Bird®
The **RF** Experts

IQC91000A
Wideband Signal Record & Playback System

WIDEBAND RECORDING FOR MODERN SIGNALS

Next generation defense electronic systems occupy large information bandwidths to meet demanding mission require-ments. Performance validation of these designs requires extensive testing on the bench, in the chamber and on the range to ensure system readiness prior to deployment. The IQC91000A was designed to record such modern waveforms and isolate anomalies that often occur during system integra-tion and real-world validation testing. With its 12 bit fidelity, the IQC91000A can continuously record 90 minutes of 1000 MHz wide waveforms to ensure designers capture transient and unexpected events.
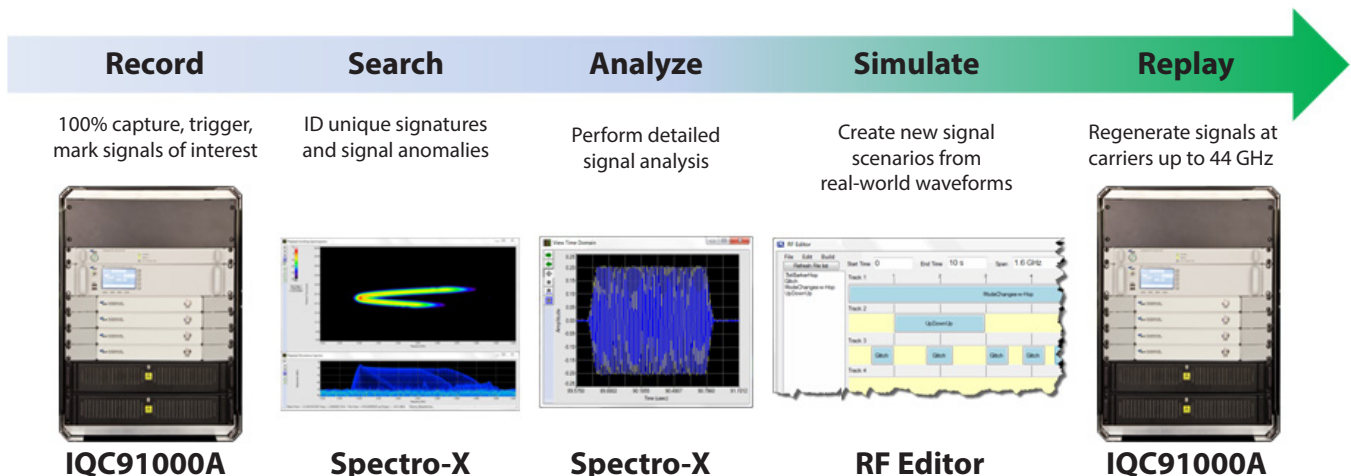
Recording wideband signals involves much more than col-lecting digital data. The quality of the RF converters, digitiz-ers and processing tools must be considered in the record and playback approach for engineers to make efficient use of their data set. Bird employs a holistic approach to ensure users can quickly collect high fidelity signal data and move it into their processing environments for analysis. Whether you need to record seconds, hours or even days of real-world RF data, the IQC91000A includes the hardware and analysis tools to get the job done.

The IQC91000A was designed to process large data sets of recorded spectrum to understand the nature of wideband waveforms. Recording 100% of the events of interest gives the engineer forensic evidence of what actually happened in the electromagnetic domain. Because these recordings contain 100% of the signal content, and not just a visual history, the interfering signals provide the user with undeniable proof of the signal event and its characteristics. These recordings can also be re-used as signal sources in margin and stress testing.

FEATURES
- 1000 MHz IQ record and playback bandwidth
- 1 GHz to 18 GHz frequency coverage, 26.5 GHz and 40 GHz option available.
- 90 minutes of continuous record and playback time.
- High-speed data offload for post-processing in MATLAB® as well as other popular VSA tools.
- Sophisticated triggers and markers to time-tag and geo-tag signal events.
- Eliminate gaps and only record signals of interest by lever-aging gated trigger capability.

Record	Search	Analyze	Simulate	Replay
100% capture, trigger, mark signals of interest	ID unique signatures and signal anomalies	Perform detailed signal analysis	Create new signal scenarios from real-world waveforms	Regenerate signals at carriers up to 44 GHz

| IQC91000A | Spectro-X | Spectro-X | RF Editor | IQC91000A |

From signal record through playback, tools are offered at each stage to help users manage their big data challenges.

