



**Panasonic Avionics Corporation**

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USA

**PRODUCT DESCRIPTION**

**FOR**

**Enhanced Cell Modem**

**PART NUMBER:**

**RD-AA8190-01**

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1.0 GENERAL

1.1 Purpose

The Enhanced Cell Modem (eCM) is a component of the GCS/eXConnect system designed to provide cellular and wireless data bridge from aircraft to ground network server for gatelink application. The eCM communicates with other head-end equipment through dual ports copper gigabit Ethernet and serves as cellular-to-wired network switch, routing media content, application software and service data.

- The eCM supports the following functions:
  - Offloads cached credit card transaction data.
  - Offloads BITE data.
  - Loads media content.
  - Loads and monitors Digital Right Management (DRM) key.
- The eCM Outline Drawing is shown in Figure 1 and Figure 2 are for reference only.

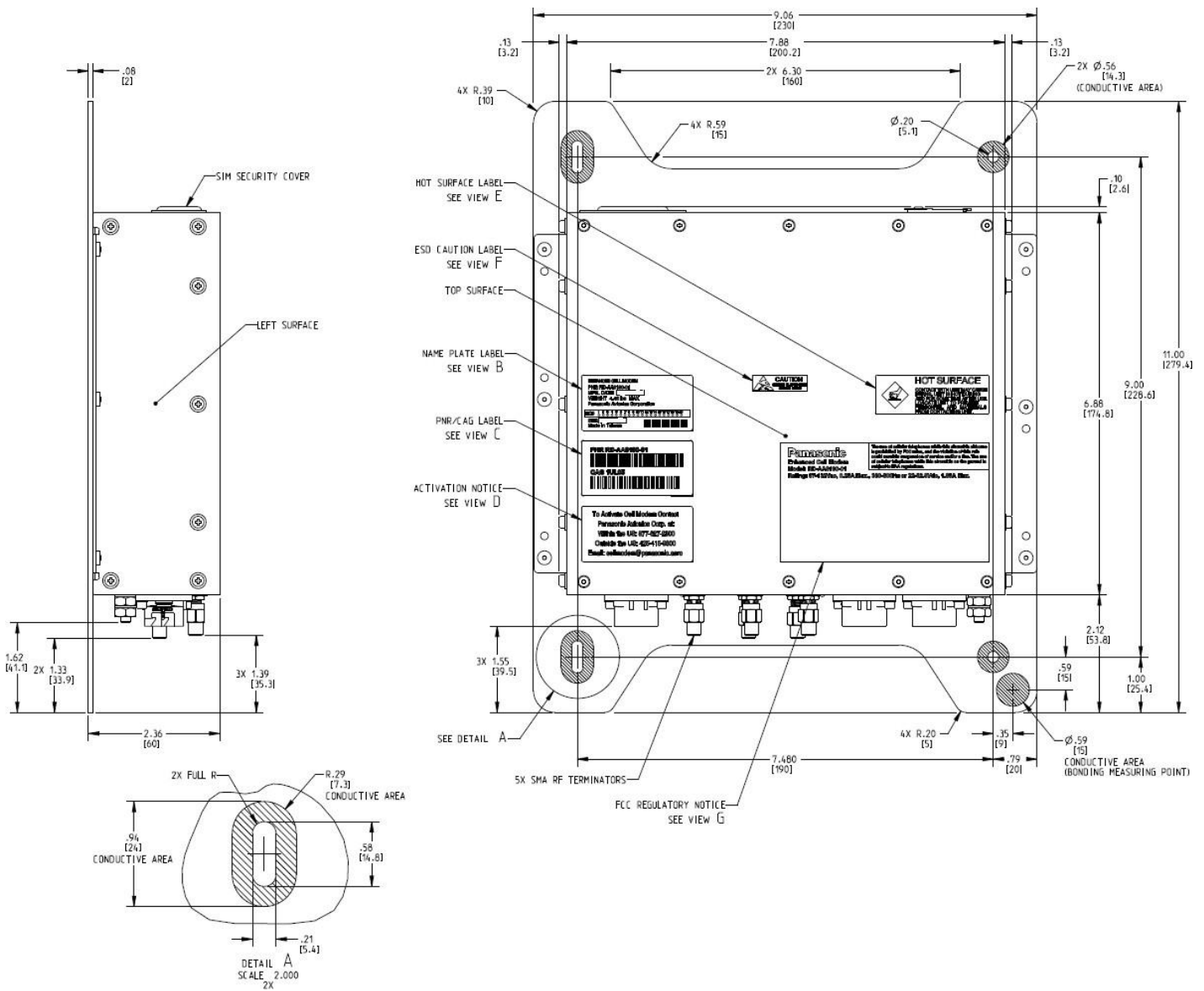


