SEL-3060 Ethernet Radio Data Sheet

Wireless LAN Extension

Major Features and Benefits

- **Two Operating Modes Provide Flexibility.** Supports point-to-point radio operation for higher performance and point-to-multipoint for efficient and economical data gathering from remote locations. In point-to-multipoint mode, as many as 63 nodes are supported and a repeater can be configured using two collocated radios.
- **Two RJ45 10/100BASE-T Ethernet Ports Provide Connectivity.** Offers a wireless LAN extension for an Ethernet LAN in a substation and compatibility with Ethernet field devices.
- **Operates in License-Free Frequency Bands for Simplicity and Lower Cost.** SEL-3060A uses the 900 MHz ISM band; SEL-3060B uses the 2.4 GHz ISM band.
- **Long-Range Operation Connects More Devices.** Supports communications links as far as 15 miles (SEL-3060A point-to-point), 10 miles (SEL-3060A point-to-multipoint and SEL-3060B point-to-point), or 7 miles (SEL-3060B point-to-multipoint).
- **High Data Rate for Higher Bandwidth Applications.** Transfers data at a rate of 1 Mbps, making the SEL-3060 suitable for synchrophasor data and surveillance video.
- **Offers Low Latency for Ethernet Control Applications.** Offers 6–12 ms latency for IEC 61850 GOOSE messages using point-to-point operation.
- **Low Power Requirements Reduce the Power Needed in Field Cabinets.** Requires less than 4 watts, making the SEL-3060 well-suited for battery backup in remote locations.
- **Operates in Harsh Environments.** Operates reliably between –40° and +85°C (–40° to +185°F), and complies with IEEE 1613, IEEE C37.90, and IEC 60255 standards.
- **Uses Encrypted Wireless Communication for Security.** Includes 128-bit AES encryption for wireless transmission. The SEL-3060 can also be paired with an SEL-3620 or SEL-3622 Security Gateway to increase security for the wired communication.
- **Easy-to-Use Interface Streamlines Radio Commissioning.** Includes intuitive SEL-3060 device webpage that simplifies configuration and management.

Product Overview

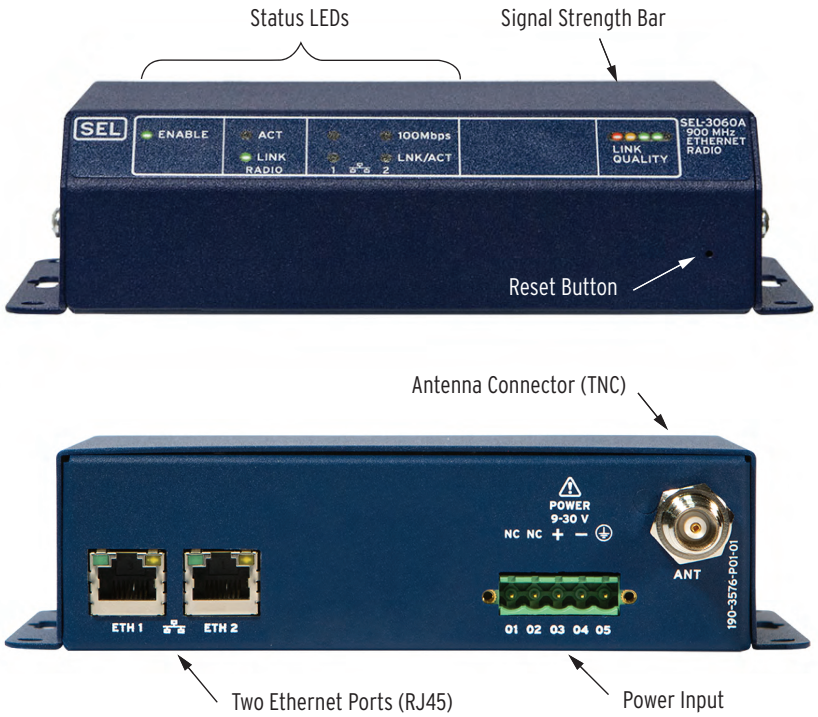

Figure 1 Product Overview

The SEL-3060 Ethernet Radio enables wireless communication from a substation to remote field devices for Distribution Automation applications including SCADA, Engineering Access, IEC 61850 GOOSE messaging, and synchrophasors. The SEL-3060 can also be used for primary or secondary wireless links between substations.

