TTU-2830 Hardware & Installation Guide

TTU-2830™

Hardware and Installation Guide

1 Introduction

Welcome to the TTU-2830™Hardware and Installation Guide. This manual is intended to give you information on the basic setup and installation of the CalAmpTTU-2830™product(s) including hardware descriptions, environmental specifications, wireless network overviews and device installation.

1.1 About This Manual

The TTU-2830™is one of the most flexible economy mobile tracking hardware products available. In order to accurately describe the functionality of these units we have broken this manual into the following sections:

- **Hardware Overview** – Describes the physical characteristics and interfaces of the TTU-2830™.
- **Installation and Verification** – Provides guidance for the installation of the TTU-2830™in a vehicle and instructions on how to verify the installation is performing adequately.

1.2 About the Reader

In order to limit the size and scope of this manual, the following assumptions have been made about the reader.

- You are familiar with GPS concepts and terminology
- You have some experience with installing equipment in vehicles

1.3 About the CalAmp Location Messaging Unit-TTU-2830™

The CalAmp Location and Messaging Unit-TTU-2830™(TTU-2830™) is a mobile device that resides in private, commercial or government vehicles. The TTU-2830™is a single box enclosure incorporating a processor, a GPS receiver, a wireless data modem, and a vehicle-rated power supply. The TTU-2830™also supports inputs and outputs to monitor and react to the vehicular environment and/or driver actions.

2 System Overview

2.1 Overview

The entire purpose behind a fleet management system is to be able to remotely contact a vehicle, determine its location or status, and do something meaningful with that information. This could include displaying the vehicle location on a map, performing an address look-up, providing real-time driving directions, updating the vehicles ETA, monitoring vehicle and driver status or dispatching the vehicle to its next pick up. These functions, of course, are completely dependent on the capabilities of the vehicle management application. The role of the CalAmpTTU-2830™is to deliver the location information when and where it is needed.
A typical fleet management system based on a CalAmp device includes the following components:

- A wireless data network
- An TTU-2830™
- Backend mapping and reporting software from Actsoft which typically includes mapping and fleet reporting functions

2.2 Component Descriptions

2.2.1 Wireless Data Network

The Wireless Data Network provides the information bridge between the Actsoft servers and the TTU-2830™. Wireless data networks can take a variety of forms, such as cellular networks, satellite systems or local area networks.

2.2.3 Backend Software

Backend software is provided by Actsoft. Regardless of its purpose, one of its primary functions is to parse and present data obtained from the TTU-2820. This allows the application to do any of the following:

- Display location database on reports received from the TTU-2830™in a variety of formats
- Present historic information received from the TTU-2830™, typically in a report/chart style format
- Request location updates from one or more TTU-2830s™

3 Hardware Overview

3.1 Location Messaging Unit-TTU-2830™

Anytime the sub assembly is shipped and it is not fully packaged in its final housing it must be sealed in an ESD safe bag.

Electrical Over-Stress (EOS)
The GPS receiver can be damaged if exposed to an RF level that exceeds its maximum input rating. Such exposure can happen if a nearby source transmits an RF signal at sufficiently high level to cause damage.

Storage and Shipping
One potential source of EOS is proximity of one TTU-2830™GPS Antenna to another TTU-2830™GSM Antenna. Should one of the units be in a transmit mode the potential exists for the other unit to become damaged. Therefore any TTU-2830™GPS Antenna should be kept at least four inches apart from any active TTU-2830™GSM Antenna or any other active high power RF transmitter with power greater than 1 Watt.

3.1.2 Battery Back-up devices

Please properly dispose of the battery in any of the CalAmp products that utilize one, do not just throw used batteries, replaced batteries, or units containing a back-up battery into the trash. Consult your local waste management facility for proper disposal instructions.

3.1.3 Environmental Specifications

The TTU-2830™is designed to operate in environments typically encountered by fleet vehicles, including wide temperature extremes, voltage transients, and potential interference from other vehicle equipment.
To ensure proper operation in such an environment, the TTU-2830™was subjected to standard tests defined by the Society of Automotive Engineers (SAE). The specific tests included temperature, shock, vibration, and EMI/EMC. These tests were performed by independent labs and documented in a detailed test report. In accordance with Appendix A of SAE J1113 Part 1, the Unit is considered a "Functional Status Class B, Performance Region II" system that requires Threat Level 3 Testing.
The following shows the environmental conditions the LMU is designed to operate in and the relevant SAE tests that were performed. No formal altitude tests were conducted.

