Installation Guide
SaviTag ST-614/ST-615

Version 0.1

Contents

Introduction

Installing SaviTag ST-614/ST-615

Appendix A: PST Reliability and Durability

Introduction

SaviTag™ ST-614/ST-615 is an active RFID tag that is purpose-bulit for locating, tracking, and managing medium to high value assets in Department of Defence (ST-614) and commercial (ST-615) applications. Fully compatible with fixed and handheld Savi® readers, these tags feature up to 270 feet (82.3 meters) of omnidirectional line-of-sight range. Battery life, using lithium cells, is typically five years. SaviTag ST-614/ST-615 is also certified as safe for operation with live ordnance.

Features

◆ 433 MHz, active RFID technology with up to 270-foot (82.3 m) range for monitor, wake-up, and RF write/read

◆ 123 KHz receiver for slot level, chokepoint tag wake-up and short range commissioning

◆ Small form factor design ideally suited for medium and large assets, such as shipping containers, vehicles, and 463L aircraft pallets.

◆ Rugged, weatherproof design

◆ Built-in 1KB firmware allows readers to rapidly collect asset configuration and maintenance information stored on the tag.

Tag ST-614/ST-615 Description

Specifications

Specification	Description
Physical characteristics	**Length:** 6.8inches (17.3 cm) **Width:** .99 inch (2.5 cm) **Height:** .68 inch (1.7 cm) **Weight:** **Color:** ST-614: Gray, ST-615: Black
Environment	Temperature: MIL-STD-810F Methods 501.4 and 502.4 -26° to 158° F (-32° to 70° C) Operating, -40°F to 185° F (-40° to 85° C) Storage Humidity: MIL-STD-810F Method 507.4: 100% at 50° C, non-condensing Salt fog:MIL-STD-810F Method 509.4 Low pressure (altitude): MIL-STD-810F Method 500.4 Maximum altitude 40,000 ft.
RF receiver/transmitter	**Ultra High Frequency transceiver:** **Frequency:** 433.92 MHz **Modulation:** FSK, deviation +/- 50 KHz **Data rate:** 27.8 Kbps **Data coding:** Manchester **Communication range (unobstructed):** Typical range is 270 feet (82.3 m) line-of-sight when mounted onto an asset and communicating with a Savi Fixed Reader SR-650-101 or SaviReader 410R. **Maximum transmit power:** 0.6 mW **Air protocol:** ST-614 only: EBCS Commands (22-bit tag identification supported) ST-614 and ST-615: Savi EchoPoint Air Protocol 2.1 (32-bit tag identification supported)

Specification	Description
LF receiver	Low Frequency receiver (downlink)
	Frequency: 123 KHz
	Modulation: ASK On-Off Keying
	Data rate: Average 1.6 Kbps, 50% duty cycle
	Data coding: Pulse Width Modulation
	Communication range: Up to 12 feet from EchoPoint SP-651/652-211 Signpost. Up to 3.5 feet from (Intermec) SMR-650 Mobile Readers.
	Up to 12 feet (3.66 meters) with Savi Signpost (model SP-65x-xxx)
	Air protocol: Savi EchoPoint Air Protocol 1.1
Network	**Wireless:** RF read/write capable
Memory	Onboard non-volatile memory 1K
Antenna	**Internal UHF:** Omni loop antenna
Shock and vibration	**Shock:** MIL-STD-810F 514.5 Loose cargo test
	Vibration: MIL-STD-810F 514.4 Random vibration
Power	**Battery type:** non-replaceable lithium-ion
	Battery life: Approximately 5 years depending on usage
	Power management: UHF sleep mode prevents unwanted collections, enabled/disabled by LF link. Over-polling protection algorithm to extend battery life.
	Diagnostics: Reports low tag battery status when battery is too low to support 500 UHF reads.