Standard Features

- Two RJ45 10/100 Ethernet ports
- Power input: 9–30 Vdc at less than 4 watts
- Output power: +20 dBm for SEL-3060A, +16 dBm ±2 dBm for SEL-3060B
- Receive sensitivity: –93 dBm at 1% packet error rate (PER) for SEL-3060A, –91 dBm at 5% PER for SEL-3060B
- Wall-mount chassis
- 128-bit AES encryption
- LEDs provide status and signal strength
- Web interface provides radio link statistics
- 10-year warranty

Applications

Distribution Automation

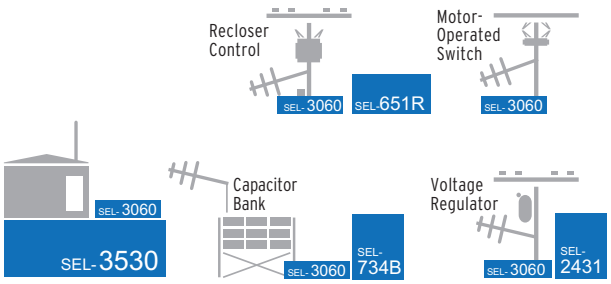

Figure 2 Distribution System Communications Example

The primary application for SEL-3060 radios is providing communication for distribution automation. Typically, the radios are in a point-to-multipoint configuration with the access point in a control house at a substation. The radio nodes are located in cabinets with field devices, such as recloser controls, capacitor banks, voltage regulators, motor-operated switches, and meters.

The radios serve as cost-effective communications links to field devices and are much more affordable than running fiber cable. The communications link can be used for collecting SCADA information from field devices and for engineering access to devices. Because the SEL-3060 radio has a high data rate of 1 Mbps, the radio

link can be used to collect synchrophasor data. Radio links can also be used for Ethernet-based control, such as IEC 61850 Generic Object-Oriented Substation Event (GOOSE) messaging.

Substation to Substation

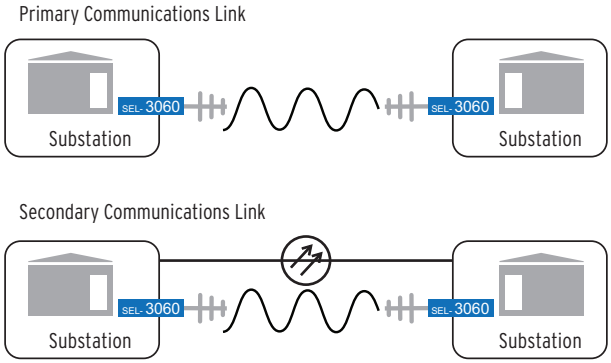

Figure 3 Primary and Secondary Communications Links

Two SEL-3060 radios can create a point-to-point link between two substations. This can be the primary communications link, or it can be a redundant link to a fiber cable. A point-to-point link utilizes two directional antennas and offers advantages for data rate, latency, and distance.

Substation Surveillance Video

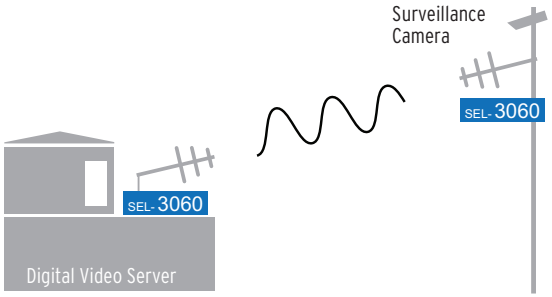

Figure 4 Transmit a Video Signal to the Control Enclosure

The high 1 Mbps data rate of the SEL-3060 makes it a good fit for transferring surveillance data from pole-mounted cameras to a digital video server in the substation control house. SEL-3060 wireless links allow users to retrofit a substation with cameras without digging trenches for new fiber cables between cameras and the control house.