Size
4.3" long x 3.2" wide x 1.6" high
110 mm long x 80m wide x 40mm high

Weight
9.6 oz (272 g)

Operating Temperature
-30° C to 70° C

Storage Temperature
-40° C to 85° C
20° C to 50° C (Internal Battery Power)

Humidity
0% to 95% relative humidity, non-condensing

Shock and Vibration
SAE Test: SAE J1455 Compliant
Mil Standard 202G and 810F Compliant
Ground vehicle environment with associated shock and vibration

Electromagnetic Compatibility (EMC/EMI)
SAE Test: SAE J1113 Parts 2, 12, 21 and 41 Compliant
FCC Part 15B Compliant
Industry Canada Compliant
EMC compliant for a ground vehicle environment

Operating Voltage Range
9 – 32VDC

Back-up Battery
5.2Ah mAh (up to 6 months at 1 message per day w/ deep sleep enabled)
4 Hour Charge Time

Power Consumption
Active Standby < 70mA at 12VDC
Radio Active Sleep <<TBD> at 12VDC
Deep Sleep < 2mA at 12VDC

GPS

50 channel WAAS capable GPS Receiver
2.5m CEP (with SA off)
-162 dBm tracking sensitivity
Communications (Comm)
Data Support
SMS, GPRS, CDMA 1xRTT or HSPA packet data
GSM/GPRS Quad-Band
850/900/1800/1900 MHz
GSM/GPRS Output Power
Class 4 (2 Watts) 850/900 bands
Class 1 (1 Watt) 1800/1900 bands
CDMA Dual-Band
800/1900 MHz
CDMA Output Power
800: +24dBm
1900: +24dBm
HSPA/UMTS Dual-Band
900/2100 MHz (bands VIII, I) or
850/1900 MHz (bands V, II)
3GPP release 6
5.6 Mbps upload, 7.2 Mbps download
GSM/GPRS Fallback
850/900/1800/1900 quad-band
GPRS class 12, EDGE MCS1-MCS9
RoHS Compliant

3.2 Primary Connector

The TTU-2830™uses 8 22AWG leads for its power and I/O connections. These leads are mapped as follows:

Wire	Signal Name	Description	Color	Input or Output
1	GND	Ground	Black	Ground
2	V_{CC}	Primary Power	Red	Input
3	IN-0	Input 0 – Ignition	White	Input
4	IN-1	Input 1 – Digital Input	Blue	Input
5	IN-2	Input 2 – Digital Input	Orange	Input
6	OUT-0	Ouput 0 – Starter Disable Relay Driver	Green	Ouput
7	OUT-1	Ouput 1 – Digital Output	Brown	Ouput
8	OUT-2	Ouput 2 – Digital Output	Yellow	Ouput

9	SER_OUT	Serial Output	Green\Black	Output
10	SER_IN	Serial Input	Blue\Black	Input

TTU-2830™Power and I/O leads

3.3 GPS Receiver

The TTU-2830™'s GPS receiver has the following specifications:

- 50 channel GPS receiver
- Accuracy: 2.5 meter CEP (with SA off)
- -162dBm Tracking Sensitivity

3.4 I/O Descriptions

The TTU-2830™provides the following I/O:
Digital Inputs

- Input 0: Ignition Sense (Always biased low)
- Input 1: Generic Digital Input (high or low bias per S-158)
- Input 2: Generic Digital Input (high or low bias per S-158)
- Input 3: Not Available
- Input 4: Not Available
- Input 5: Motion Sensor (low = no motion, high = motion)
- Input 6: Power Switch State (low = external power, high = internal battery)
- Input 7: Battery Voltage Critical Sensor (low = VBatt ok, high = VBatt low. 3500mV threshold)

- Input 8: High Temperature Sensor (low = below Temp Threshold, high = above Temp threshold. Temp Threshold = 300)

Analog to Digital Inputs

- A/D 0: External Power Supply Monitor
- A/D 1: Generic External Analog to Digital Input
- A/D 2: GPS Antenna Monitor
- A/D 3: uP Temperature
- A/D 4: uP Voltage
- A/D 5: Battery Voltage
- A/D 6: Temperature Sensor
- A/D 7: Vcc Sys

Outputs:

- Output 0: Standard Open Collector Relay Output
- Output 1: Standard Open Collector Relay Output
- Output 2: Standard Open Collector Relay Output
- Output 3: Not Available
- Output 4: Power Supply Switch (cleared = switch to external power, set = switch to internal power)
- Output 5: Enable/Disable Battery charging (cleared = enable battery charging, set = disable battery charging)

3.5Motion Sensor Input

The TTU-2830™supports an internal motion sensor as one of its discreet inputs. In this case, the TTU detects motion and will determine if the device is moving for at least 30 consecutive seconds. If it is moving the device will track at a 5 minute interval for about 350 messages.