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TURNING DATA INTO INFORMATION

High-speed recording systems create vast amounts of IQ data. Spectro-X can accelerate your time-to-insight by rapidly characterizing emitters and generating PDWs with its built-in search tools. For MATLAB® users, our 'xdatfile' class definition allows you to efficiently process blocks of IQ data and metadata without having to load the entire recording into the computing environment.
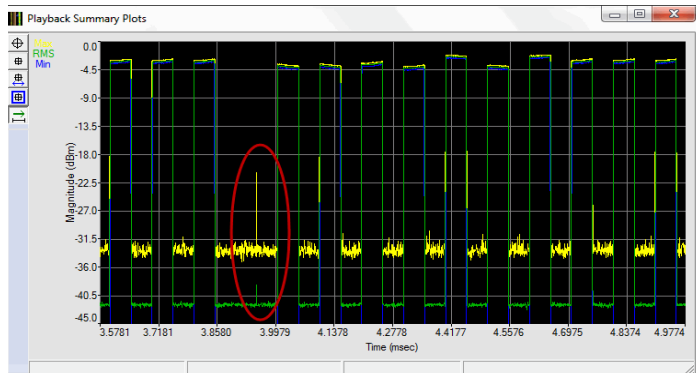
100% signal capture means users can identify design issues such as LO feedthrough, image responses and switching transients as shown in this photo.
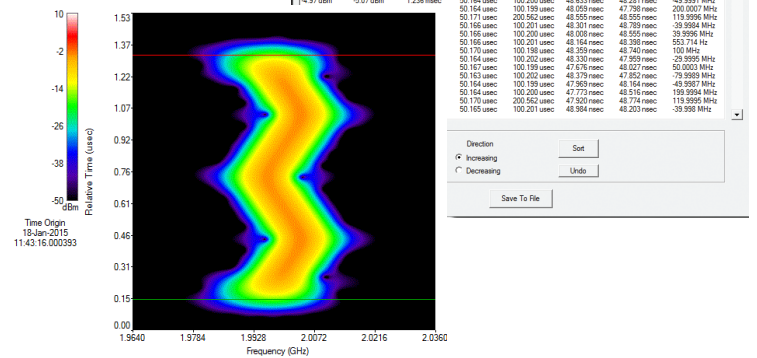
Spectro-X includes three search engines for locating and characterizing signals of interest. Shown here are the results of a Pulse Search with each of the PDWs computed along with the Spectrogram plot of each result

SYSTEM FRIENDLY INTERFACES

The complexity of modern defense systems demands that test equipment integrate well into the test environment to verify performance under all modes of operation. This is especially true during early design phases where test equipment must act as surrogate prior to actual hardware availability. The IQC91000A is designed to integrate into your test environment to record both metadata along with IQ data during system tests. This includes triggers to initiate and terminate recordings plus markers to time-tag and geo-tag signal events of interest. Additionally, you can leverage gated trigger capability to eliminate gaps and only record signals of interest. The PCIe Gen2 x8 interface allows rapid offload of recordings so you can begin post-processing in MATLAB® and other popular VSA tools.
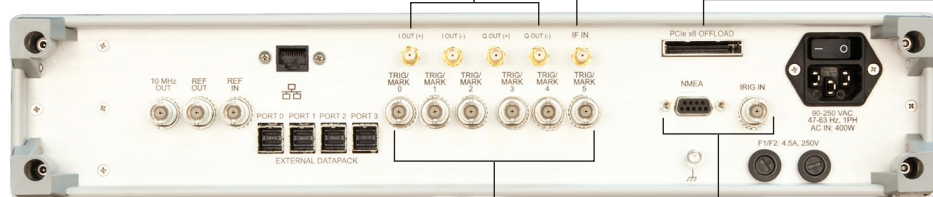
Monitor spectrum events while recording

Differential IQ outputs for vector up-conversion

Configure network and instrument settings

IF Input from Bird® or 3rd party converters

Cabled PCIe interface for high speed offload to workstation

Synchronize operation with other system events

Correlate data to IRIG-B and GPS time and location

COMPATIBILITY WITH THIRD PARTY CONVERTERS

Base configuration of the IQC91000A comes with a microwave down converter to cover 1 GHz to 18 GHz, with options up to 40 GHz. However, the system is compatible with the Keysight® X-Series signal analyzers for down-conversion of signals up to 110 GHz. Replay of high-fidelity recordings is accomplished via industry-leading microwave upconverters such as the vector signal generator from Keysight Technologies® (E8267D). This product offers streaming RF up-conversion via their wideband IQ inputs to replay recordings at carriers up to 44 GHz.