Figure 1: RD-AA8190-01 Enhanced Cell Modem Outline Drawing

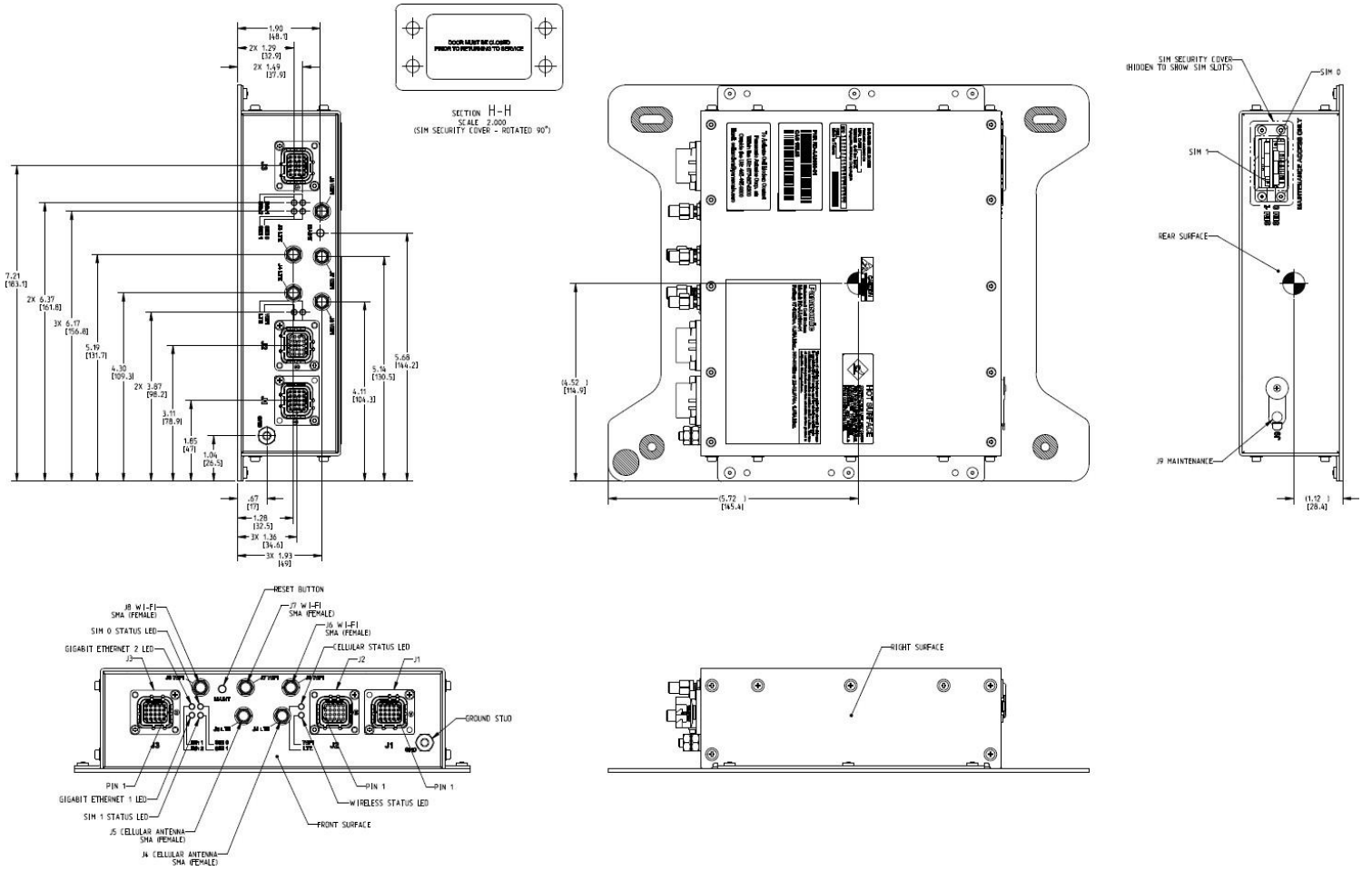


Figure 2: RD-AA8190-01 Enhanced Cell Modem Outline Drawing (continued)

## 2.0 WIRELESS DATA INTERFACES

### 2.1 Frequency Band or Channel Usage

- 2.412 GHz – 2.4835 GHz (802.11b/g/n).
- 5.180 GHz – 5.825 GHz (802.11a/ac/n).
- 717 MHz – 2690 MHz (LTE band).
- 824 MHz – 2170 MHz (DC-HSPA band).
- Exception: 2.402 GHz to 2.422 GHz (Wi-Fi 2.4 GHz Channel 1) is reserved for Crew Wireless.

### 2.2 Hardware Maximum Transmitter Output Power

- Wi-Fi
  - +18 dBm Max per chain.
  - 2.4 GHz: 18 dBm (802.11b/11Mbps), 8.2 dBm (802.11n/VHT40/MCS9).
  - 5 GHz: 18 dBm (802.11a/6Mbps), 10.2 dBm (802.11ac/VHT80/MCS9).
- Cellular (LTE)
  - +23 dBm  $\pm$  1 dBm Max.

### 2.3 Hardware Reset Button

The hardware reset button is located on the front panel and is disabled.

- To enable the button, one must log into the modem's Web interface and click on the "Factory Reset" button.