3.5.1 Power State Input

The TTU-2830™can detect if it's using external power or if it's using its internal back-up battering. If the TTU-2830™is using external power, this input will be in the Low state. If they have switched to the internal battery, then the input will register in the High state.

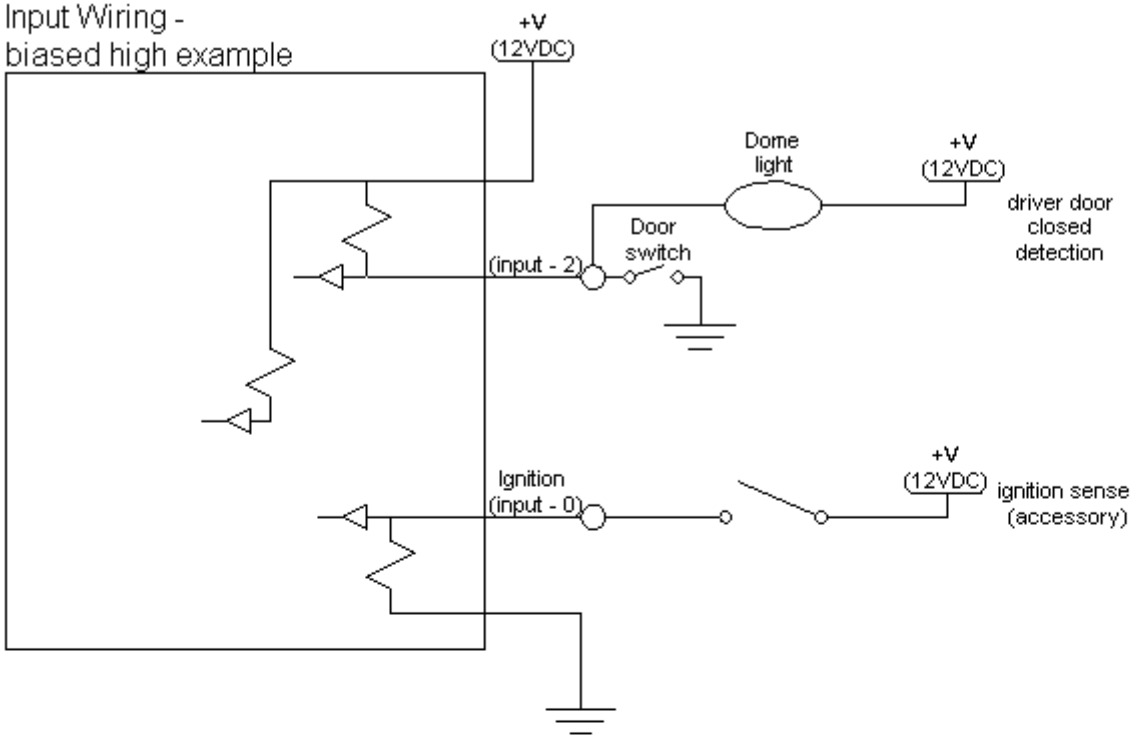
3.5.2 Battery Voltage Critical Input

The TTU-2830™has a built in low battery threshold of 3500mV, which is tied to a discreet input. If the battery in the device reaches this limit a Low Battery event will be sent to Actsoft systems.

