RSU-3 User Guide

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Revision History

Revision	Date	Author(s)	Notes
1.0	11/14/10	Bryan Shah	Initial release.

1 Table of Contents

2 Regulatory Compliance

FCC STATEMENT:

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/her own expense.

Changes or modifications not expressly approved by Cubic Global Tracking Solutions for compliance could void the user's authority to operate the equipment.

EUROPEAN UNION:

This product complies with the R&TTE Directive and the EMC Directive (89/336/EEC) issued by the Commission of the European Community

This product has been tested to verify compliance to the following European Standards:

EN 300 328 – Technical Requirements for Radio Equipment

EN 301 489 –EMC Emissions and Immunity

INDUSTRY CANADA:

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

3 Introduction to the CGTS mesh network

The CGTS mesh network enables end-to-end security and management of your mobile assets through continuous monitoring and near real-time reporting.

Cubic GTS designed the Next Generation Wireless Communication for Logistics Applications (NGWC) mesh network to meet the U.S. Army NGWC requirements. The *Overview* section explains the CGTS mesh network operation.

3.1 Remote Sensor Unit

The Remote Sensor Unit (RSU) provides identification, security and sensor monitoring. The remote sensor can measure temperature, humidity, motion, light, battery charge, shock, and door state. A RSU also provides connectivity for other RSUs through the mesh network. For more information about the RSU, see the Remote Sensor Unit section.

3.2 CGTS mesh network Overview

CGTS mesh network connects RSUs that act as remote sensing units to a web based Device Management Center (DMC). The DMC collects information from the RSUs and stores the data on the server. You can use the web access to the DMC to manage the mesh network. Data is communicated securely between the RSUs and the DMC in encrypted packets, and the DMC provides secure management of the collected data.

A gateway between the RSUs and the DMC provides communication between the RF network of RSUs and the Internet. The RSUs communicate using the CGTS proprietary protocol stack based on IEEE 802.15.4 physical layer at 2.4 GHz using all 16 channels.

3.3 The Device Management Center

The Device Management Center (DMC) is located at a Cubic GTS facility. The DMC provides the following services:

- Secure storage on the DMC for data that is transmitted securely from CGTS mesh network devices.
- Secure system management of the CGTS mesh network.
- Worldwide health monitoring of the RSUs in the CGTS mesh network.
- Event notification to individuals via email or short messaging service (SMS).
- Software upgrade of deployed devices (future functionality).

3.4 CGTS mesh network Operation

The mesh network that is formed by the Remote Sensor Units (RSUs) and the gateways operates independently of the Internet connection that forms the link between the gateways and the Device Management Center (DMC). This section describes the foundation of the mesh network operation between the gateways and the RSUs.

The CGTS mesh network allows for multiple paths between the RSUs and the gateways in the network. Because the data path through the network is non-deterministic, the CGTS mesh network is an ad hoc network.

3.4.1 RSU Network Processes

The RSU software performs the following three tasks:

- Searching, or scanning, for the presence of neighboring RSUs or gateways.
- Announcing, or beaconing, the presence of this RSU.
- Performing scheduled communication with other RSUs or sinks.

4 Remote Sensor Unit

A Remote Sensor Unit (RSU) communicates with the DMC through RF signals to an FMG or MMG. A RSU that includes GPS capability is called a RSU-GPS.

4.1 RSU

A RSU is shown in Figure 1. A RSU is packaged in a rugged IP66 production housing. It has several mounting options which include built-in self tapping screws, glue-on mounting sled, strap holes, optional magnet mounts. RSU can include up to four A size lithium batteries, and has an integrated antenna. A RSU sensor measures temperature, humidity, motion, and light, and monitors the state of magnetic door sensor. The battery life varies based upon the RSU configuration, but the minimum battery life can be guaranteed for any specific configuration.

Figure 1: Remote Sensor Unit (RSU)

4.2 RSU LEDs

The RSU LEDs function as follows by default:

- Short blink (~20ms) red every 2.5 seconds if not connected to a network.
- Short blink green every 2.5 seconds when connected to a network.
- Long red blink on magnet transition (1s).

To control light pollution LED blinking can be slowed down and turned off.

4.3 RSU Sampling and Reporting Behavior

A RSU has the following sensor sampling behavior by default:

- Door sensor and shock sensor cause immediate sampling.
- Other sensor sampling is every 20 minutes.

A RSU has the following reporting behavior by default:

- Sends a sensor report every 2 hours.
- Sends a report on a magnet touches immediately or if default sensor thresholds were surpassed during sampling.
- Sends a GPS every 24 hours (RSU-GPS only).

- Sends a GPS report when transition from-motion-to-still is determined and remains so for more than 10 minutes (RSU-GPS only).