Specification	Description
Regulatory approvals	**Radiated emission (intentional):** U.S. emissionstandards as contained in FCC Part 15 subclauses 15.231a, 15.231e, and 15.240. European Community emission standards as contained in EN 300 220-1 (433 MHz) and EN 301 489-1. Korean MIC regulation 2005-50 (433 MHz). Compliance with ISO 18000-7 specifications
	Electromagnetic immunity: 80 MHz to 1,000 MHz, 3 V/m in accordance with EN 301 489-1.
	ESD compliance: Exposed to 8 kV air discharge or 4 kV contact discharge in accordance with EN 301 489-1.
	Radiated emission (unintentional): U.S. emissions standards as contained in FCC Part 15 and European Community emission standards as contained in EN 301 489-1
	Ordnance Safety (ST-614 only): HERO Certification at 4″ distance. Self-certified at 1″ distance through ARDEC.
	Markings: Savi Name & Logo, Product Model Number, Serial Number, ARDEC / HERO Label (ST-614 only), EMC Compliance Label.
Mounting	✦ Pressure-sensitive tape mounting kit ✦ Magnetic mounting kit
Software	Savi SmartChain® Site Manager, Retriever, or Savi SmartChain® Client Tools 4.0

Model Description

Part number: ST-614-001 and ST-615-001

Description: SaviTag ST-614-001 and SaviTag ST 615-001

Onboard memory: 1K Serial EEPROM – User memory

Contacting Customer Support

If you cannot find the information you need in this guide, contact Savi Customer Support.

◆ Call 1-888-994-SAVI (North America only) or 1-408-743-8888 between 9 a.m. and 5 p.m. Pacific time.

◆ Send email to help@savi.com.

◆ Check www.savi.com/support for information.

When you contact Savi Customer Support by telephone or email, have the following information available:

◆ Contact information (company name, your name, email, and phone number)

◆ Problem description

◆ Product type and location

◆ Serial number or license information

Installing SaviTag ST-614/ST-615

Required Tools and Materials

Before you begin installation of SaviTag ST-614/ST-615, make sure you have the following materials available:

◆ SaviTag ST-614/ST-615
◆ Savi SmartChain Client Tools 4.0 or TAV Tools 3.6x or later
◆ Pressure sensitive tape (provided)
◆ Two (2) zip ties (provided) or:
◆ Alternatively: Two (2) rivets and a handheld rivet gun

Commissioning SaviTag ST-614/ST-615

You can commission SaviTag ST-614/ST-615 using the low-frequency UHF interface.

You can send a low frequency command from SmartChain Mobile Manager to SaviTag ST-614/ST-615 to enable the UHF receiver.

Note: SmartChain Mobile Manager cannot process this command while the Savi Mobile Reader is charging. If the external power supply to the mobile reader is plugged in, you must disconnect it and remove the mobile device from the charging unit to run the command.

1. Start SmartChain Mobile Manager.
2. On the Main Menu, select **Next >>** to view the second page of commands.

3. Select **Enable/Disable Tag UHF Receiver**.
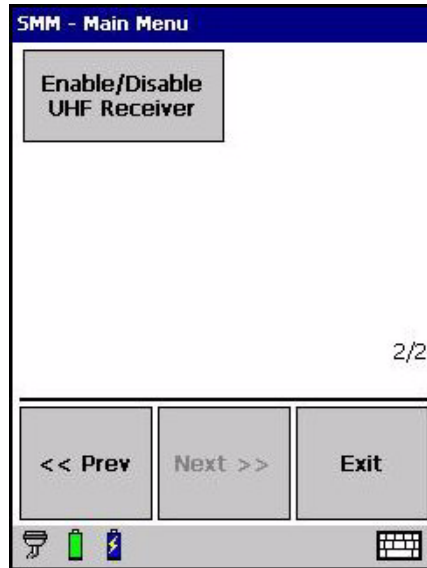
Savi SmartChain Mobile Manager searches for and displays a list of all
SaviTag ST-614/ST-615 within range and indicates if they can be
enabled or disabled.