Connectivity to Serial Devices

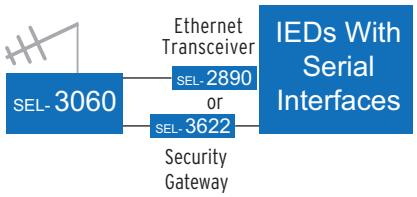

Figure 5 Connect to Serial Devices

The SEL-3060 can be connected to devices that only have serial ports through use of an SEL-2890 Ethernet Transceiver. Or, if security is important, the SEL-3622 can provide a Serial-to-Ethernet connection and also add security features like centralized access, activity logs, and VPN tunneling with IPsec.

Repeater Mode

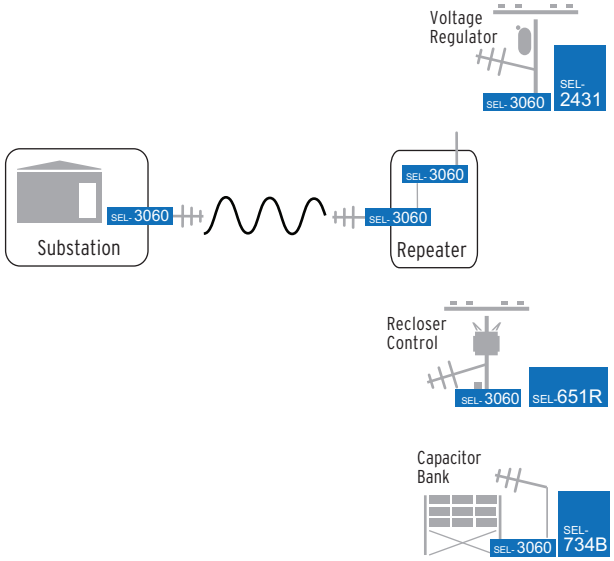

Figure 6 Repeater Mode

In radio networks, repeaters are commonly used to extend distances or route signals over a mountain or other obstacles to devices on the other side. In this example two SEL-3060 radios form a point-to-point link. At the repeater there is a second SEL-3060 which is the access point for a point-to-multipoint extension to three field devices. By using two radios at the repeater site, the throughput is not reduced and the range is maximized.