SIGNAL RECORD PERFORMANCE SPECIFICATIONS

The following specifications pertain to the IQC91000A record and playback system. Each system consists of the following elements: 1ea IQC91000A, 1ea IQC90000A-101, 1ea IQC90000A-DC5, 4ea IQC90000A-MEM and 2ea IQC90000A-S15 units. All specifications are nominal values that are representative of expected performance. Some variation may exist from system to system.

Category	Specification	Conditions	Notes
Center Frequency Tuning Range	1 GHz to18 GHz		
Frequency Tuning Resolution	1 kHz		
Maximum Record Bandwidth	1000 MHz	@ 4 dB BW	Decimated record bandwidths at 500 MHz, 250 MHz and 125 MHz
Record Sample Rate	3.2 GS/s		1.6 GS/s for I and 1.6 GS/s for Q
Record Resolution	12 bits		
Gain Adjustment Range	10 to 30 dB		
Gain Adjustment Resolution	1.0 dB		
Full-scale Amplitude	+3 dBm	Input signal + Gain	To avoid clipping, (Input signal amplitude + gain) ≤ +3 dBm
Input 1 dB Compression Point	-5 dBm (typically)	When configured with a gain of +15 dB	Note that this is above the (Input signal amplitude + gain) maximum value of +10 dBm
Third Order Intercept Point	-5 dBm (typically)	When configured with a gain of +15 dB	
Amplitude Flatness	+/- 2 dB	Across 1000 MHz bandwidth	
Displayed Average Noise Level	-160 dBm/Hz	@ 1 GHz center frequency	with 30 dB gain applied
Displayed Average Noise Level	-162 dBm/Hz	@ 4 GHz center frequency	with 30 dB gain applied
Displayed Average Noise Level	-160 dBm/Hz	@ 10 GHz center frequency	with 30 dB gain applied
Displayed Average Noise Level	-160 dBm/Hz	@ 16 GHz center frequency	with 30 dB gain applied
Spurious Free Dynamic Range	> 50 dB	1 GHz to 18 GHz	with 0 dB gain applied
Noise Figure	13 dB	500 MHz to 7.9 GHz, 10.101 GHz to 17.499 GHz	with 30 dB gain applied
Noise Figure	14 dB	7.901 GHz to 10.1 GHz	with 30 dB gain applied
Noise Figure	16 dB	17.5 to 18.5 GHz	with 30 dB gain applied

SIGNAL RECORD GENERAL SPECIFICATIONS

Category	Specification	Conditions
Number of Record Channels	1	
Input Connector	SMA Female x1	
Input Impedance	50 ohms	
Input VSWR	< 2.5 : 1	
Record Modes	Manual Timed Triggered Time Of Day Gated Record	Software/API Start and Stop, Supports both sample count and time in seconds, minutes and hours 2 Trigger Ports with rising or falling edge, boolean AND/OR logic Start on Time of Day (System Clock) Record only when Gate is High or Low

IQC91000A
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DATA STORAGE SPECIFICATIONS

Category	Specification	Conditions	Notes
Capacity	30 Tbytes	Configured as 2 each 15 TB RAIDs	
Storage Time	90 min	1000 MHz bandwidth	
Data Format	Binary packed 12 bit signed integers	RAID0 formatted as EXT4	
Data Offload Speed	> 500 MB/sec	via PCIeGen2 x8	Data rate subject to performance of source computer and storage device
Data Offload Format	16 bit		16 bit signed integers
Data Upload Speed	> 150 MB/sec	via PCIeGen2 x8	Data rate subject to performance of source computer and storage device
Data Upload Format	16 bit		16 bit signed integers

SIGNAL PLAYBACK (ANALOG IQ OUTPUTS) PERFORMANCE SPECIFICATIONS

Category	Specification	Conditions	Notes
Playback Bandwidth	1000 MHz		500 MHz for I and 500 MHz for Q
Playback Sample Rate	1.6 GS/s each I and Q		
Playback Resolution	12 bits		
Amplitude (full scale)	500mVp-p differential		
Amplitude Flatness	+/- 2 dB	Across 1000 MHz bandwidth	

SIGNAL PLAYBACK (ANALOG IQ OUTPUTS) GENERAL SPECIFICATIONS

Category	Specification	Conditions	Notes
Number of Channels	1		1 each, I and Q
Output Connectors	SMA Female x4		
Output Impedance	100 ohm differential		
Playback Modes	Manual, Triggered		

