



TUX User Manual

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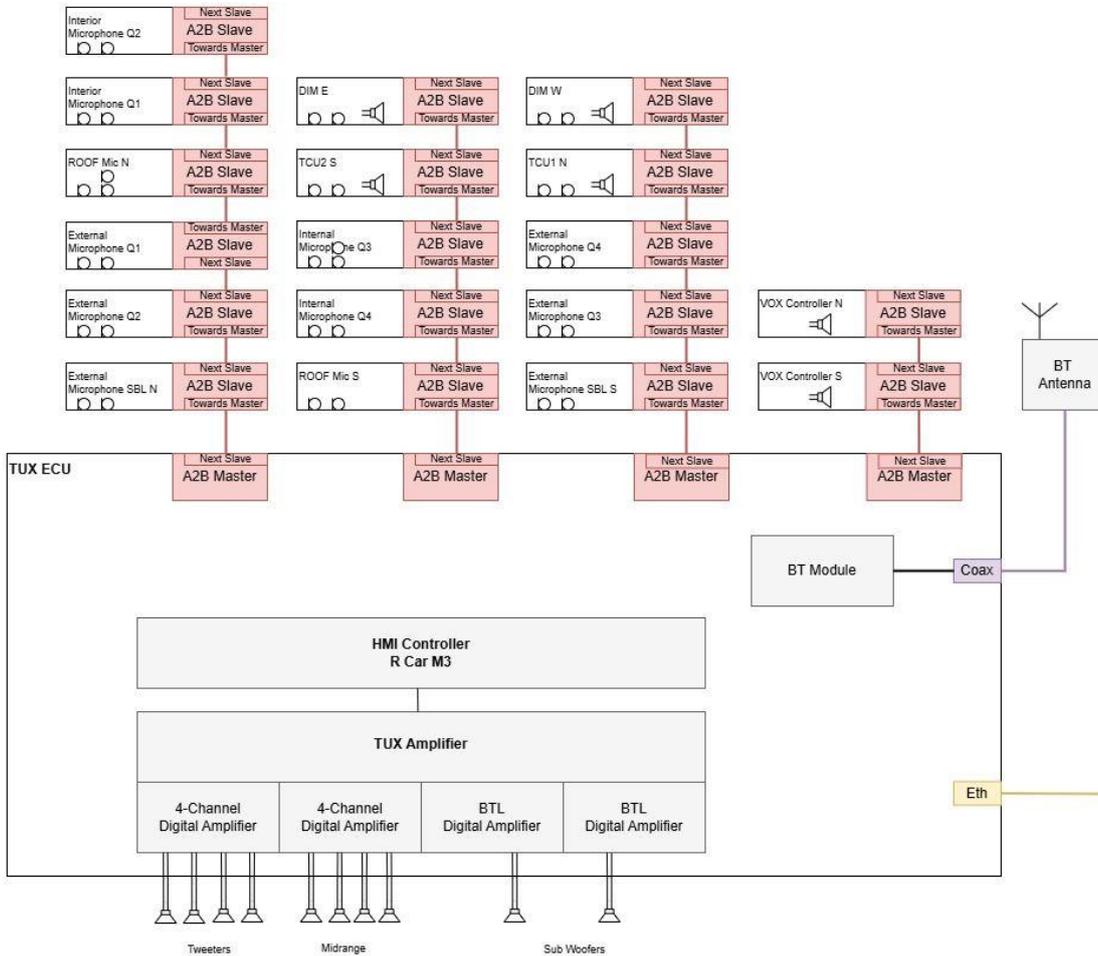
## 1 REVISION HISTORY

Revision	Date	Author	Status	Description of Changes
1.0	14/03/2025	Rubén Rodríguez	Released	First version of the document.