Configuration

SEL-3060 Discovery Tool

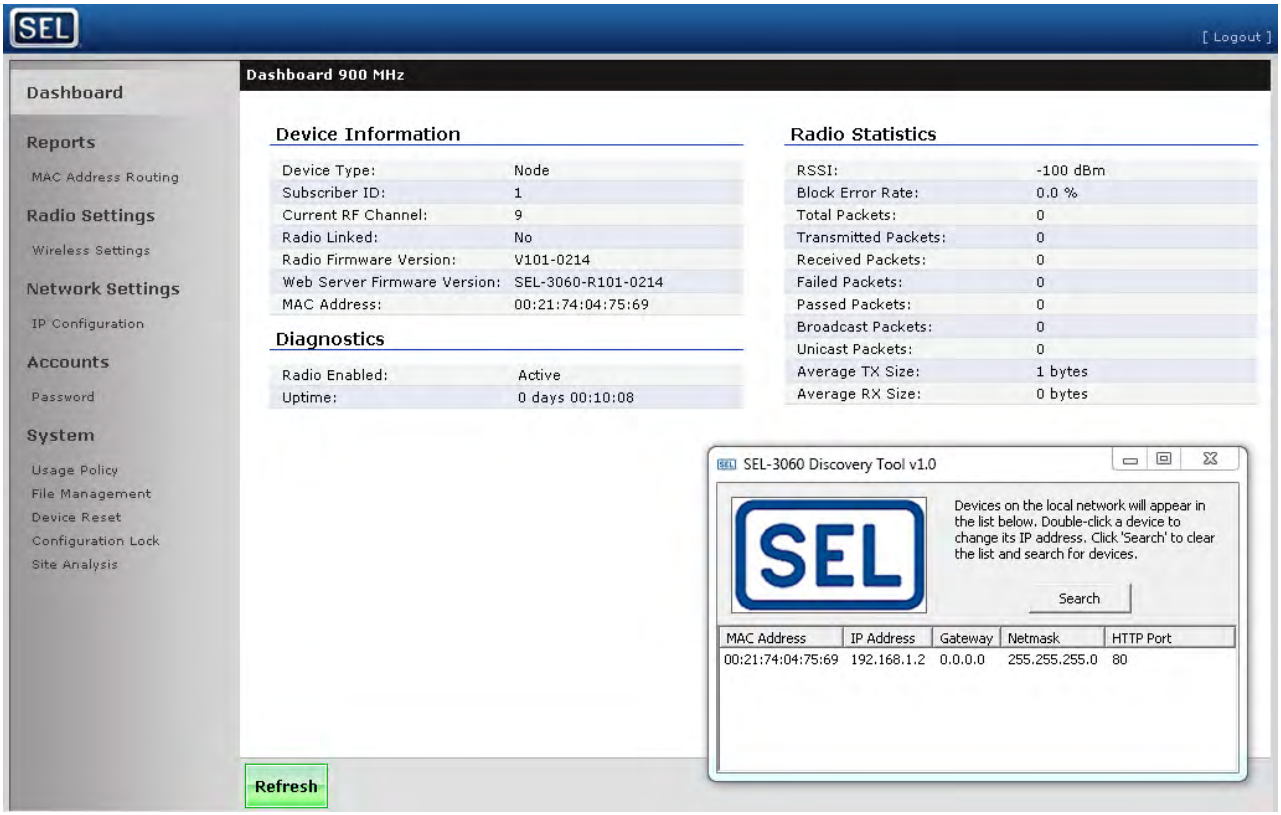

Figure 7 Device Webpage and SEL-3060 Discovery Tool Window

SEL offers a Window-based IP finder utility to easily find SEL-3060 radios and set their IP address. Then users can connect to each device radio webpage for configuration of the wireless settings (i.e., access point or node, number of nodes, etc.). After deploying the radios, the device webpage allows users to lock down the device to ensure that settings are not changed. The device webpage also includes a spectrum analyzer to use as a troubleshooting tool if radio interference problems occur.

Antenna Options

The following antennas are qualified for use with the SEL-3060 radio.

Table 1 Antennas Permitted for Use With the SEL-3060A 900 MHz Radio

Antenna Type	Maximum Allowed Gain
Yagi antenna	16.15 dBi or less
Omnidirectional antenna	11.15 dBi or less

Table 2 Antennas Permitted for Use With the SEL-3060B 2.4 GHz Radio

Antenna Type	Maximum Allowed Gain
Yagi antenna	16.15 dBi or less
Omnidirectional antenna	15 dBi or less
Panel antenna	19 dBi or less

SEL offers the following antennas as part of its complete radio solution.