DISPLAY SPECIFICATIONS

Category	Specification	Conditions	Notes
System Status	Displays current system state		Idle, Busy, Booting, Armed, Recording, Playing, Offloading
FFT Display	Incoming Snapshots of the Spectrum		
Network Connection Status			
Network Settings Configuration			

INPUTS AND OUTPUTS SPECIFICATIONS

Category	Specification	Conditions	Notes
IF Input			
Connector	SMA Female		
Amplitude	+3 dBm full scale		
Center Frequency	800 MHz		
Reference Input			
Connector	BNC Female		
Amplitude	0 to +13 dBm		
Frequency Accuracy	10 MHz ± 100 Hz		
Reference Output			
Connector	BNC Female		
Amplitude	+3 dBm nominal		
Frequency Accuracy	Equivalent to Reference Input		
10 MHz Output			
Connector	BNC Female		
Amplitude	0 dBm, nominal		
Frequency Accuracy	10 MHz ± 20 Hz		

TRIGGER SPECIFICATIONS

Category	Specification	Conditions	Notes
Connector	SMA Female		
Functions	Start/Stop Record Start/Stop Playback		
Impedance	10 kOhms		
Input Level Range	0 to 5 V		V_{IH} (input on threshold) = 1.7 V (min) and V_{IL} (input off threshold) = 0.7 V (max)
Over Voltage Protection	Overvoltage protection of +11 Volts and max undervoltage of -6 Volts		
Record Latency	-25 ns	2.001 to 18 GHz	
Record Uncertainty	±8 samples (±5ns at full rate)		
Gated Trigger Re-arm Time	20 ns		

MARKER SPECIFICATIONS

Category	Specification	Conditions	Notes
Connector	SMA Female		Can be used in either record or playback modes
Impedance	10 kOhms		
Input Level Range	0 to 5 V		V_{IH} (input on threshold) = 1.7 V (min) and V_{IL} (input off threshold) = 0.7 V (max)
Over Voltage Protection	Overvoltage protection of +11 Volts and max undervoltage of -6 Volts.		
Latency	-25 ns	2.001 to 18 GHz	-37 ns 0.5 to 2.0 GHz
Uncertainty	±8 samples (±5ns at full rate)		All frequency bands
Marker Re-arm Time	20 ns		
Total Available Per File	100000		
Content	Date, time of day, latitude, longi-tude, elevation sample number		
Timing Sources	IRIG-B122, GPS via NMEA sentences w/1 PPS Marker input, PC-Time		

IRIG SPECIFICATIONS

Category	Specification	Conditions	Notes
Connector	BNC Female		Can be used in either record or playback modes
Standard	IRIG-B122		
Voltage Levels	Amplitude modulated, 3 Vpp, sine wave carrier		
Over Voltage Protection	Overvoltage protection of +11 Volts and max undervoltage of -6 Volts.		

GPS NMEA SPECIFICATIONS

Category	Specification	Conditions	Notes
Connector	9 pin D Female		Can be used in either record or playback modes
Speed	4800 and 9600 baud		
Supported Sentences	GPGGA, GPVTG, GPZDA		
Protocol	ASCII, 8-bit data, one start and one stop bit, no parity		

SYSTEM CONTROL SPECIFICATIONS

Category	Specification	Conditions	Notes
System Requirements (minimum)	Windows 7, 8, 8.1, 10, Server 2012, 64 bit, 8 GB RAM		
System Requirements (recommended)	Option IQC90000A-WS1: Rackmounted SigAnalyst Workstation Dual Xeon, Quad-Core Workstation, 64GB RAM with 128 TB HDD Storage Archive (96 TB usable). RAID60.		
Communication Interface Standard	LAN TCP/IP Interface		
Communication Interface Speed	1000Base-T		
System Re-Arm Time	4 Seconds (without markers) when using API		

SYSTEM SYNCHRONIZATION SPECIFICATIONS

Category	Specification	Conditions	Notes
Trigger timing uncertainty between any two IQC91000A systems	±7.8ns	Same 10 MHz reference and trigger signals must be applied to all IQC91000A systems	

PHYSICAL SPECIFICATIONS

Category	Specification	Conditions	Notes
System Warm Up Time	30 minutes		
Operating Temperature Range	0 to 35 °C		
Storage Temperature Range	-20 to +70 °C		
Altitude	Max 2000m above sea level		
Humidity	Max 80% non-condensing		