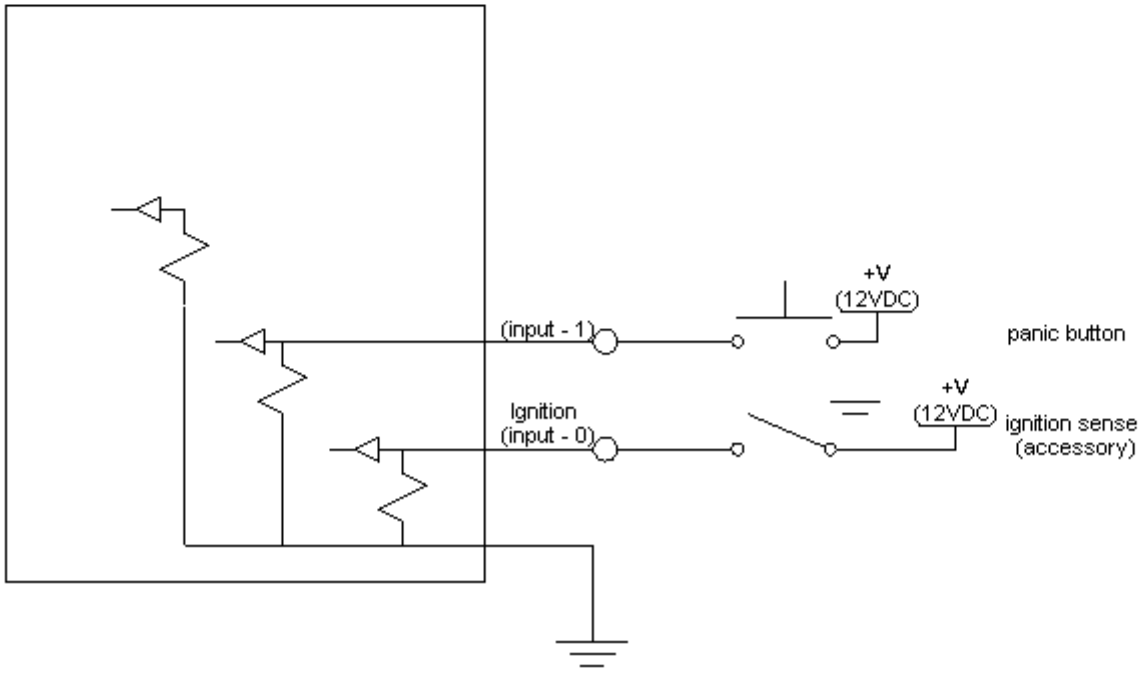
3.5.3 Ignition and Inputs

The TTU-2830™provides up to 3external inputs. The external inputs are protected from typical vehicle transients and can be directly connected to most vehicle level logical inputs from 4 volts up to the vehicle power input level (typically 12 VDC). Their input impedance is approximately 10kΩ. One of these inputs is dedicated to sensing the vehicle's ignition status to provide for flexible power management. The other two inputs may be used to sense vehicle inputs such as cooling unit operation, a hidden driver "Panic" switch, taxi on-duty/off-duty meter status or many others.
The ignition input is pulled to ground through the 10k resistance, where the other inputs can either be normally High (i.e. pulled to +12v through a 10kΩ resistor) or Low (i.e. pulled to ground through a 10kΩ resistor). Input 1 is always biased low, while inputs 2-4 are biased high. The diagrams below show how to connect the inputs in both a high and low-biased configuration:

Input Wiring -
biased high example



Input Wiring -
biased low example



Sample Input Wiring

3.5.4 Status LEDs

The TTU-2830™is equipped with two Status LEDs, one for GPS and one for COMM (wireless network status). The LEDs use the following blink patterns to indicate service:

LED #1 (Comm LED - Orange) Definitions

Condition	LED 1
Modem Off	Off
Comm On - Searching	Slow Blinking
Network Available	Fast Blinking
Registered but no Inbound Acknowledgement	Alternates from Solid to Fast Blink every 1s
Registered and Received Inbound Acknowledgement	Solid

LED #2 (GPS LED - Green) Definitions

Condition	LED 2
GPS Off	Off
GPS On Slow	Blinking
GPS Time Sync	Fast Blinking
GPS Fix	Solid

TTU-2830™LED Positions

4 Installing the LMU

The installation of the LMU and its antennas can have a major impact on the LMU's performance. It is recommended that installers be familiar with the installation of GPS and cellular devices and are comfortable in a vehicle environment.

4.1 Preparing for Installation

Be sure you have received all the LMU components you need. This must include:

- The LMU to be installed
- A power harness
- GPS Antenna (for external devices)
- Comm Antenna (for external devices)
- Optional Components:

- Input and output cables

4.2 Plan The Installation

Verify Power, Ground and Ignition. Be sure to check each source (power, ground and ignition) to ensure that the proper signaling exists. This is typically accomplished with a multi-meter.
Before drilling any holes or running any wires, decide where each hardware component will be located (LMU, antennas, peripherals, etc.). Be sure that the cables to the LMU are not bent or constricted in any way. Also make sure that the LMU is kept free from direct exposure to the elements (sun, heat, rain, moisture etc...).
Be advised that an installation that violates the environmental specifications of the LMU will void the warranty.
The best way to ensure a trouble-free installation is to consider your options and make some decisions before you start. Take a look at the vehicle and determine how to best install the LMU for the following purposes:

- Accurate data gathering and simulation of how customers actually use your solution
- Ongoing monitoring and maintenance of LMU equipment
- Accidental or intentional alteration of the equipment or cable connections

The following sections cover some of the issues to consider when planning your LMU installation.