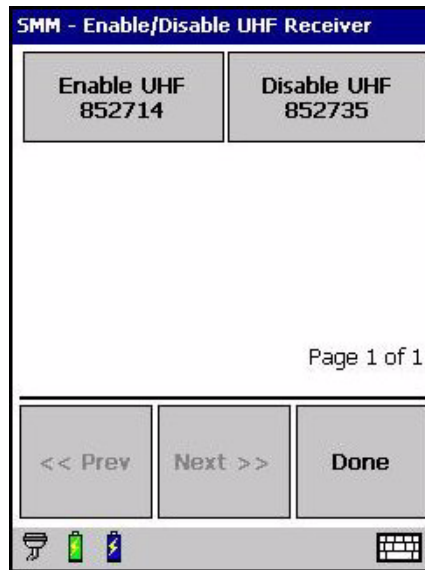4. Select a tag to enable its UHF receiver.

5. Select **OK** to close the confirmation message.

6. Select another tag to enable or select **Done**.

Conserving the Battery

SaviTag ST-614/ST-615 is equipped with a non-replaceable battery which can become depleted by excessive accessing through overpolling.

Low Battery Warning

The battery will last approximately three to five years. When the battery is too low to support two complete shipments, the tag will report a low-battery message to the SaviChain software. At that time, the SaviTag ST-614/ST-615 battery is depleted and the tag must be replaced.

Avoiding Overpolling

The most common cause of early battery depletion is overpolling from leaving the tag in an area where the tag is idle within range of an RF interrogator, such as in a warehouse or shipping yard.

The SaviTag has an algorithm to identify when it is in an idle environment and manage its power consumption. In addition, you can put the SaviTag ST-614/ST-615 to sleep or wake it from a sleeping state manually by enabling or disabling the UHF receiver. With the UHF receiver disabled, the tag stops responding to tag collections from any fixed or mobile reader initiating UHF collection commands.

To put the SaviTag ST-614/ST-615 to sleep using the SmartChain Mobile Manager, follow these steps:

Note: SmartChain Mobile Manager cannot process this command while the Savi Mobile Reader is charging. If the external power supply to the mobile reader is plugged in, you must disconnect it and remove the mobile device from the charging unit to run the command.

1. Start SmartChain Mobile Manager.

2. On the Main Menu, select **Next >>** to view the second page of commands.

3. Select **Enable/Disable Tag UHF Receiver**.
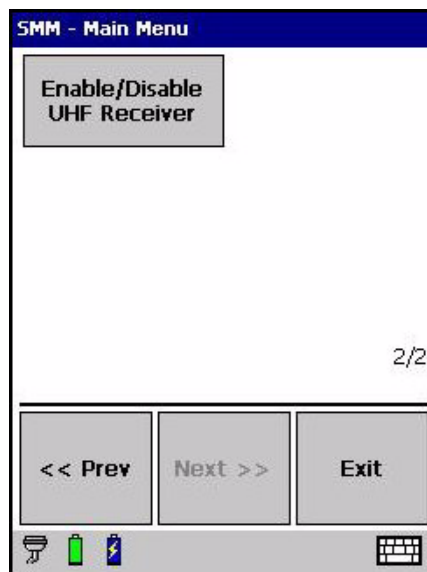
Savi SmartChain Mobile Manager searches for and displays a list of all SaviTag ST-654 within range and indicates if they can be enabled or disabled.

4. Select a tag to disable its UHF receiver.

SMM - Enable/Disable UHF Receiver

Enable UHF 852714	Disable UHF 852735

Page 1 of 1

<< Prev	Next >>	Done
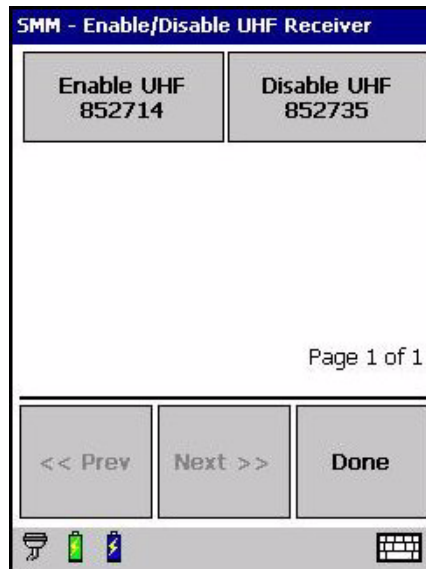
5. Select **OK** to close the confirmation message.