IQC91000A
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DIMENSIONS SPECIFICATIONS

Category	Specification	Conditions	Notes
IQC91000A	3.5" H x 16.5" W x 19.5" D		
option IQC90000A-DC5	1.75" H x 17" W x 21.25" D		
option IQC90000A-MEM	1.75" H x 12" W x 10.5" D		
option IQC90000A-S15	3.5" H x 16.5" W x 17.75" D		
option IQC90000A-UC1	7" H x 16.8" W x 20.3" D		

POWER SPECIFICATIONS

Category	Specification	Conditions	Notes
IQC91000A	100/120 or 220/240 VAC, 50/60 Hz, 400 W maximum		
option IQC90000A-DC5	100/120 or 220/240 VAC, 50/60 Hz, 30 W maximum		
option IQC90000A-MEM	100/120 or 220/240 VAC, 50/60 Hz, 72 W maximum for each unit		four each option -MEM units are required per system
option IQC90000A-S15	100/120 or 220/240 VAC, 50/60 Hz, 130 W maximum		two each option -S15 units are required per system
option IQC90000A-UC1	100/120 or 220/240 VAC, 50/60 Hz, 650 W maximum		

WEIGHT SPECIFICATIONS

Category	Specification	Conditions	Notes
IQC91000A	22 lbs.		
option IQC90000A-DC5	13.5 lbs.		
option IQC90000A-MEM	5 lbs. for each unit		four each option -MEM units are required per system
option IQC90000A-S15	14 lbs. for each unit		two each option -S15 units are required per system
option IQC90000A-UC1	54 lbs.		

ENVIRONMENTAL SPECIFICATIONS

Category	Specification	Conditions	Notes
IQC91000A System	Designed for compliance with test methods aligned with IEC 60068-2 and have humidity, shock, vibration, altitude, and power line condition levels similar to MIL-PRF-28800F Class 3.		

ORDERING INFORMATION

IQC91000A	1000 MHz single channel signal recorder with 800 MHz IF input and maximum digital IQ output rate of 4.8 Gbytes/sec. Includes 4ea IQC90000A-MEM adapters with rackmounts, Control SW and documentation on CD.
IQC90000A-DC2	3.6 GHz to 26.5 GHz down-converter with 700 MHz bandwidth centered at 800 MHz IF output.
IQC90000A-DC5	1 GHz to 18 GHz down-converter with 1000 MHz bandwidth centered at 800 MHz IF output.
IQC90000A-101	Adds analog differential baseband IQ outputs for playback (4ea SMA female), 1000 MHz IQ bandwidth.
IQC90000A-MEM	Interface Adapter to RAID0 external disk storage units. Four option MEM units are required per IQC90000A system
IQC90000A-S15	External RAID0 SSD external disk storage. Two data packs required per system for a total of 90 minutes storage at 1000 MHz bandwidth.
IQC90000A-UC1	500 MHz to 18 GHz up-converter with differential IQ inputs for 1000 MHz output at carriers up to 18 GHz. Includes rackmount kit.
IQC90000A-UC2	500 MHz to 40 GHz up-converter with differential IQ inputs for 1000 MHz output at carriers up to 40 GHz. Includes rackmount kit.
IQC90000A-WS1	Rackmounted SigAnalyst Workstation Dual Xeon, Quad-Core Workstation, 64GB RAM with 128 TB HDD Storage Archive (96 TB usable)
IQC90000A-WS2	Rackmounted SigAnalyst Workstation Dual Xeon, Quad-Core Workstation, 64GB RAM with 128 TB HDD Storage Archive (96 TB usable). Spectro-X and RF Editor software packages included.
IQC90000A-TRN	Daily rate for onsite training and consulting by Applications Engineer. Travel not included.
IQC90000A-ENL	Rack enclosure to house IQC90000A down-converter, 2ea solid state data packs, up-converter, workstation, storage archive and power distribution.
IQC90000A-EX1	Extends factory warranty of IQC90000A by one additional year.
IQC90000A-EX2	Extends factory warranty of IQC90000A by two additional years.
IQC90000A-EX3	Extends factory warranty of IQC90000A by three additional years.
IQC90000A-EX4	Extends factory warranty of IQC90000A by four additional years.
WC-RF-EDITOR	RF Editor Signal Generation software.
SPECTRO-X	Spectro-X Advanced Signal Analysis software.

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Pg. 8

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