4.2.1 Size and Placement of LMU Unit

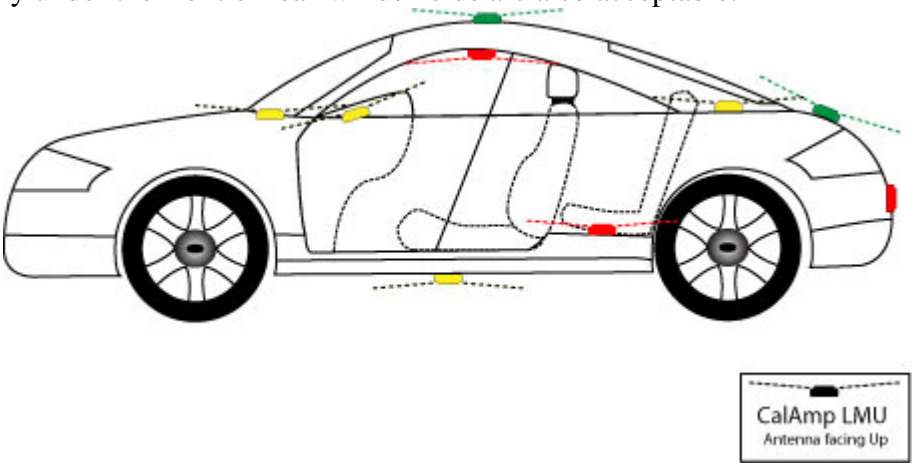
The dimensions of the LMU should be taken into account, particularly when installing in a vehicle:
Whether you intend to place the LMU under a seat or into a cavity behind the vehicle's interior molded trim, be sure the LMU will fit before drilling any holes or running cable

- Be certain that the cables running to the LMU will not be bent or constricted. Damage to the cables may impede the LMU's performance.
- Be certain that the installation point will not violate any of the LMU's environmental specification (temperature, moisture, etc…) as improper installation of the LMU may void the warranty.

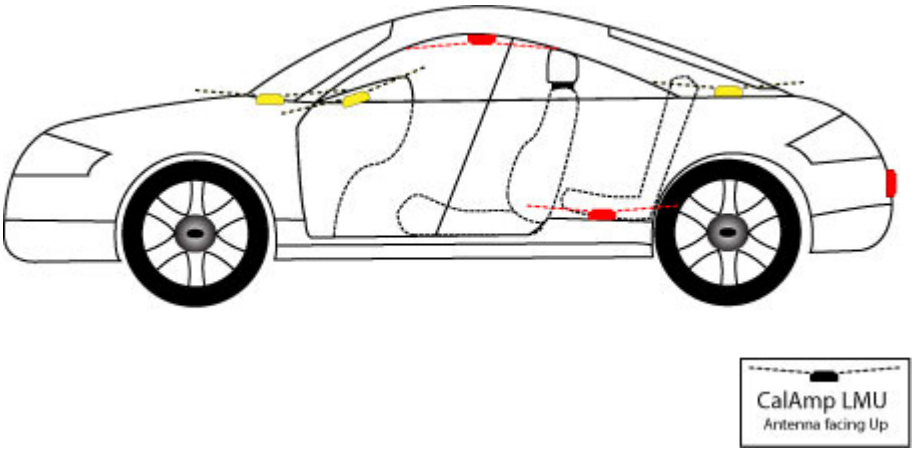
Typical installations will place the LMU under the vehicle dash board, or in the trunk. Make sure you can get access to the unit afterwards as under some circumstances it may be necessary to add additional wiring or connections to the LMU.

4.2.2 Placement of Antennas

Placement of Combination and Internal Antennas
When dealing with combination antennas, it is more important to considered GPS performance over Comm performance. GPS signal strengths are much lower than those typically seen by cellular networks supported by the LMU. In order to maximize the performance the LMU should have a clear view of the sky as possible. When installing the GPS antenna in a vehicle, make sure that there are as few obstructions as possible close to the LMU that might block the view 360° to the horizon. As with stand-alone GPS antennas, nothing should not block the combination antenna beyond 5° above the horizon with the best location being near the center of the roof. For more covert installs, directly under the front or rear-windshields are also acceptable.