*Table 1. Revision history*

## 2 Overall System Description

The TUX Controller is a general-purpose Linux-based controller that operates system-level functions such as audio and speech processing and BT interfaces:

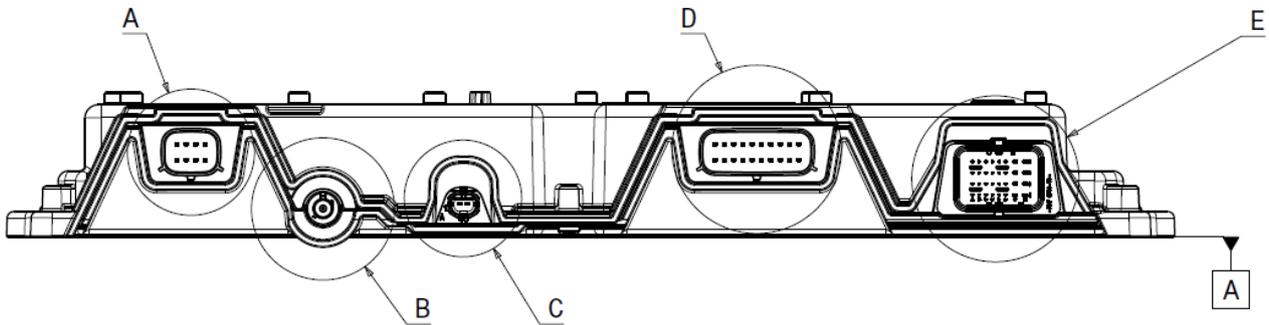


The interfaces included are the following ones:

- Ethernet 100Base-T1
- Bluetooth (with connector for external antenna)
- 4 x A2B strings
- Analog output for 10 Speakers ( 2 Subwoofer + 4 Mids + 4 Tweets)

## 2.1 Connectors Pin-out

The TUX includes a total of five different connectors



- A- TUX Power Connector
- B- Bluetooth Connector
- C- Ethernet Connector
- D- Speakers Connector
- E- HMI Power Supply and A2B connector

### 2.1.1 HMI Power Supply and A2B connector

The pin-out of the vehicle connector is described in Table 2.

CONNECTOR E: 64334-0100 (MOLEX)			
PIN	DESCRIPTION	PIN	DESCRIPTION
A1	A2B CHAIN 1_P	E1	A2B CHAIN 4_N
A2	GND	E2	GND
A3	A2B CHAIN 2_P	E3	A2B CHAIN 3_P
A4	GND	E4	GND
B1	A2B CHAIN 1_N	F1	GND
B2	GND	F2	GND
B3	A2B CHAIN 2_N	F3	GND
B4	GND	F4	GND
C1	GND	G1	VBAT
C2	GND	G2	VBAT
C3	GND	G3	VBAT
C4	GND	G4	VBAT
D1	A2B CHAIN 4_P	H1	GND
D2	GND	H2	GND
D3	A2B CHAIN 3_N	H3	GND
D4	GND	H4	GND

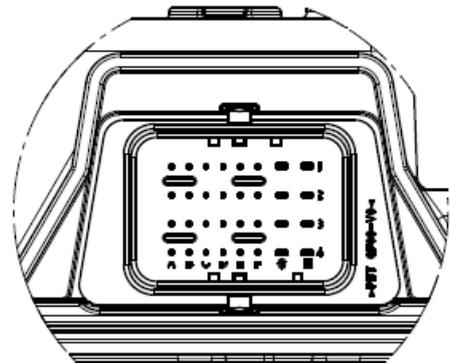


Table 2. Pin-out of the vehicle connector

### 2.1.2 Ethernet 100BaseT1 Connector

The pin-out of the Ethernet 100BaseT1 connector is described in Table 3.

CONNECTOR C: 2339032-1 (TE)	
PIN	DESCRIPTION
1	BROA_P
2	BROA_N

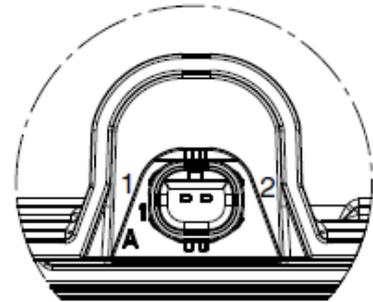


Table 3. Pin-out of the Ethernet 100BaseT1 connector

### 2.1.3 Bluetooth connector

The pin-out of the Bluetooth connector is described in Table 4.