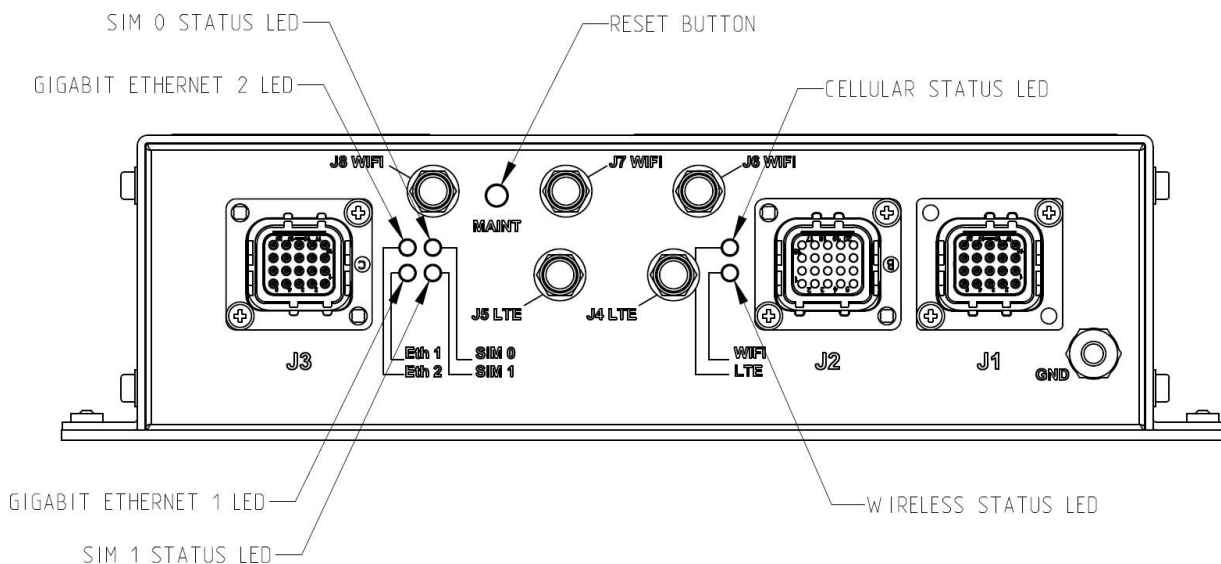


Figure 3: eCM Front Panel

**2.4 Cellular Interface**

- Frame Format & Protocol:
  - ETSI TS 125.101 (3GPP).
- Topology:
  - User Equipment (UE).
- Data Rate:
  - DL/FDD/Cat6: 300 Mbits/s with 2x2 MIMO antenna.
  - DL/TDD/Cat6: 222 Mbits/s with 2x2 MIMO antenna.
  - UL/FDD/Cat6: 50 Mbits/s with 2x2 antenna.
  - UL/TDD/Cat6: 26 Mbits/s with 2x2 antenna.
- RF Bands:

At a minimum, the eCM supports the following:

- 2G – GSM/GPRS/EDGE bands: not required.
- 3G – UMTS/DC-HSPA + bands: 1-5 & 8.

**WCDMA Frequency Bands Support**

Band <sup>1</sup>	Frequency (Tx)	Frequency (Rx)
Band 1	1920–1980 MHz	2110–2170 MHz
Band 2	1850–1910 MHz	1930–1990 MHz
Band 3	1710–1785 MHz	1805–1880 MHz
Band 4	1710–1755 MHz	2110–2155 MHz
Band 5	824–849 MHz	869–894 MHz
Band 8	880–915 MHz	925–960 MHz

- 4G – LTE bands: 1-5, 7, 8, 12, 13, 20, 25, 26, 29, 30 & 41.

**LTE Frequency Bands**

Band	Frequency (Tx)	Frequency (Rx)
Band 1	1920–1980 MHz	2110–2170 MHz
Band 2	1850–1910 MHz	1930–1990 MHz
Band 3	1710–1785	1805–1880 MHz
Band 4	1710–1755	2110–2155 MHz
Band 5	824–849 MHz	869–894 MHz
Band 7	2500–2570 MHz	2620–2690 MHz
Band 8	880–915 MHz	925–960 MHz
Band 12	699–716 MHz	729–746 MHz
Band 13	777–787 MHz	746–756 MHz
Band 20	832–862 MHz	791–821 MHz
Band 25	1850–1915 MHz	1930–1995 MHz
Band 26	814–849 MHz	859–894 MHz
Band 29	n/a	717–728 MHz
Band 30	2305–2315 MHz	2350–2360 MHz
Band 41	2496–2690 MHz (TDD)	

- RF Performance:
  - Meets ETSI TS 125.101 (3GPP).
  - There are two characteristics to specify the RF performance; Transmitter power for Transmitter characteristics and Receiver Sensitivity for Receiver characteristics. These are all defined in the ETSI's specification.
- Receiver Sensitivity:

Table 4-4: Conducted Rx (Receive) sensitivity—LTE bands

LTE bands		Conducted Rx sensitivity (dBm)			
		Primary (Typical)	Secondary (Typical)	SIMO (Typical)	SIMO <sup>1</sup> (Worst case)
LTE Band 1	Full RB BW: 10 MHz <sup>2</sup>	-97.5	-97.0	-100.5	-96.3
LTE Band 2		-97.0	-98.0	-100.5	-94.3
LTE Band 3		-97.0	-98.0	-100.0	-93.3
LTE Band 4		-97.5	-97.0	-100.0	-96.3
LTE Band 5		-98.5	-99.0	-102.0	-94.3
LTE Band 7		-96.5	-97.0	-100.0	-94.3
LTE Band 8		-99.0	-98.0	-101.5	-93.3
LTE Band 12		-97.5	-99.0	-101.5	-93.3
LTE Band 13		-97.0	-98.5	-101.0	-93.3
LTE Band 20		-98.5	-98.5	-101.5	-93.3
LTE Band 25		-97.0	-97.5	-100.5	-92.8
LTE Band 26		-98.5	-99.0	-102.0	-93.8
LTE Band 29		n/a	n/a	-101.75	-93.3
LTE Band 30		-95.5	-97.0	-99.5	-95.3
LTE Band 41		-95.5	-95.5	-98.5	-94.3

1. Per 3GPP specification  
 2. Sensitivity values scale with bandwidth:  
 $x_{MHz\_Sensitivity} = 10_{MHz\_Sensitivity} - 10 \cdot \log(10 \text{ MHz} / x_{MHz})$   
 Note: Bandwidth support is dependent on firmware version.

Table 4-5: Conducted Rx (Receive) sensitivity—UMTS bands

UMTS bands		Conducted Rx sensitivity (dBm)		
		Primary (Typical)	Secondary (Typical)	Primary / Secondary (Worst case) <sup>1</sup>
Band 1	0.1% BER 12.2 kbps	-110.5	-109.0	-106.0
Band 2		-110.0	-110.0	-104.0
Band 3		-109.5	-110.0	-103.0
Band 4		-110.0	-109.5	-106.0
Band 5		-111.0	-112.0	-104.0
Band 8		-111.5	-110.5	-103.0

1. Per 3GPP specification



- Transmitter Power:
  - Meets ETSI TS 125.101 (3GPP).

