

# IQC91000A

## Wideband Signal Record and Playback System



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### The RF Experts

### ORDERING INFORMATION

<b>IQC91000A</b>	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.
<b>IQC90000A-DC1</b>	500 MHz to 18 GHz downconverter with 1000 MHz bandwidth centered at 800 MHz IF output.
<b>IQC90000A-DC2</b>	3.6 GHz to 26.5 GHz downconverter with 700 MHz bandwidth centered at 800 MHz IF output.
<b>IQC90000A-DC3</b>	18 GHz to 40 GHz downconverter with 1000 MHz bandwidth centered at 800 MHz IF output.
<b>IQC90000A-101</b>	Adds analog differential baseband IQ outputs for playback (4ea SMA female), 1000 MHz IQ bandwidth.
<b>IQC90000A-MEM</b>	Interface Adapter to RAID0 external disk storage units. Four option MEM units are required per IQC90000A system
<b>IQC90000A-S15</b>	External RAID0 SSD external disk storage. Two data packs required per system for a total of 90 minutes storage at 1000 MHz bandwidth.
<b>IQC90000A-UC1</b>	500 MHz to 18 GHz upconverter with differential IQ inputs for 1000 MHz output at carriers up to 18 GHz. Includes rackmount kit.
<b>IQC90000A-UC2</b>	500 MHz to 40 GHz upconverter with differential IQ inputs for 1000 MHz output at carriers up to 40 GHz. Includes rackmount kit.
<b>IQC90000A-WS1</b>	Rackmounted SigAnalyst Workstation Dual Xeon, Quad-Core Workstation, 64GB RAM with 128 TB HDD Storage Archive (96 TB usable)
<b>IQC90000A-WS2</b>	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.
<b>IQC90000A-TRN</b>	Daily rate for onsite training and consulting by Applications Engineer. Travel not included.
<b>IQC90000A-ENL</b>	Rack enclosure to house IQC90000A downconverter, 2ea solid state data packs, upconverter, workstation, storage archive and power distribution.
<b>IQC90000A-EX1</b>	Extends factory warranty of IQC90000A by one additional year.
<b>IQC90000A-EX2</b>	Extends factory warranty of IQC90000A by two additional years.
<b>IQC90000A-EX3</b>	Extends factory warranty of IQC90000A by three additional years.
<b>IQC90000A-EX4</b>	Extends factory warranty of IQC90000A by four additional years.
<b>WC-RF-EDITOR</b>	RF Editor Signal Generation software.
<b>SPECTRO-X</b>	Spectro-X Advanced Signal Analysis software.

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### WIDEBAND RECORDING FOR MODERN SIGNALS

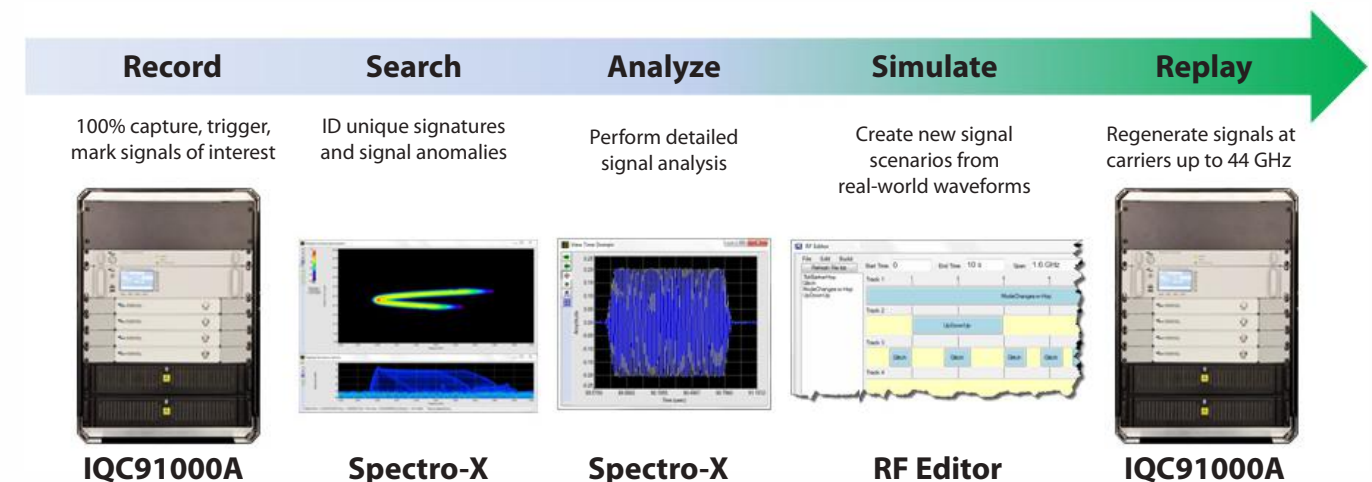
Next generation defense electronic systems occupy large information bandwidths to meet demanding mission requirements. Performance validation of these designs requires extensive testing on the bench, in the chamber and on the range to ensure system readiness prior to deployment. The IQC91000A was designed to record such modern waveforms and isolate anomalies that often occur during system integration 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 collecting digital data. The quality of the RF converters, digitizers 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