CONNECTOR B: 2FA1-NISP-PCBE8 (AMPHENOL)	
PIN	DESCRIPTION
1	RF
2	GND

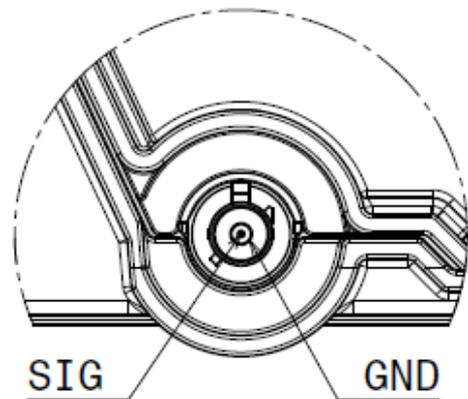


Table 4. Pin-out of the Bluetooth connector

### 2.1.4 TUX Power Connector

The pin-out of the TUX power connector is described in 5.

CONNECTOR A: 34830-0801 (MOLEX)	
PIN	DESCRIPTION
1	VBAT
2	VBAT
3	GND
4	GND
5	VBAT
6	VBAT
7	GND
8	GND

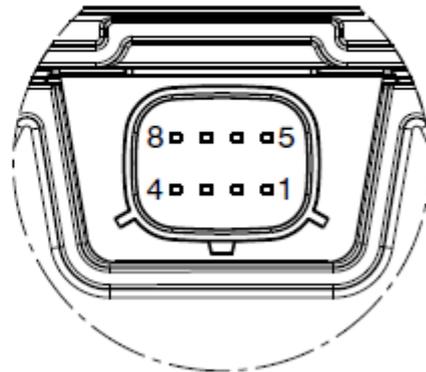


Table 5. Pin-out of the vehicle connector

### 2.1.5 Speakers Connector

The pin-out of the Speakers connector is described in 6.

CONNECTOR D: 34830-2001 (MOLEX)			
PIN	DESCRIPTION	PIN	DESCRIPTION
1	MID2-	11	MID2+
2	MID1-	12	TWE1+
3	MID1+	13	TWE1-
4	SUB1+	14	TWE2-
5	SUB1-	15	TWE2+
6	SUB2-	16	TWE3+
7	SUB2+	17	TWE3-
8	MID4+	18	TWE4-
9	MID4-	19	TWE4+
10	MID3-	20	MID3+

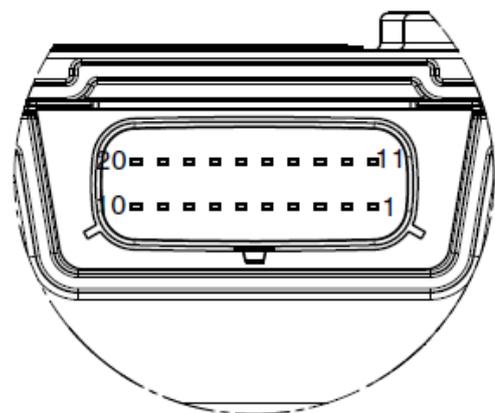


Table 6. Pin-out of the Speakers connector

## 3 RF Communications

### 3.1 Bluetooth

#### 3.1.1 Bluetooth Module

The HMI Board includes a Bluetooth Module according to the following details:

**Module:** Panasonic ENW89823C4KF



RF category	Bluetooth® 5.1 dual mode (BR, EDR, Bluetooth® LE)
Software/profile	HCI, Init Script by TI, Bluetooth Stack by TI
Used IC	CC2564C
Rx sensitivity	-90 dBm@1Mb/s
Tx power max	+8 dBm (Chip Antenna) +11.5 dBm (RF Bottom Pad)
Antenna option	Ceramic Chip Antenna, External Antenna over RF Bottom Pad
Size (l x w x h) [mm]	9.0 x 9.5 x 1.8 (ENW89823A5KF) 9.0 x 6.5 x 1.8 (ENW89823C4KF)
Power supply [V]	1.7 to 4.8
Power consumption Tx	40 mA @8dBm (3.3V)
Power consumption Rx	20 mA (3.3V)
Power consumption sleep	Deep Sleep Mode: 105 µA