4.4 Installing a RSU

<TODO>

4.5 Configuring a RSU

<TODO>

4.6 Maintaining a RSU

<TODO>

4.6.1 Replacing a RSU Battery

<TODO>

4.7 RSU 2.4GHz Antenna Pattern

RSU antenna is mostly omnidirectional and provides good communication regardless of the orientation. However, RSU antenna plain Figure 2: RSU antenna plains shows 2 weak spots. Measured antenna patterns are presented on Figure 3 and Figure 4 .

Figure 2: RSU antenna plains

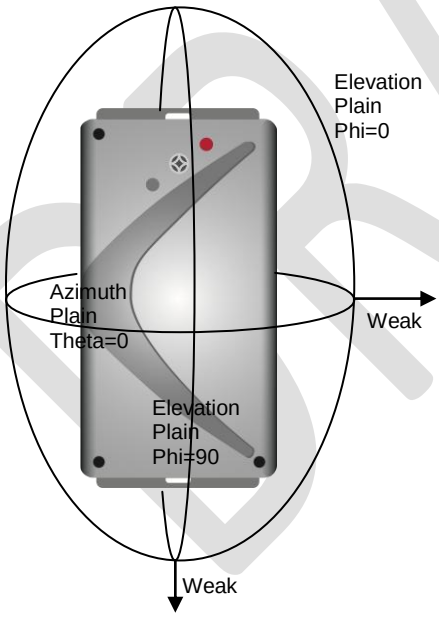
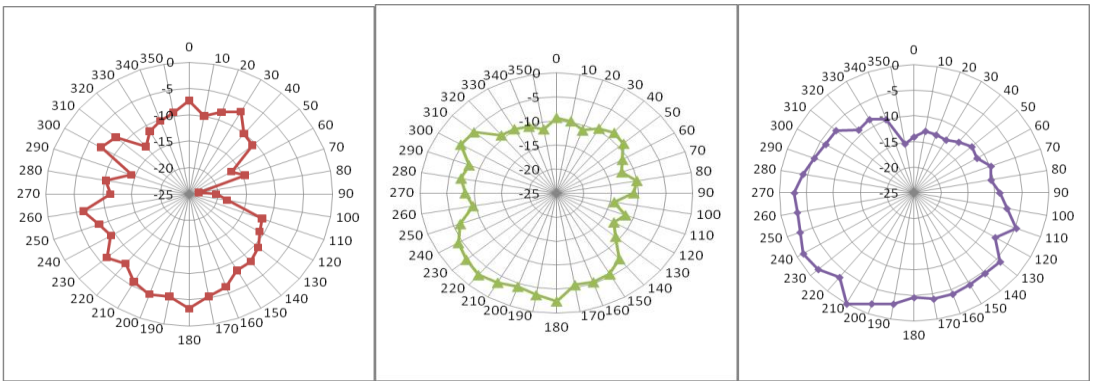
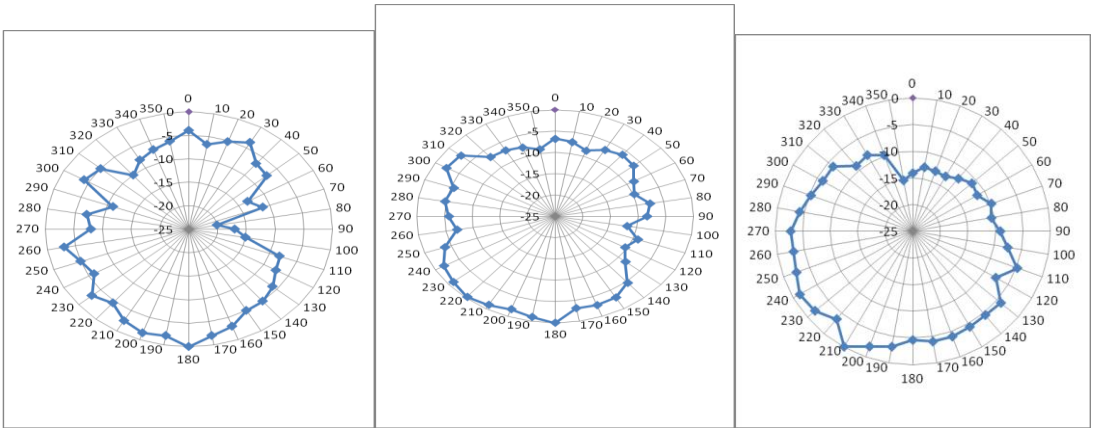


Figure 3: RSU normalized to Max signal from all orientations



Azimuth Plane Theta=0 | Elevation Plane Phi=0 | Elevation Plane Phi=90

Figure 4: RSU normalized to Max signal from individual orientation



Azimuth Plane Theta=0 | Elevation Plane Phi=0 | Elevation Plane Phi=90

4.8 RSU Sensor Characteristics

<TODO>