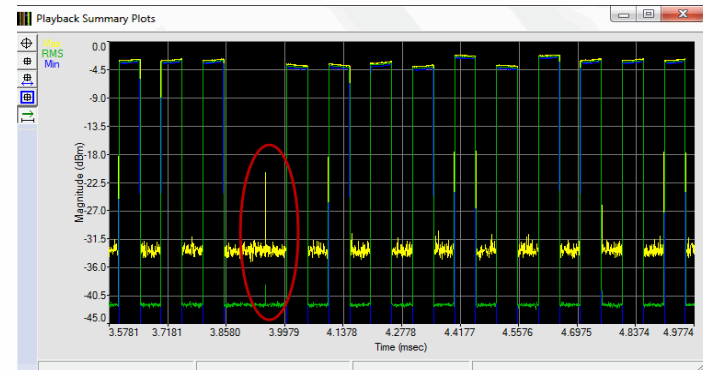
- 1000 MHz IQ record and playback bandwidth.
- 500 MHz to 18 GHz frequency coverage.
- 90 minutes of continuous record and playback time.
- High-speed data offload for post-processing in Matlab® popular VSA tools.
- Sophisticated triggers and markers to time-tag and geo-tag signal events.



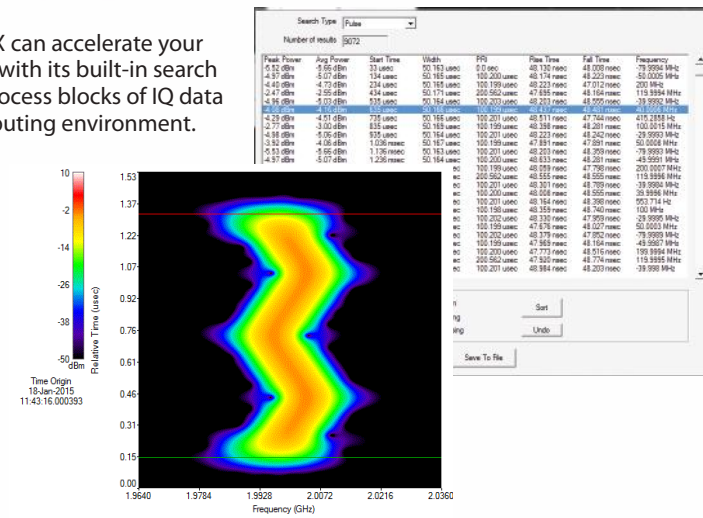
From signal record through playback, tools are offered at each stage to help users manage their big data challenges.

### 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 Class Definition allows you to efficiently process blocks of IQ data and metadata without having to load the entire recording into the computing environment.