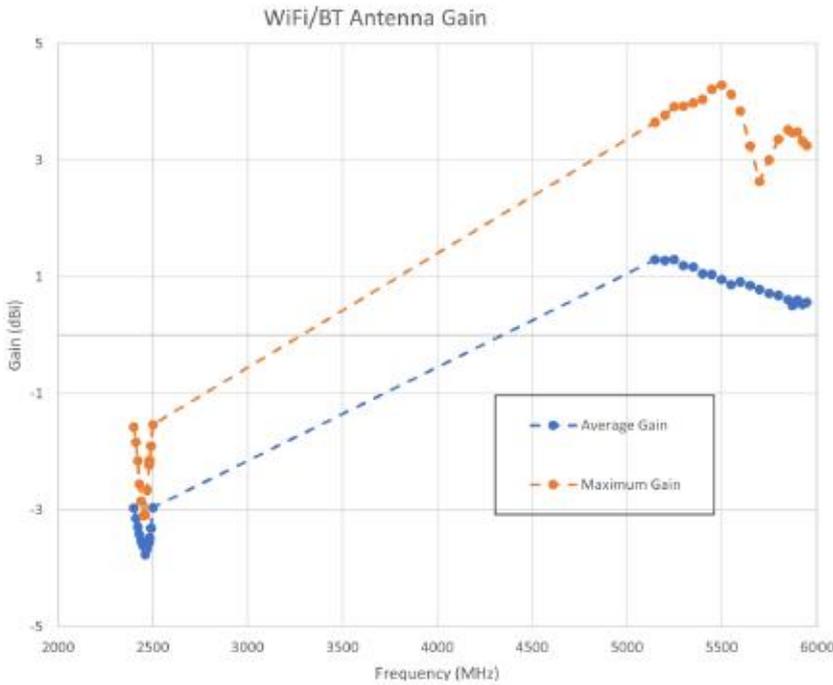
**Chipset:** Texas Instruments CC2564C

- TI's Single-Chip *Bluetooth*® Solution With Bluetooth Basic Rate (BR), Enhanced Data Rate (EDR), and Low Energy (LE) Support
- Bluetooth 5.1 Declaration ID D049226
- Highly Optimized for Size-Constrained and Low-Cost Designs:
  - Single-Ended 50-Ω RF Interface
  - VQFN-MR Package Family, RVM Footprint: 76 Terminals, 0.6-mm Pitch, 8-mm x 8-mm
- BR and EDR Features Include:
  - Up to Seven Active Devices
  - Scatternet: Up to Three Piconets Simultaneously, One as Master and Two as Slaves
  - Up to Two Synchronous Connection Oriented (SCO) Links on the Same Piconet
  - Support for All Voice Air-Coding—Continuously Variable Slope Delta (CVSD), A-Law, µ-Law, Modified Subband Coding (mSBC), and Transparent (Uncoded)
  - Provide an Assisted Mode for HFP 1.6 Wideband Speech (WBS) Profile or A2DP Profile to Reduce Host Processing and Power
  - Support of Multiple Bluetooth Profiles With Enhanced QoS

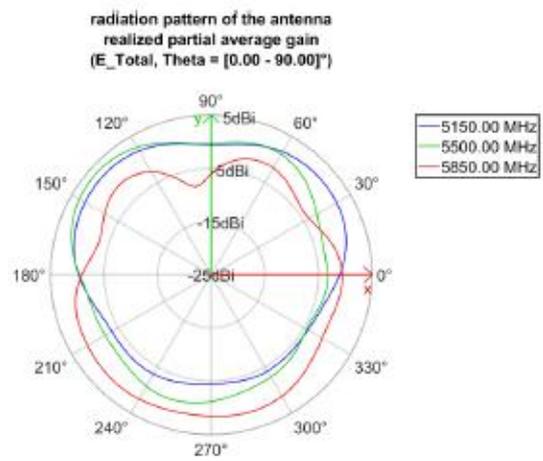
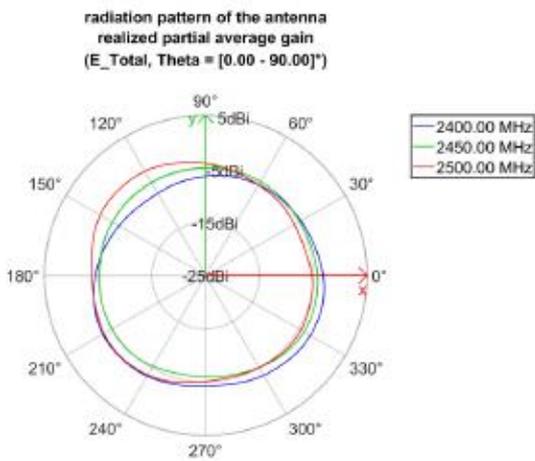