**Table 4-6: Conducted Tx (Transmit) power tolerances**

Parameter	Conducted transmit power	Notes
<b>LTE</b>		
LTE Band 1,2,3,4,5,8,12,13,20,25,26	+23 dBm ± 1 dB	
LTE Band 7,30,41	+22 dBm ± 1 dB	
<b>UMTS</b>		
Band 1 (IMT 2100 12.2 kbps) Band 2 (UMTS 1900 12.2 kbps) Band 3 (UMTS 1800 12.2 kbps) Band 4 (AWS 1700/2100 12.2 kbps) Band 5 (UMTS 850 12.2 kbps) Band 8 (UMTS 900 12.2 kbps)	+23 dBm ± 1 dB	Connectorized (Class 3)

- Transmitter Attenuation:
  - The transmitter output level has programmable limitations depending on the mechanism inside the chip. The transmitter output level is limited by the Transmitter power. Maximum output power of Cellular UE is +23 dBm ± 1 dB per 3GPP standard requirement.
- Modem Control:
  - The modem is only operational while the aircraft is on ground with all of the Modem Enable 1, Discrete In1 and Modem Enable 2a, 2b (Weight-on-Wheels) discrete inputs are active.
  - The RF frequency bands and RF power amplifier output is controlled by the Modem Enable 1 and Modem Enable 2a, 2b (Weight-on-Wheels) discrete inputs.
  - If any discrete input is not active, the RF frequency bands and RF power amplifier output remains disable and cannot be overridden by software.
  - The eCM has fail safe circuitry to prevent unacceptable radiated or conducted interference to aircraft system.
  - At power start up, the eCM defaults the RF frequency bands and RF power amplifier output to disable.
- Cellular Status:
  - The eCM provides one LED (Green) for Cellular connectivity/activity status indicator.

**2.5 Cellular Antenna Interface**

- The eCM requires two external 2x2 MIMO Cellular Antennas.
- Two SMA type connectors:
  - J4 & J5 are provided and the connections are interchangeable.
- Antenna Topology:
  - 2x2 MIMO.
- Transmit/Receive:
  - 1 Tx, 2 Rx.
- Frequency Range:
  - 3G & 4G.
- Polarization:
  - Omni by design.

- Impedance:
  - 50  $\Omega$  unbalanced.
- Gain:
  - 1 dBi (Peak) per antenna over supported frequency range.
- Antenna Isolation:
  - 20 dB minimum.

## 2.6 Wireless LAN Interface

- Frame Format & Protocol:
  - IEEE 802.11a/b/g/n/ac.
- Topology:
  - Peer-to-access point (infrastructure).
- Data Rate:
  - 11 Mbits/s (802.11b).
  - 54 Mbits/s (802.11a/g).
  - 450 Mbits/s (802.11n) with 3x3 MIMO antenna.
  - 1.3 Gbits/s (802.11ac) with 3x3 MIMO antenna.
- RF Bands:
  - 2.412 GHz – 2.462 GHz (802.11b/g/n).
  - 5.180 GHz – 5.240 GHz (802.11a/ac/n).
  - 5.260 GHz – 5.320 GHz (802.11a/ac/n)
  - 5.500 GHz – 5.720 GHz (802.11a/ac/n)
  - 5.745 GHz – 5.825 GHz (802.11a/ac/n)
  - Exception: 2.402 GHz to 2.422 GHz is reserved for Crew Wireless use.
- Wireless Modulation Technique:
  - Direct Sequence Spread Spectrum (802.11b).
  - Orthogonal Frequency Division Multiplexing (802.11a).
  - Orthogonal Frequency Division Multiplexing and Direct Sequence Spread Spectrum (802.11g).
  - Orthogonal Frequency Division Multiplexing (802.11n).
  - 256-QAM (802.11ac).
- Receiver Sensitivity:
  - 2.4 GHz: -86 dBm (802.11b/11Mbps), -63 dBm (802.11n/VHT40/MCS9).
  - 5 GHz: -74 dBm (802.11a/54Mbps), -61 dBm (802.11ac/VHT80/MCS9).
- Transmitter Power:
  - 2.4 GHz: 18 dBm (802.11b/11Mbps), 8.2 dBm (802.11ac/VHT40/MCS9).
  - 5 GHz: 18 dBm (802.11a/6 Mbps), 10.2 dBm (802.11ac/VHT80/MCS9).
- Transmitter Attenuation:
  - The max output power of the Wi-Fi 3x3 module is +18 dBm per chain (limited by local regulatory requirements). Transmit power Configurable in increments of 0.5 dBm.
- Transmitter Control:
  - The modem is only operational while the aircraft is on ground with all of the Modem Enable 1, Modem Enable 2a, 2b and Discrete In1 are active.
  - The RF frequency bands and RF power amplifier output is controlled by the Modem Enable 1 and Modem Enable 2a, 2b and Discrete In1 discrete inputs.
  - The discrete inputs have priority over software control in the disable state.

- If any discrete input is not active, the RF frequency bands and RF power amplifier output remains disable and cannot be overridden by software.
  - The eCM has fail safe circuitry to prevent unacceptable radiated or conducted interference to aircraft system.
  - At power start up, the eCM defaults the RF frequency bands and RF power amplifier output to disable.
- Wireless Status:
- The eCM provides one LED (Green) for Wireless connectivity/activity status indicator.

## 2.7 Wireless Antenna Interface

- The eCM has three external 3x3 MIMO wireless antenna interfaces.
- Three SMA (female) bulkhead type connectors are located on the front panel.
- J6, J7 & J8 are provided and the connections are interchangeable.
- Antenna Topology:
- 3x3 MIMO, Dual-band.
- Transmit/Receive:
- 3x3 for 2.4 GHz / 5GHz.
- RF Bands:
- 2.412 GHz – 2.4835 GHz (802.11b/g/n).
  - 5.180 GHz – 5.825 GHz (802.11a/ac/n).
- Polarization:
- Horizontal.
- Impedance:
- 50  $\Omega$  unbalanced.
- Peak Gain:
- 3 dBi for 2.4 GHz - 2.5 GHz per antenna.
  - 5 dBi for 5.15 GHz - 5.92 GHz per antenna.

