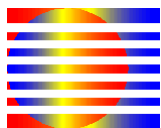# PAL-650

Short Pulse Precision Asset Location System

User's Guide

Revised 2 Oct. 2006

MULTISPECTRAL SOLUTIONS, INC.
A Tradition of Excellence in Innovation

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<center>**NOTICE**</center>

FCC IDs (Indoor Only Use):

> **QCJPAL650 (round tag)**
> **QCJPALBDG (badge tag)**
> **QCJPAL1X1 (cube tag)**

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

> (1) This equipment may not cause harmful interference;

> (2) This equipment must accept any interference received, including interference that may cause undesired operations; and,

> (3) 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.

FCC ID (Indoor/Outdoor Use):

> **QCJPAL6511X1 (indoor/outdoor cube tag)**

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

> (1) This equipment may not cause harmful interference;

> (2) This equipment must accept any interference received, including interference that may cause undesired operations; and,

> Note: This equipment may be operated both indoors and outdoors.

1.   Introduction

PAL-650 is a wireless tagging and identification system designed for the real-time inventory and tracking of indoor and outdoor assets.   Applications include hospitals, warehouses, sea freight, supermarkets, retail stores, robotic vehicles, manufacturing and security. Utilizing MSSI's patented ultra wideband (UWB) technology, the PAL-650 system has a real-time, 2-D or 3-D resolution capability of one foot. Much higher resolutions can be achieved with software averaging techniques. With the use of short pulse, UWB technology, the system is highly immune to multipath effects which plague other wireless tagging solutions (e.g., spread spectrum) designed for indoor operation.

PAL-650 is easily installed and requires no precision cables or calibration. A set of three or four receivers, located at the corners of the region to be supervised, together with a network hub and reference tag are all that are required for system infrastructure. The individual tags are programmed with unique ID codes which are used for inventory and tracking. Because of the unique properties of UWB technology, the tags have an extremely long battery life of better than five years.

As with any RF technology, there are certain precautions that must be observed to prevent interference to other systems. Please carefully read the following sections to properly install and operate your PAL-650 system.

2.   Information to User

PAL-650 operation is authorized under FCC Part 15. As such, there are certain precautions which must be taken during installation to assure compliance with FCC regulations.

   a. Changes or modifications not expressly approved by Multispectral Solutions, Inc. (MSSI) could void the user's authority to operate this equipment;

   b. PAL650 tags labeled QCJPAL1X1, QCJPAL650 and QCJPALBDG may only be used indoors. These tags are certified under Part 15.517. For these applications, each passive receiver must be located indoors, and with its directional antenna facing inwards; i.e., not intentionally directed outside (e.g., out a window or external doorway);

   c. PAL650 tags labeled QCJPAL6511X1 may be used either indoor or outdoors. These tags are certified under Part 15.250. There are no restrictions on the placement of passive receivers for use with these tags.

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.

3. Installation and Operating Instructions

The first step in installing the PAL-650 system is to locate and position the passive PAL-650 Receivers.

Note: Except when using QCJPAL6511X1 tags, receivers must be operated indoors and with their directional antennas facing inwards, in order to ensure compliance with FCC Part 15.517.

For optimum performance, the PAL-650 Receiver locations should be chosen so as to provide adequate coverage of the area of interest. Typical ceiling mountings for the Receivers are illustrated in Figures 1 and 2 below.

Figure 1. Typical ceiling mount for PAL-650 Receiver. Note placement of directional antenna (pointing inwards).

Figure 2. Another typical ceiling mount for PAL-650 Receiver.

The Receivers are interconnected (daisy-chained) via CAT-5 cabling, which is also used to provide power to the units from the PAL-650 Hub and Power Distribution System (Figure 3).


Figure 3.   PAL-650 Hub and Power Distribution System.

Please see the User's Manual for the PAL-650 Hub and Power Distribution System for information on how to connect the Hub to a separate computer for 3-D display of tag positions; and for instructions on how to calibrate the system.

Once the receivers and hub are installed and interconnected, the PAL-650 tags (cf. Figure 4 below) need to be activated. To do so, remove the metal ring (cf. Figure 5) which attaches the polystyrene protective bottom plate to the tag radome using the special tool provided with the system. Once disassembled, the tag internal battery will be visible. (The tag battery should last at least 5 years in regular service.)
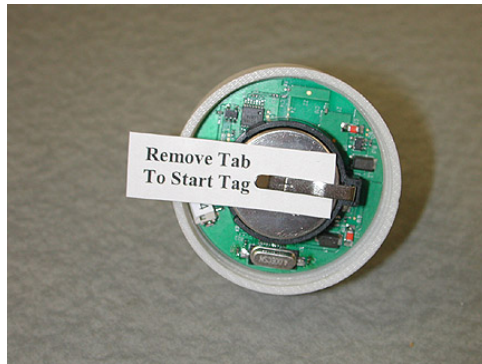

Figure 4.   Active PAL-650 Tag.
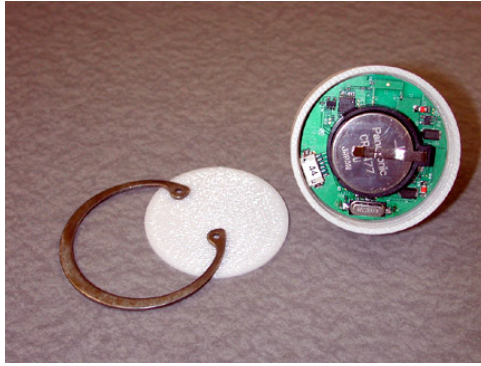
Figure 5.   PAL-650 Tag (disassembled).

When delivered, the tags are provided with a protective tab (cf. Figure 6) which disconnects the internal lithium battery from the rest of the tag circuitry. Once this tab is removed, the tag is activated and can then be used for precision localization applications.

Figure 6.   PAL-650 Tag (before power activation).

4. General Specifications

Principle of Operation: Ultra Wideband (UWB) burst transmissions (FCC Part 15)

Frequency: 6.2 GHz   (QCJPAL6511X1-6.35GHz)

Bandwidth: 700 MHz (-10 dB instantaneous)

Range: 50 meters (indoors)

Update Rate: 1 per second

System Resolution: 1 foot (3-dimensional)