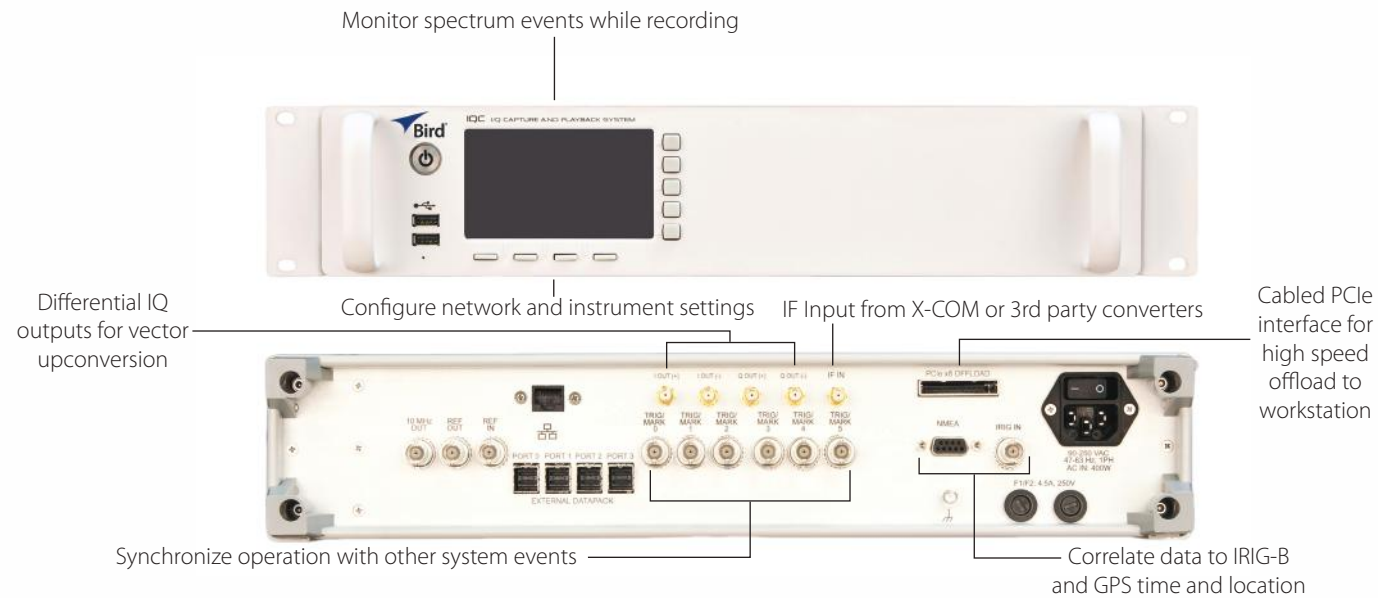
100% signal capture means users can identify design issues such as LO feedthrough, image responses and switching transients as shown in this photo.



Spectro-X includes four 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. The PCIe Gen2 x8 interface allows rapid offload of recordings so you can begin post-processing in Matlab® and other popular VSA tools.



### COMPATIBILITY WITH THIRD PARTY CONVERTERS

The IQC91000A comes standard with a microwave down converter to cover 500 MHz to 18 GHz, however, the system is compatible with any converter that can produce an 800 MHz IF such as the Keysight® X-Series signal analyzers for downconversion of signals up to 50 GHz. Replay of high fidelity recordings is accomplished via industry-leading microwave upconverters such as the vector signal generators from Keysight Technologies® (E8267D) and Rohde & Schwarz® (SMW200A). These products offer streaming RF upconversion via their wideband IQ inputs to replay recordings at carriers at 20 GHz and beyond.