### 3.0 ELECTRICAL CHARACTERISTICS

#### 3.1 Power Consumption & Current Draw

**Power Input:**

Single Input Power – Cannot operate with AC & DC at the same time.  
(Note: BOEING Installations – Install with 28 VDC Only, Not 115 VAC).

**Power Consumption:**

Full Load (AC): 23.43 W Max at 115 VAC 400Hz.  
Idle mode (AC): 13.86W Max at 115 VAC 400Hz.

**Current Draw:**

Full Load (AC): 241.5 mA Max at 97 VAC 400Hz.  
Idle mode (AC): 143mA Max at 97 VAC 400Hz.

**Power Consumption:**

Full Load (DC): 19.36W Max at 28 VDC.  
Idle mode (DC): 11.66W Max at 28 VDC.

**Current Draw:**

Full Load (DC): 1844 mA Max at 10.5 VDC.  
Idle mode (DC): 1110 mA Max at 10.5 VDC.

#### 3.2 Power Factor

0.94 Min.

#### 3.3 Circuit Breakers and Fuses

No Circuit breakers in this unit.

Fuses listed in **Error! Reference source not found..**

## 4.0 FUNCTIONS

### 4.1 Functionality and Interface Characteristics

The Enhanced Cell Modem (eCM) is a component of the GCS/eXConnect system designed to provide cellular and wireless data bridge from aircraft to ground network server for gatelink application. The eCM communicates with other head-end equipment through dual ports copper gigabit Ethernet and serves as wireless-to-wired network switch, routing media content, application software and service data.

- The eCM supports the following Functions:
  - Offloads cached credit card transaction data.
  - Offloads BITE data.
  - Loads media content.
  - Loads and monitors Digital Rights Management (DRM) key.
- The eCM has the following interfaces:
  - One 1000Base-T Ethernet port to headend server.
  - One 1000Base-T Ethernet port for redundant loopback port or daisy-chained Ethernet port
  - One cell modem card.
  - Two external 2x2 MIMO cellular antennas.
  - One integrated 802.11 a/b/g/n/ac wireless adapter.
  - Three external 3x3 MIMO wireless antennas.
  - One smart card.
  - Two“plug-in” UICC SIM Card slots.
  - One SSD to store media content.
  - One real-time clock.
  - Three modem enable discrete inputs 1, 2a, 2b.
  - One Battery Pack Radio Enable discrete input (Optional).
  - One pass through Remote Off discrete from J1 to J2.
  - One pass through RF Disable discrete from J1 to J2.
  - One Maintenance Enable discrete input.
  - Three spare discrete inputs.
  - One RS-232 port for maintenance.
  - AC power input from aircraft.
  - DC power input from aircraft / Battery Pack power input.
  - Battery Pack RS-485 interface.

4.2 Hardware Block Diagram

# eCM Block Diagram

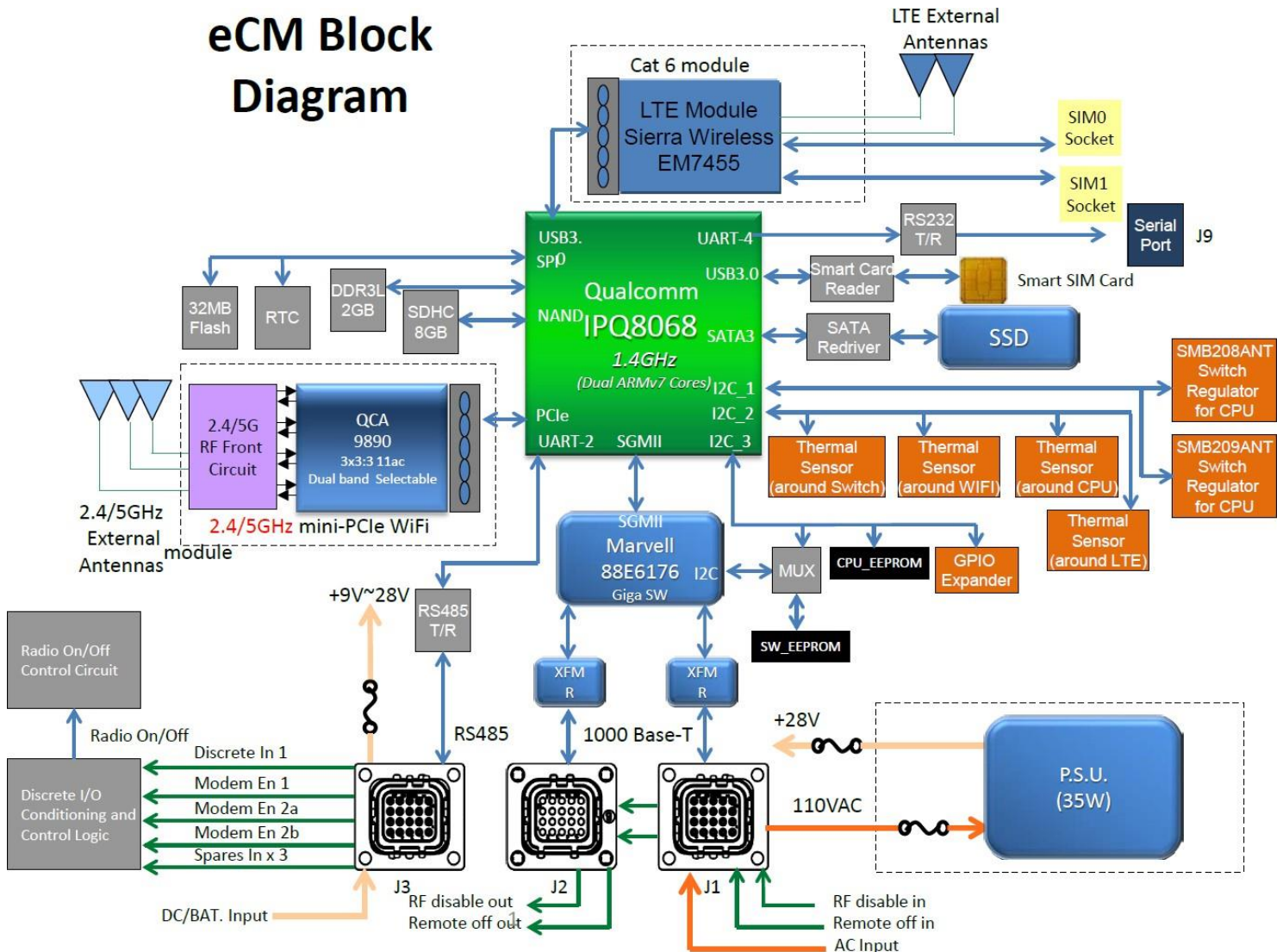



Figure 4: LRU Block Diagram(s)