6. Select another tag to disable or select **Done**.

To wake the SaviTag ST-614/ST-615, follow the steps outlined for taking the SaviTag out of storage mode, as described in "Commissioning SaviTag ST-614/ST-615" on page 13.

Placing the Tag

Savi Technology recommends that you mount SaviTag ST-614/ST-615 on a flat surface. For optimal radio communication, place SaviTag ST-614/ST-615 as high as possible, safe from impact (for example, between the ribs of an ISO-type shipping container), and away from obstructions on the asset.

When SaviTag ST-614/ST-615 is mounted in its optimal position:

◆ It is mounted at no less than a 4-foot (1.21 meters) elevation.

SaviTag ST-614/ST-615 will achieve a 270-foot (82.3 m) read range to SR-410 and SR-650 fixed readers. To achieve the most consistent communications with SaviTag ST-614/ST-615, the fixed readers must be mounted:

◆ To have an unobstructed line of sight to the tag
◆ At 20 feet (6 meters) or higher
◆ With the reader dome pointed downward

Example Asset Mounting Locations

M3 Container Roll-in/out Platform (CROP) Mounting Locations

Recommended mounting locations for an M3 Container Roll-in/out Platform (CROP) and other mobile assets are shown in the following pictures.

Figure -1   Primary CROP location for SaviTag ST-614/ST-615

Figure 1   Alternative location for mounting SaviTag ST-614/ST-615 to CROP.

ISO Container Mounting Locations

Figure -1   Examples of tag mounting locations on mobile assets

463L Pallet Mounting Locations

Figure -2   Tag mounting locations on 463L pallet

Mounting SaviTag ST-614/ST-615

The primary mounting tool for SaviTag ST-614/ST-615 is pressure sensitive tape, but you also have the option to use rivets, screws, or zip-ties. Whichever mounting method you select, the goal is to prevent accidental loss of the tag by sudden impact, vibration, or shock during transport. The fastener you choose often depends on the material from which the asset or container is constructed and your personal preference.

SaviTag ST-614/ST-615 includes these recommended mounting fasteners:

◆ Pressure sensitive tape (PST)

◆ Rivets

◆ Magnetic mount STA-610-M (must be ordered separately)

Unlike similar products, there is no plastic mounting sleeve option.

You can also use the following alternative fastening methods:

◆ Tie-wraps (included in STA-610-RPK)
◆ Twine
◆ Screws

Mounting SaviTag ST-614/ST-615 Using Pressure Sensitive Tape

The recommended mounting method is pressure-sensitive tape (PST) to attach a SaviTag ST-614/ST-615. The only brand of PST that Savi

Technology recommends for mounting SaviTags is 3M Corporation's Automotive Acrylic Plus Attachment Tape.

For ease of installation, during manufacturing Savi installs this PST on the back of the tag. PST mounting kits are also available for separate purchase.

Figure -3   SaviTag ST-614/ST-615 factory installed PST

Preparing the Surface for PST Application

PST is suitable for almost any smooth, flat surface made of metal or plastic. Metal surfaces may be coated with most paints, including Chemical Agent Resistant Coating (CARC). It is, however, extremely important that you follow proper surface preparation to enable optimal adhesion.

PST is not intended for attachment to wooden surfaces because of the surface roughness of wood, and the wicking of rain or spray through wood fiber. Screws are the preferred mounting method for wooden surfaces.

PST surface preparation is a simple, but critical process. The surface cleaning procedure on page 21 demonstrates how to clean a shipping container that has greasy residue and dirt on the intended mounting surface as shown in Figure -4.

Figure -4   Dirty, greasy mount location

This demonstration was performed at about 50 degrees Fahrenheit on a mounting surface covered with moisture and condensation. The optimum mounting surface temperature for PST application is 60 degrees Fahrenheit or above. At this temperature full adhesion strength will be achieved within

a few hours. But 3M has successfully applied PST to exposed surfaces at temperatures as low as 40 degrees Fahrenheit. Even at these lower temperatures, tags can be installed immediately after PST application; full adhesion strength will be achieved within 24 hours.