WiFi/BT	
Frequency range	2400 to 2500 MHz, 5150 to 5850 MHz
Linear Average Gain (dBi)	-3.5 dBi @ 2450 MHz, 1 dBi @ 5500 MHz
Maximum Gain (dBi)	-1.54 dBi 2400-2500 MHz, 4.13 dBi 5150-5850 MHz
Impedance	50 $\Omega$

### 1. Antenna Gain



### 2. Azimuth Gain Patterns



## 4 ELECTRICAL CHARACTERISTICS

TUX Sub-System			
Parameter	Conditions	Min	Max
Battery Voltage	Normal operation	10 V	16 V
Electrostatic discharge voltage	According to 10605 -2008+Amendment A1		
Transient voltage	According to ISO 7637-2-2011		
Temperature	Normal operation	-10°C	60°C
	Storage	-40°C	85°C
Current	Sleep Mode	< 150mA (12V)	
	Normal Mode	Up to 25A (12V)	

## 5 RECOMMENDATIONS OF USE

### 5.1 Transport - Storage

Recommendation	Risk
Do not expose the containers to bad weather conditions	Pollution of the systems, degradation of the aspect, or functional damages
Do not apply weight over the packing	Breaking or deformation of a part of the delivery
Keep the containers in horizontal position	Displacements of parts within container. Parts might be damaged.

## 5.2 Handling - Conditioning

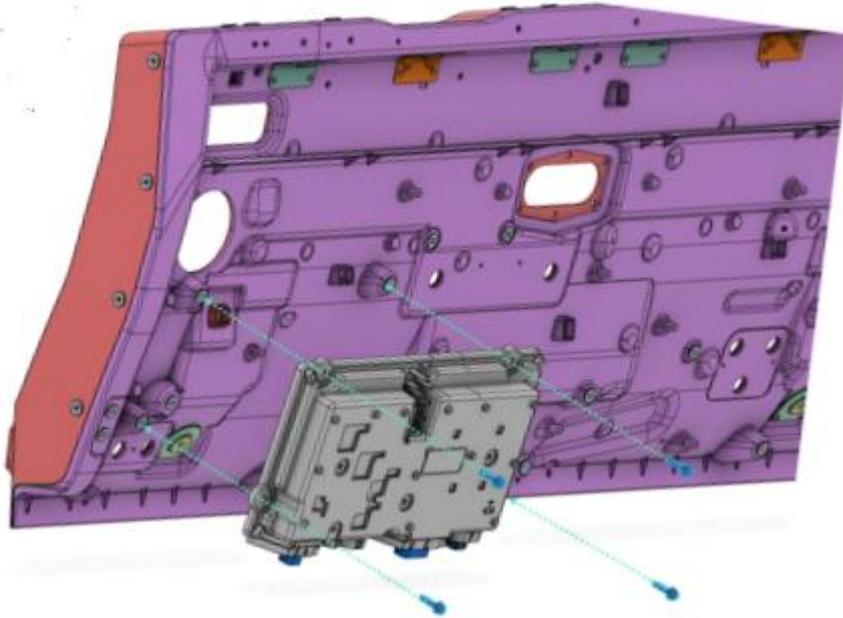
Recommendation	Risk
<p>Do not apply violent efforts on the product.</p> <p>Do not hold the units using a delicate part (i.e connectors, cable)</p> <p>Use firm and rigid parts for holding the unit.</p>	<p>Functional internal elements may be damaged due to efforts applied from the outside.</p>
<p>Parts should not be exposed to shocks, falls at the time of handling. In case of falling. THE PART MUST BE DISCARDED.</p>	<p>Internal components may be damaged, even though the external appearance is still OK.</p>
<p>Take out of the conditioning the systems at the time their use.</p> <p>Do not use sharp or aggressive instruments in contact with the system.</p>	<p>Functional elements of the order can be twisted, broken, or folded, and generate dysfunctions. Strange particles may enter inside the unit, causing different damage.</p>
<p>Protection measures against ESD (Electro Static Discharge) are advisable, even though the part is protected against ESD of a reasonable magnitude.</p> <p>Avoid touching the connectors with the fingers or metallic objects.</p>	<p>Deterioration of the internal electronic components. Even with the unit completely closed.</p>

