import/Export	Available – Call Factory
88XX	Custom Software Extension	Available – Call Factory
99XX	Custom Hardware Extension	Available – Call Factory

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