5.0 PHYSICAL CHARACTERISTICS

5.1 Installation Location(s)

- The eCM is located in the VCC, Bag Bin or Crown.
- Refer to Section **Error! Reference source not found.** herein for installation limitations.

5.2 Form Factor

- Case Size: ARINC 836-1-7.  
2.36" (Height) x 9.06" (Width) x 11" (Length).  
[60 mm (Height) x 230 mm (Width) x 279.4 mm (Length)].
- Weight:  
Nominal: 4.25 lbs. [1.93 kg].  
Not to Exceed: 4.46 lbs. [2.023 kg].
- Center of Gravity indicated by  in Figure 5.

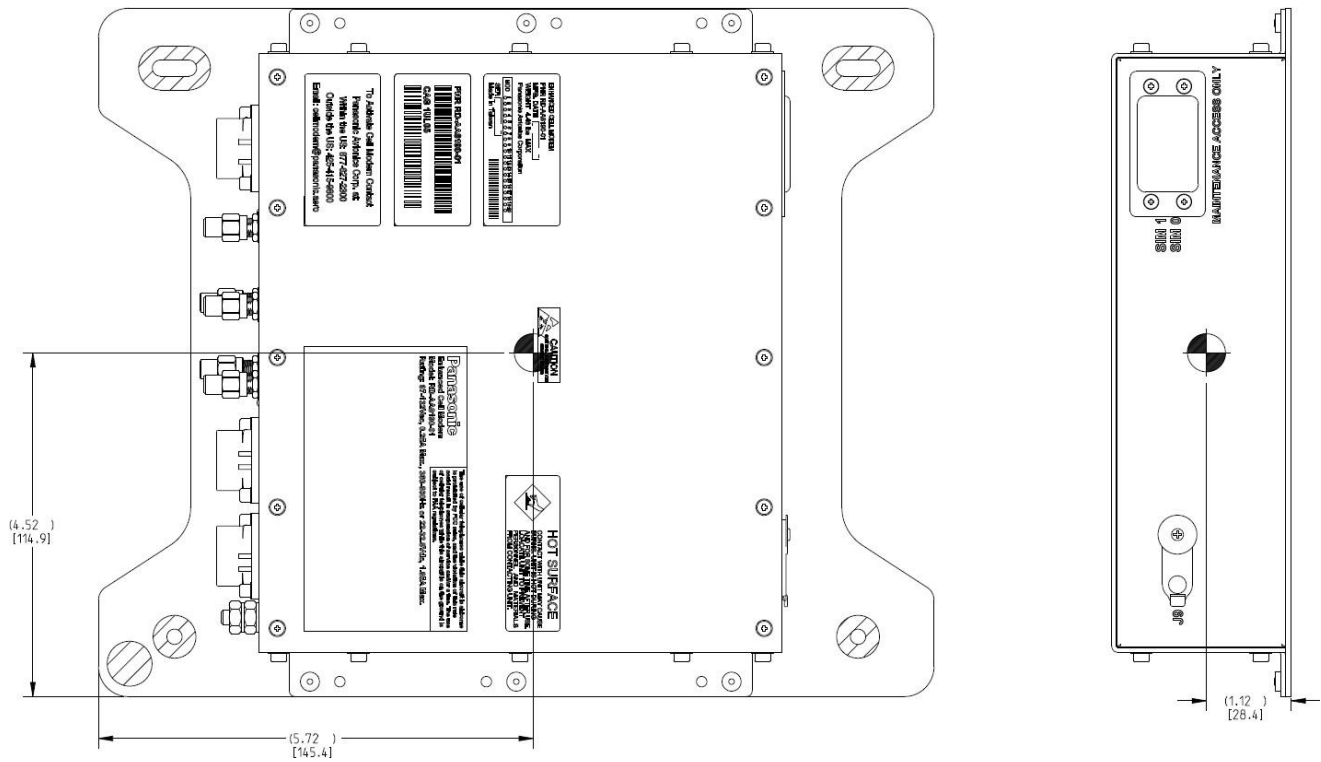


Figure 5: Center of Gravity

### 5.3 Digital Inputs and Outputs Characteristics

#### 5.3.1 Ethernet Interface

- Frame Format & Protocol:
  - IEEE802.3 Ethernet Specification.
- Data Rate:
  - 1000Mbps/s.
- Data Encoding:
  - Differential Manchester Encoding for 10Base-T.
  - 3-level 4b/5b MLT-3 Encoding for 100Base-T.
  - 5-level 4 Dimensional PAM-5 Encoding for 1000Base-T.
- Transmitter Impedance:
  - $100 \pm 10 \Omega$ , balanced.
- Transmitter Voltage Level:
  - Differential  $\pm 2.5V$  minimum for 10Base-T.
  - Differential 3-level  $\pm 950mV$  minimum for 100Base-T.
  - Differential 5-level  $\pm 670mV$  minimum for 1000Base-T.
- Receiver Sensitivity:
  - Differential  $\pm 200mV$  minimum.
- Feature:
  - Head-of-line blocking prevention, port-based data rate / traffic storm control, port-based VLAN, port trunking, QoS and Spanning Tree protocol, unicast/multicast addresses filtering, port-based unregistered multicast filtering.
- MAC Address:
  - Ethernet Switch has 8K MAC address entries with automatic learning and aging.
- Switch Configuration:
  - The Ethernet switch ports are initialized to disabled (closed) state at power up to prevent Ethernet loop.
  - The switch configuration data can be loaded from both the EEPROM and the host processor.
  - The EEPROM is required to provide switch configuration data in case the host processor does not boot.
  - The EEPROM is accessible from both the Ethernet switch and the host processor.
  - The Ethernet switch remains operational in the event that the host processor fails or does not boot.
- PoE Tolerance:
  - The unit Ethernet switch ports are capable of accepting power input from an external device with PoE capability per IEEE 802.af without damaging its Ethernet ports even though the unit does not have the PoE feature.
- Port Status:
  - The unit provides Ethernet link/activity status indicator. The LED has green color.
- Cable Length:
  - Up to 100meters on Cat 5e cable.



## 5.4 Discrete Inputs and Outputs Characteristics

### 5.4.1 5V Discrete Input

The eCM provides one maintenance Enable discrete input to allow the unit entering test mode.

The discrete input has the following requirements:

Ground	=	Logic Low – Enable maintenance mode
	=	< 100 $\Omega$ or < 1.5V with sink current 1mA maximum
Open	=	Logic High – Disable maintenance mode
	=	> 100 K $\Omega$ or > 2V

### 5.4.2 28V Discrete Input

The eCM provides five 28V aircraft discrete inputs and three spares. The 28V discrete input conforms to Boeing D6-36440, paragraph 3.6.2 and Airbus ABD100.1.9, paragraph 3.2.

- 1) The eCM provides one Modem Enable 1 discrete input and the logic state conforms to ARINC 628, Part 1, paragraph 17.2:

Ground	=	Turn on the cell modem and Wi-Fi cards power.
	=	< 100 $\Omega$ or < 3.5V with sink current between 2mA minimum and 5.36mA maximum.
Open	=	Turn off the cell modem and Wi-Fi cards power.
	=	> 100 K $\Omega$ or within 14.5V to 36V

- 2) The eCM provides two Modem Enable 2a (Active Low ) and Modem Enable 2b (Active High) discrete inputs. Depending on manufacturers Boeing/Airbus or aircraft types B787, B777, etc.; only one Modem Enable discrete is connected to the eCM. The discrete inputs have the following requirements:

Modem Enable 2a (Active Low):

Ground	=	Aircraft is on the ground. Turn on the cell modem and Wi-Fi cards power.
	=	< 100 $\Omega$ or < 3.5V with sink current between 2mA minimum and 5.36mA maximum.
Open	=	Aircraft is on the air. Turn off the cell modem and Wi-Fi cards power.
	=	> 100 K $\Omega$ or within 14.5V to 36V.

The Modem Enable 2a (Active Low) discrete input is connected to ground when not used or not connected to aircraft discrete signal.

Modem Enable 2b (Active High):

Ground	=	Aircraft is in the air. Turn off the cell modem and Wi-Fi cards power
	=	< 100 $\Omega$ or < 3.5V with sink current between 2mA minimum and 5.36mA maximum.
Open	=	Aircraft is on the ground. Turn on the cell modem and Wi-Fi cards power.
	=	> 100 K $\Omega$ or within 14.5V to 36V.

The Modem Enable 2b (Active High) discrete input is left open when not used or not connected to aircraft discrete signal.

- 3) The eCM provides three spare 28V discrete inputs and have the following requirements:

Ground	=	Active.
	=	< 100 $\Omega$ or < 3.5V with sink current between 2mA minimum and 5.36mA maximum.
Open	=	Inactive.
	=	> 100 K $\Omega$ or within 14.5V to 36V.

The Panasonic enhanced cell modem (eCM) incorporates a commercial off the shelf (COTS) cellular radio. The eCM COTS cellular radio utilizes a combination of software, firmware and frequency selective hardware to support multiple 3GPP cellular standards and frequency bands. Though the COTS radio is flexible, frequency selective hardware components such as filters, amplifiers, etc. limit the transmission capabilities of the COTS radio. Thus, the eCM COTS radio is not considered a software defined radio.

COTS radio detailed design information is generally unavailable, and a quantitative analysis of COTS radio failure modes and their effects on airplane systems is impossible. Given the limited information, Panasonic elected to mitigate potential failure effects by disabling the COTS radio based on aircraft discrete input signals. The eCM incorporates high reliability, simple hardware circuits which process the aircraft discrete input signals and control power to the COTS radio. The reliability of these simple hardware circuits has been proven to sufficiently mitigate potential interference with airplane systems and potential hazards through the use of industry standard techniques, such as fault tree analyses, reliability calculations, etc. Panasonic supplemented the eCM hardware mitigation through qualitative analyses of eCM COTS radio failure modes. The analyses concluded that interference with airplane systems caused by eCM COTS radio failure is extremely unlikely. Though qualitatively it is extremely unlikely that the eCM will interfere with airplanes systems, Panasonic suggests multiple aircraft discrete signals are routed to the eCM. The combination of multiple input discrete signals in conjunction with qualitative analyses provide further mitigation of eCM COTS radio interference with airplane systems.

Under normal operating conditions, when the eCM radios are transmitting in operational frequency bands, there is no potential for interfering with airplane systems. Panasonic chose to use simple hardware to remove power from the COTS radios based on the state of airplane discrete input signals to the eCM in order to preclude the potential for unintended operation resulting in out of band emissions. The simple hardware has an intended probability of failure of less than  $1e-009$  at Boeing's worst case for Life of Aircraft (LOA) of 76,000 hours at 35°C ambient temperature.