Table 3 900 MHz Antennas

Name	SEL Part Number
Low-Profile 3 dBi Gain Omnidirectional, N Female Connector	235-0003
Vertical 7.15 dBi Gain Omnidirectional, N Female Connector	235-0232
Vertical 9.15 dBi Gain Omnidirectional, N Female Connector	235-0233
Three-Element 8.15 dBi Gain Yagi, N Female Connector	235-0009
Five-Element 11.1 dBi Gain Yagi, N Female Connector	235-0220
Eleven-Element 14.15 dBi Gain Yagi, N Female Connector	235-0222
Eighteen-Element 16.15 dBi Gain Yagi, N Female Connector	235-0224
Indoor 8" Vertical, TNC Male Connector	235-0108

Table 4 2.4 GHz Antennas

Name	SEL Part Number
Low-Profile 3 dBi Gain Omnidirectional, N Female Connector	235-0003
Vertical 10 dBi Gain Omnidirectional, N Female Connector	235-0227
15 dBi Gain Enclosed Yagi, N Female Connector	235-0225
19 dBi Gain Panel, N Female Connector	235-0228
Indoor 8" Vertical, TNC Male Connector	235-0108

Front- and Rear-Panel Diagrams

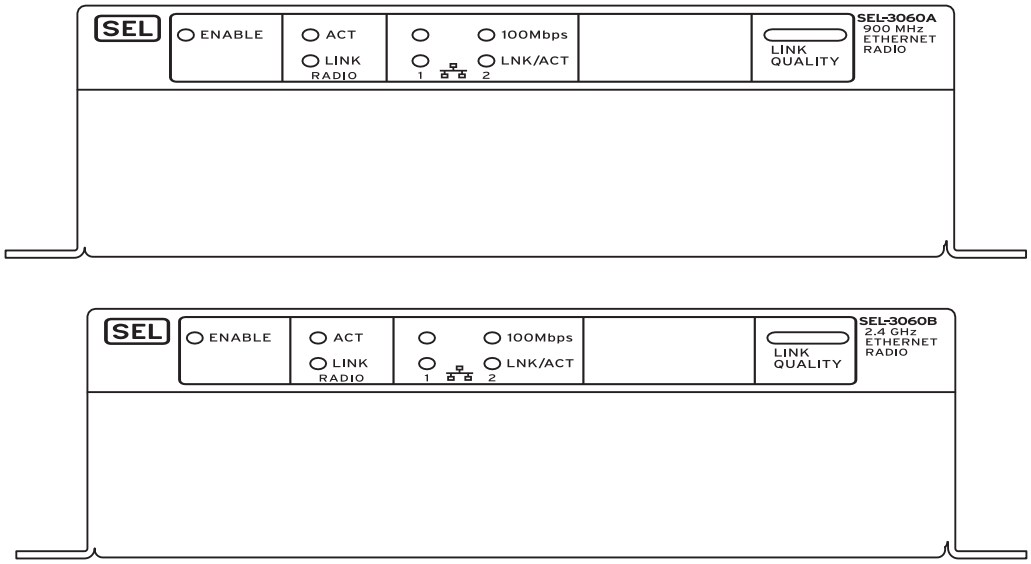

Figure 8 SEL-3060 Front Panels

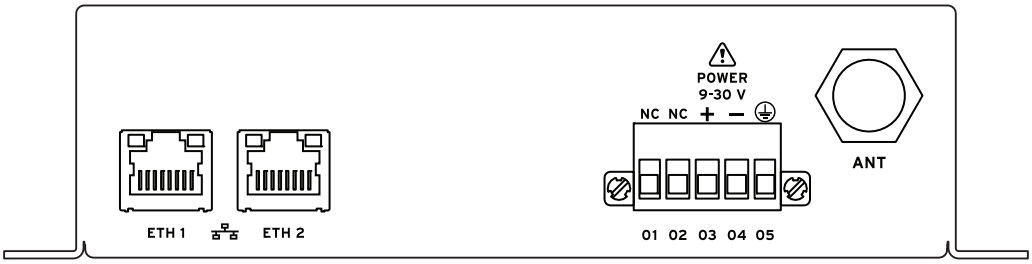

Figure 9 SEL-3060 Rear Panel

Dimensions

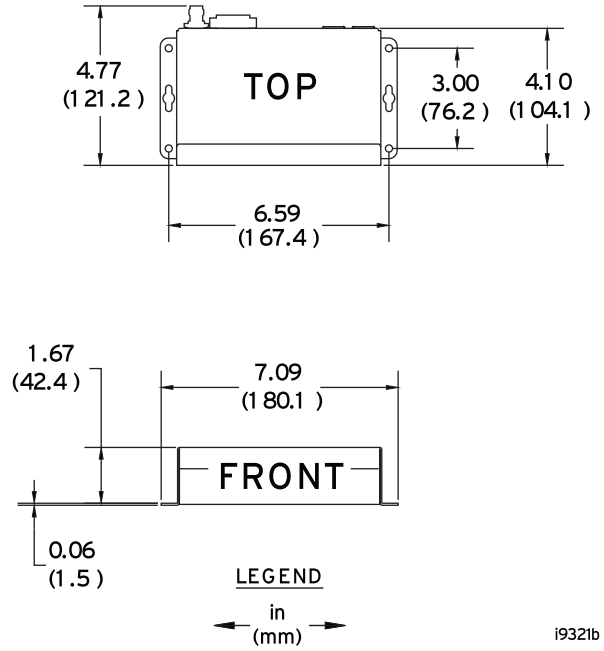

Figure 10 SEL-3060 Dimensions

Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system

Also see *Table 5*.

General

Temperature Range

–40° to +85°C per IEC 60068-2-1 and 60068-2-2

Operating Environment

Pollution Degree:	2
Relative Humidity:	5–95%, noncondensing
Maximum Altitude:	2000 m

Dimensions