### 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-DC1, 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	500 MHz to 18 GHz		
Frequency Tuning Resolution	1 MHz		
Maximum Record Bandwidth	1000 MHz	at 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	0 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
Amplitude Limiting	+10 dBm	Input signal + Gain	To avoid damage to the system, an internal switch will open if (Input signal amplitude + gain) ≥ +10 dBm
Input 1 dB Compression Point	> 0 dBm	When configured with a gain of +15 dB	Note that this is above the (Input signal amplitude + gain) limiting value of +10 dBm
Third Order Intercept Point	> +10 dBm	When configured with a gain of +15 dB	
Amplitude Flatness	+/- 2.3 dB	Across 1000 MHz bandwidth	
Displayed Average Noise Level	-158 dBm/Hz	@ 1 GHz center frequency	with 30 dB gain applied
Displayed Average Noise Level	-160 dBm/Hz	@ 4 GHz center frequency	with 30 dB gain applied
Displayed Average Noise Level	-155 dBm/Hz	@ 10 GHz center frequency	with 30 dB gain applied
Displayed Average Noise Level	-155 dBm/Hz	@ 16 GHz center frequency	with 30 dB gain applied
Spurious Free Dynamic Range	> 50 dB	500 MHz 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
SSB Phase Noise	-65 dBc/Hz	@ 100 Hz offset	When measured with a gain of 30 dB and an input signal level of -10 dBm. Specifications valid for all center frequency tuning ranges
SSB Phase Noise	-90 dBc/Hz	@ 1 kHz offset	When measured with a gain of 30 dB and an input signal level of -10 dBm. Specifications valid for all center frequency tuning ranges
SSB Phase Noise	-100 dBc/Hz	@ 10 kHz offset	When measured with a gain of 30 dB and an input signal level of -10 dBm. Specifications valid for all center frequency tuning ranges
SSB Phase Noise	-105 dBc/Hz	@ 100 kHz offset	When measured with a gain of 30 dB and an input signal level of -10 dBm. Specifications valid for all center frequency tuning ranges
SSB Phase Noise	-111 dBc/Hz	@ 1 MHz offset	When measured with a gain of 30 dB and an input signal level of -10 dBm. Specifications valid for all center frequency tuning ranges
SSB Phase Noise	-130 dBc/Hz	≥ 10 MHz offset	When measured with a gain of 30 dB and an input signal level of -10 dBm. Specifications valid for all center frequency tuning ranges

### SIGNAL RECORD GENERAL SPECIFICATIONS

Category	Specification	Conditions
Number of Record Channels	1	≥ 10 MHz offset
Input Connector	SMA Female x1	≥ 10 MHz offset
Input Impedance	50 ohms	≥ 10 MHz offset
Input VSWR	< 2.5:1	≥ 10 MHz offset
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



### DATA STORAGE SPECIFICATIONS

Category	Specification	Conditions	Notes
Capacity	30 Tbytes	configured as 2 each 15 TB RAID5	
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	12 bit format
Data Offload Format	12 and 16 bit		12 bit packed and 16 bit unpacked signed integers
Data Upload Speed	> 150 MB/sec	via PCIeGen2.x8	12 bit format
Data Upload Format	12 and 16 bit		12 bit packed and 16 bit unpacked 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
<b>IF Input</b>			
Connector	SMA Female		
Amplitude	+3 dBm full scale		
Center Frequency	800 MHz		
<b>Reference Input</b>			
Connector	BNC Female		
Amplitude	0 to +13 dBm		
Frequency Accuracy	10 MHz ± 100 Hz		
<b>Reference Output</b>			
Connector	BNC Female		
Amplitude	+3 dBm nominal		
Frequency Accuracy	Equivalent to Reference Input		
<b>10 MHz Output</b>			
Connector	BNC Female		
Amplitude	0 dBm, nominal		
Frequency Accuracy	10 MHz ± 20 Hz		

### TRIGGER SPECIFICATIONS

Category	Specification	Conditions	Notes
Connector	Connector		
Functions	Functions		
Impedance	Impedance		
Input Level Range	Input Level Range		$V_{IH}$ (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, longitude, elevation sample number		
Timing Sources	PC, IRIG-B and GPS via NMEA sentences		

### 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, 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		
Communication Interface Connector	RJ45 Ethertwist		
System Re-Arm Time	4 Seconds (without markers) from the graphical user interface	faster using API commands	

### 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		Can be used in either record or playback modes
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		

### DIMENSIONS SPECIFICATIONS

Category	Specification	Conditions	Notes
IQC91000A	3.5" H x 16.5" W x 19.5" D		Can be used in either record or playback modes
option IQC90000A-DC1	1.75" H x 16.75" W x 23" 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-DC1	100/120 or 220/240 VAC, 50/60 Hz, 150 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-DC1	25 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	Compliant 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.		