Make sure you have the following cleaning materials available:

◆ General purpose cleaner. Any commercial cleaner with a degreaser; for example Formula 409® Cleaner, Ajax® All-Purpose Cleaner, or Simple Green® All-Purpose Industrial Degreaser
◆ Rags or paper towels
◆ Scrub brush, bucket, and mild soap and water solution if needed

To clean the surface:

1. Determine where the SaviTag ST-614/ST-615 is to be attached to the shipping container or asset. Be sure that the surface to which the tapes will be applied is flat.

2. Spray a liberal amount of general purpose cleaner onto the mounting surface.

3. Using rags or paper towels, clean the mounting surface so it is free of dirt, rust, and loose paint flakes.

4. If the surface is heavily soiled, use a mild soap and water solution to scrub the surface clean.

5. Ensure that the mounting surface is free from moisture and condensation.

Applying the Tag

1. Return to the location where the tag is to be attached to the shipping container or asset.

Mounting SaviTag ST-614/ST-615 Using Rivets

Note: If you want to mount SaviTag ST-614/ST-615 using rivets, consider removing the PST as outlined in "Removing Pressure Sensitive Tape-Mounted Tags" on page 25.

1. Determine where the SaviTag ST-614/ST-615 is to be attached to the asset.

2. Use a marker to mark on the shipping container or asset the location of the rivet holes on the tag.

3. On the asset, drill holes at the locations you marked in step 2.

4. Return to the location where the tag is to be attached to the asset. Align the rivet holes on the tag with the rivet holes you made in step 3.

5. Push the head of the rivets through the tag.

   Figure -5   Insert rivets

6. Use the handheld rivet gun to clip the nail of the rivet and secure the tag to the asset. Avoid fastening the rivets too tightly so as not to damage the tag.

Mounting SaviTag ST-614/ST-615 Using Other Methods

You can mount SaviTag ST-614/ST-615 using some or all of the fasteners listed on page 19. You will need to provide your own rivets or screws.

Figure -6   SaviTag ST-614/ST-615 mounting holes

The tag is equipped with a tie-wrap groove to ensure that SaviTag ST-614/ST-615 is securely fastened.

Figure -7   Use the tie-wrap to secure the tag

Removing Pressure Sensitive Tape-Mounted Tags

Savi recommends that you leave the tag attached to the asset for later reuse, but if it is necessary to remove the tag:

1. Lift one end of the RFID tag with a putty knife or chisel and separate the tape.

2. Remove the tape on the tag or mounting surface by rubbing with dry thumbs.

3. Use a scouring pad with a mild soap and water solution to remove any remaining adhesive.

Appendix A: PST Reliability and Durability

3M Corporation has conducted extensive environmental testing on their Automotive Acrylic Plus Attachment Tape. In addition, Savi has conducted its own independent environmental tests of PST using SaviTag ST-410 as a test platform. The U.S. Army (Tobyhanna Army Depot) has also tested PST for use on surfaces treated with Chemical Agent Resistant Coating (CARC). All these tests confirm that PST is an appropriate choice for mounting SaviTags.

◆ Savi Technology successfully conducted the following tests upon samples of 3M PST:

- ❖ Extreme temperature (–40º to +70º Celsius)
- ❖ Step test (200 pounds applied in shear)
- ❖ Shock (140g or 120 lbs.)
- ❖ Vibration (MIL-STD-810E)
- ❖ Salt fog (MIL-STD-810E)
- ❖ Corrosive liquids
- ❖ Peel test (50 pounds of peel force)

Savi's tests confirm the excellent adhesion integrity and reliability of 3M PST.

◆ 3M Corporation conducted a longevity test of PST. They found no significant degradation in the performance of PST even after five years of service on a test vehicle. As long as the surface is prepared properly, PST will work reliably for five years or longer. See "Preparing the Surface for PST Application" on page 20.

◆ 3M Corporation compared the peel strength of a new roll of PST versus a roll that had been aged 21 months. In all cases, the aged roll matched performance of the new roll in tests conducted over a 72-hour period.