Wall Mount:	151 mm x 2104 mm x 44 mm (5.96 in x 4.08 in x 1.73 in)
Weight:	0.39 kg (0.86 lb)

Communications

Communications Ports

Ethernet Ports

Ports:	2 rear
Rate:	10/100 Mbps
Rear Connectors:	RJ45
Standard:	IEEE 802.3

Protocols

Modbus TCP, TCP/IP, UDP, FTP, DNP3 LAN/WAN, HTTP Webpage Support, Telnet, SEL ASCII and Compressed ASCII, SEL Fast Messaging, IEEE C37.118 Synchrophasors, IEC 61850 GOOSE

Typical Latency

Point-to-Point (IEC 61850 GOOSE)

500-Byte Packet:	12.5 ms

Point-to-Multipoint (IEC 61850 GOOSE)

500-Byte Packet:	~50 ms (4 nodes simultaneously transmit GOOSE)

Radio

Transmitter

Frequency Band:	
SEL-3060A:	902–928 MHz ISM band
SEL-3060A3 (Brazil Firmware):	902.0–907.5, 915–928 MHz
SEL-3060B:	2.40000–2.46875 GHz ISM band
Technology:	Digital Modulation
Modulation:	Frequency Shift Keying (FSK)
Operating Mode:	Point-to-Point, Point-to-Multipoint (63 nodes)
RF Connector:	TNC
Power Output:	
SEL-3060A:	20 dBm (100 mW)
SEL-3060B:	16 dBm ±2 dBm (40 mW)
Number of Channels	
SEL-3060A:	12
SEL-3060B:	26
Channel Bandwidth:	2 MHz

Receiver

SEL-3060A:	–93 dBm ± 2 dB at 1% PER
SEL-3060B:	–91 dBm ± 2 dB at 5% PER
Distance:	
SEL-3060A Point-to-Point:	15 miles with 15 dB fade margin
SEL-3060A Point-to-Multipoint:	10 miles with 15 dB fade margin
SEL-3060B Point-to-Point:	10 miles with 15 dB fade margin
SEL-3060B Point-to-Multipoint:	7 miles with 10 dB fade margin
Error Detection:	16-bit CRC
Forward Error Correction (FEC):	4:16 block code