### 5.3 Preparation and Assembly

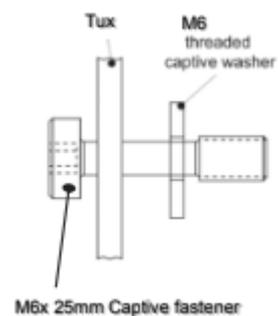
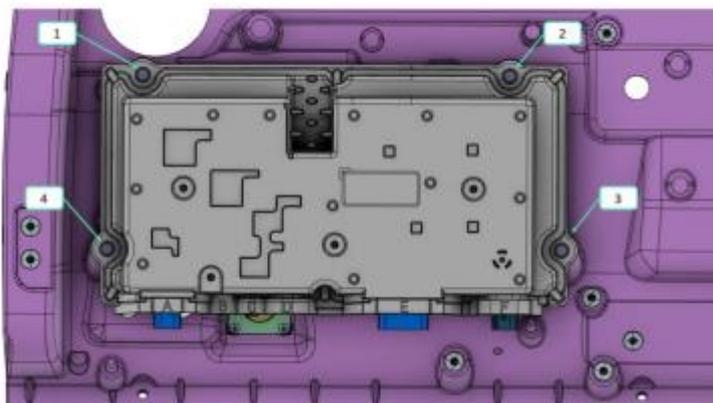
Recommendation	Risk
Handling the electronic components with care.	Connections between different parts may be deteriorated and ESD may damage the electronic components-
The unit shall be installed with connection to a power supply line protected with a power limitation device of 45A according to IEC60127.	-
Only Authorized operator can proceed to install the device in the vehicle.	-
<b>Installation shall be done inside Restricted access area:</b> area accessible only to skilled persons and instructed persons with the proper authorization.	-

## 5.4 Mounting guidelines

The technician must physically align the TUX to the firewall and at the same time pick up the bolt and a hand start tool to install the bolt to temporarily set TUX to the Body (BiB).



To ease TUX installation at GA, TUX uses M6 captive fasteners+ washers that will allow the technician to immediately screw the fastener and avoid the need to hold the unit, align it to BiB, and then install the screw which the tech is having difficulties with due to the size and weight of the unit.



TUX TO BE ATTACHED TO BIB USING AN M6 SCREW AT EACH MOUNTING POINT.

DETAIL: SCREW, HEX FLG, M6 1.0 X 20MM

TORQUE: 9.1N·m +/-1N·m

## 5.5 Maintenance

Recommendation	Risk
<p>The TUX enclosure should not be covered (or painted) by any metallic material during operation.</p>	<p>The performance of the unit may be affected.</p>
<p>No maintenance operations can be performed on the unit.</p> <p>Do not open the unit or try to remove the mechanical protection.</p>	<p>Risk of damage sensitive electronic components in case of manipulation of unit interior electronics.</p>

## 5.6 Dangerous Materials

Recommendation	Risk
No specific recommendation. Only common electronics components.	-

## 6 FCC Regulatory Notices

### Modification statement

IDNEO TECHNOLOGIES / FICOSA has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate the equipment.

### Interference 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 interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

### FCC Class B digital device notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

**FCC ID: 2BGE31TUX0624**

### Wireless Notice

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. The antenna should be installed and operated with a minimum distance of 2 cm between the radiator and your body.