Examples of Good (Green), OK(Yellow) and Poor(Red) combo antenna placements



Examples OK(Yellow) and Poor(Red) internal antenna placements

4.2.3 Protection from Heat

It is best not to place the LMU unit in an unusually warm location such as directly near heater vents, near hot engine components or in direct sunlight. The maximum temperature that can be tolerated by the LMU is described in the LMU Environmental Specifications section.

4.2.4 Visibility of Diagnostic LEDs

Status LED lights on the front of the LMU unit can provide valuable information about the operation of the LMU. When feasible, attempt to install the LMU in such a way that these lights can be seen with reasonable ease.
You may find it useful to be able to view the LEDs periodically to make sure that the LMU is operating properly. If at any time you should encounter a problem with the LMU, you may need to read the LEDs in order to troubleshoot the problem. If you cannot fix the LMU yourself, you will need to provide the LED information to CalAmp customer support.
For information about how to interpret the LEDs, see the Status LED Behavior section.

4.2.5 Moisture and Weather Protection

The LMU unit must be located where it will not be exposed to moisture or water. In a typical installation inside a vehicle this is not commonly thought to be a concern; however, it might be best to avoid locating the LMU below a car's cup holders, or where rain might easily splash into the compartment when a door is opened.

4.2.6 Preventing Accidental or Unauthorized Modification

If you anticipate that fleet drivers or others might interfere with the LMUs once they are installed, take steps to be sure that it is not easy to disconnect the antenna wiring, remove the LMU from its power source, etc.
Two common methods are the use of Tamper Proof Sealant or creation of PEG Script to detect power loss or GPS antenna disconnections.

5.Installing the LMU in a Vehicle

This section provides instructions for installing an LMU in a vehicle.
Be sure to consider the design decisions described in the previous sections. When you are ready to begin installing the LMU, follow these steps:

5.1 Place the LMU unit in the vehicle.

Typically, the LMU should be placed under the passenger seat or dashboard of the vehicle. LMUs with internal antennas should be placed to maximize their GPS performance. A typical location include under the dash close to the front wind-shield. Attach the LMU to the solid body of the vehicle, not to plastic panels. The LMU can be placed out of sight by removing interior trim and molding to expose available space, then replacing the trim once the LMU is in place.

5.2 Connect power, ignition, and ground.

The power input (red wire) must be connected to a constant (un-switched) +12 VDC or +24 VDC supply; preferably, connected directly to the vehicle battery terminal or as close to it as possible. This connection point should be fuse protected to not more than 5 Amps.
The ignition input (white wire) must be connected to the vehicle ignition or another appropriate key operated line, such as ACCESSORY, ensuring that power to the ignition wire is available only when the vehicle ignition is on.
The ground line (black wire) must be connected to chassis ground.
Failure to connect these lines in the manner described may result in discharge of the vehicle battery.
For best results, it is strongly recommended that the LMU connection be on its own circuit. Connect the power input directly to the vehicle battery if possible and protect the circuit with an inline fuse. If you must connect through the fuse box, use standard

commercial wiring practices to create a permanent installation rather than using press-in fuse clips or other temporary measures.
DO NOT connect the power cable to the LMU at this time.

5.3 Installation Verification

In many cases it is desirable to verify that an installed TTU-2830™is working properly. That is, installers should verify that the GPS and communications functions of the TTU-2830™are working properly before departing the installation site. In more robust cases, some key configuration settings such as the Inbound Address and URL should also be verified.

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8 Regulatory Information

Human Exposure Compliance Statement
Pursuant to 47 CFR § 24.52 of the FCC Rules and Regulations, personal communications services (PCS) equipment is subject to the radio frequency radiation exposure requirements specified in § 1.1307(b), § 2.1091 and § 2.1093, as appropriate.

CalAmpDataCom Inc. certifies that it has determined that the TTU-2830™complies with the RF hazard requirements applicable to broadband PCS equipment operating under the authority of 47 CFR Part 24, Subpart E of the FCC Rules and Regulations. This determination is dependent upon installation, operation and use of the equipment in accordance with all instructions provided.

The TTU-2830™complies with RF specifications when used near at a distance of 10 mm from your body. Ensurethat the device accessories, such as a device case and deviceholster, are not composed of metal components. Keep thedevice away from your body to meet the distance requirement.