Data Rate

Aggregate Data Rate:	1 Mbps

Encryption

AES 128-bit encryption for over-the-air data

Power Supply

Rated Supply Voltage:	12/24 Vdc
Input Voltage Range:	9–30 Vdc
Power Consumption:	<4 W

Type Tests

Communications Equipment Tests

IEEE 1613-2003	
Power Frequency Disturbances:	IEC 61850-3:2002

Environmental Tests

Vibration Resistance:	IEC 60255-21-1:1988 Class 2 Endurance, Class 2 Response IEC 60255-21-3:1993 Class 2
Shock Resistance:	IEC 60255-21-2:1988 Class 1 shock withstand, bump, Class 2 shock response
Cold:	IEC 60068-2-1:2007 –40°C, 16 hours
Damp Heat, Cyclic:	IEC 60068-2-30:2005 25° to 55°C, 6 cycles, 95% relative humidity
Dry Heat:	IEC 60068-2-2:2007 +85°C, 16 hours

Dielectric Strength and Impulse Tests

Dielectric (HiPot):	IEC 60255-5:2000 IEEE C37.90–2005
Impulse:	IEC 60255-5:2000 0.5 J, 5 kV 2.4 kV on Ethernet Ports

RFI and Interference Tests

EMC Immunity

Standard:	IEEE 1613, Class 1
Electrostatic Discharge:	IEC 60255-2-2:2008 Severity Level 4 8 kV contact discharge 15 kV air discharge IEC 61000-4-2:2008 Severity Level 4 8 kV contact discharge 15 kV air discharge IEEE C37.90.3–2001 Severity Level 4 8 kV contact discharge 15 kV air discharge
Radiated RF Immunity:	IEC 60255-22-3:2007 10 V/m IEC 61000-4-3:2008 10 V/m IEEE C37.90.2–2004 35 V/m
Fast Transient, Burst Immunity:	IEC 60255-22-4:2008 4 kV @ 5.0 kHz for power port 2 kV @ 5.0 kHz for communications ports IEC 61000-4-4:2011 4 kV @ 5.0 kHz for power port 2 kV @ 5.0 kHz for communications ports
Power Frequency Magnetic Field:	IEC 61000-4-8:2009 1000 A/m for 3 seconds, 100 A/m for 1 minute
Pulse Magnetic Field:	IEC 61000-4-9:2001 1000 A/m
Damped Oscillatory Magnetic Field:	IEC 61000-4-10:2001 100 A/m
Voltage Dips, Short Interruptions and Voltage Variations on DC Input Power Port:	IEC 60255-11:2008 IEC 61000-4-11:2004 IEC 61000-4-17:2002 IEC 61000-4-29:2000
Surge Withstand Capability Immunity:	IEC 60255-22-1:2007 2.5 kV common-mode, 1 kV differential-mode IEEE C37.90.1–2002 2.5 kV oscillatory, 4 kV fast transient
Conducted RF Immunity:	IEC 60255-22-6:2001 10 Vrms IEC 61000-4-6:2008 10 Vrms
Digital Radio Telephone RF Immunity:	ENV 50204-1995 Severity Level: 10 V/m at 900 MHz and 1.89 GHz

EMC Emissions

Radiated Emissions

IEC 60255-25:2000

FCC Part 15.247; ICES-001; RSS-247

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

FCC Part 15, Class A

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Section 15.21

Users manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Canada ICES-001(A) / NMB-001(A)

Table 5 Certifications by Country

Country	Authority	Reference
3060A		
Brazil	Anatel	0781-15-7001
Canada	IC	5303A-AW900MR
Mexico	IFETEL	RCPSCSE14-0853
Trinidad and Tobago	TATT	2/2/1/1693/7
USA	FCC	R4N-AW900MR
3060B		
Australia	ACMA	RCM
Canada	IC	5303A-AW2400MR
Mexico	IFETEL	RCPSCSE14-1847
New Zealand	Ministry of Economic Development	RCM
USA	FCC	R4N-AW2400MR

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