## **5.5 SIM Slots**

The eCM provides two UICC SIM slots located on the rear panel and identified as SIM 0 and SIM 1. The eCM ships to customers with a Panasonic Avionics Corporation M2M SIM Card installed in SIM 0. Please do not remove the PAC SIM Card. An optional (airline preferred carrier) M2M SIM Card may be installed in SIM 1 slot. The optional SIM Card must be manufactured in accordance with PAC Drawing A502000004. SIM cards must be inserted into SIM slots as illustrated. For SIM 0, the contacts will be face down. For SIM 1, the contacts will be face up. In both cases, the end of the SIM card with the chamfered corner should face out. For security reasons, the SIM slots are covered with a panel and four screws.

## 6.0 ENVIRONMENTAL CHARACTERISTICS

### 6.1 Operating Temperature

-15°C to +55°C

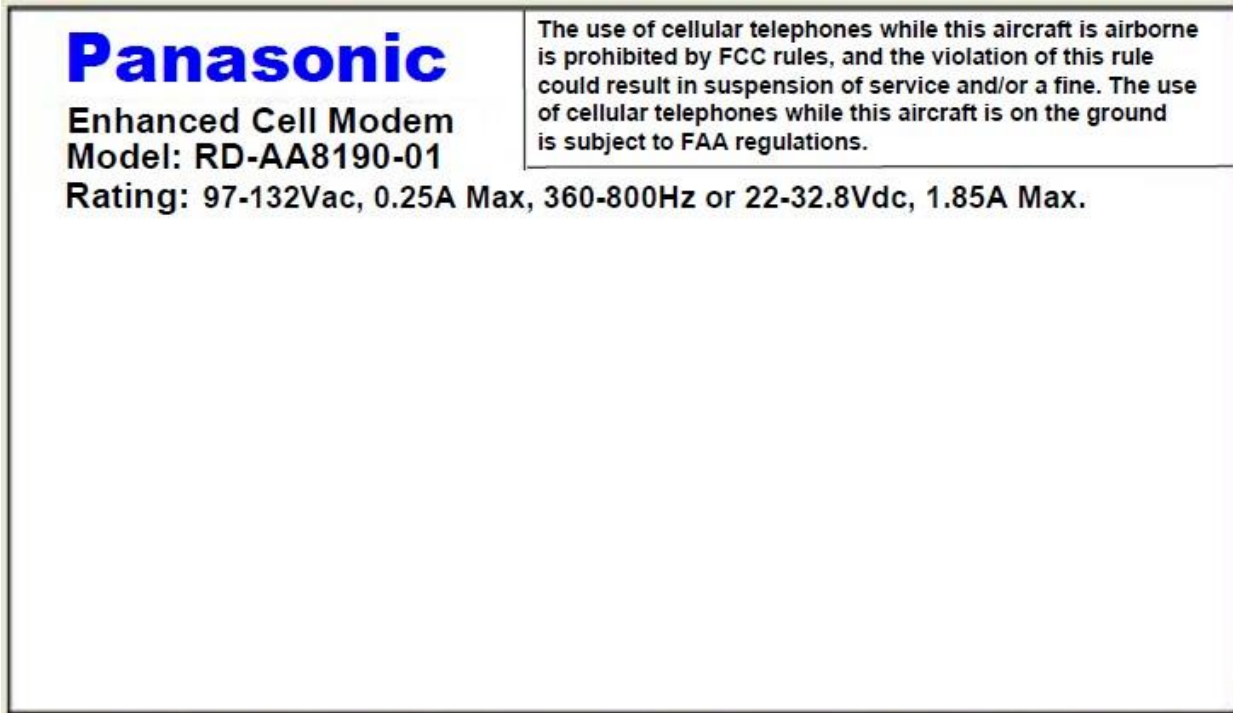
## 7.0 BATTERIES

The eCM has a battery for backup power to the Real Time Clock (RTC) and is not used unless aircraft power is shutoff to maintain time.

- The eCM has a battery for backup power to the Real Time Clock (RTC) and is only used to maintain the time while the aircraft power is shut off.
- Intended Function: Continuous time keeping; The battery is internal to the LRU and is not accessible to the aircraft crew.
- Operation condition: 0.8 Ua typical when LRU power is off.
- The battery is a non-rechargeable solid-cathode single cell.
- Material: Poly-carbonmonofluoride Lithium battery. Li (CF).
- The battery contains ~0.039 g of lithium.
- RTCA/DO-227 – Minimum Operational Performance Standards for Lithium Batteries states in 2.1.1.1 cells that contain less than 0.15grams of lithium do not require testing under this MOPS(Minimum Operational Performance Standard).
- The battery is a fully enclosed component.
- Size: 9.77 H x 14.98 W x 21.84 L mm.
- The battery part number is BR1225.
- The battery manufacturer is Panasonic with UL file# MH1210;  
or Rayovac with UL file# MH12542.  
The battery is not required for safe operation of the airplane;  
The battery is less than 2 Watt-hours;  
The battery complies with UL1642.

8.0 WARNINGS

The “eCM” has the following warning labels located on the Top Panel.



Note: Regulatory information is printed on the label as required.  
For complete list of regulatory information and user countries, see User Guide & Regulatory Statement RS-AA8190-01.

Figure 6: FCC ID



Figure 7: Hot Surface



Figure 8: ESD

## 9.0 FCC and ISED Statements

### FCC statement

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could not void the user's authority to operate the equipment.

"This equipment may only be operated indoors. Operation outdoors is in violation of 47 U.S.C. 301 and could subject the operator to serious legal penalties."

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines.

### ISED statement

This device complies with Industry Canada's applicable licence-exempt RSSs. Operation is subject to the following two conditions: (1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : 1) l'appareil ne doit pas produire de brouillage; 2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment has very low levels of RF energy that is deemed to comply without testing of specific absorption rate (SAR).

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques

(RF) CNR-102 de l'IC. Cet équipement émet une énergie RF très faible qui est considérée comme conforme sans évaluation du débit d'absorption spécifique (DAS).