User Guide – BT720 Tracker Quuppa Compatible Tag

BT720

Version 1.1

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REVISION HISTORY

Version	Date	Notes	Contributors	Approver
1.0	24 Sept 2020	Initial Release	Henry Wagner	Chris Boorman
1.1	30 Sept 2020	Recategorized from Application Note to User Guide	Dave Drogowski	Chris Boorman

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1 Introduction

This document provides a brief summary of some of the capabilities of the Laird Connectivity Sentrius™ BT720 Quuppa compatible tag.

The Sentrius™ BT720 can be registered in the Quuppa Site Planner (QSP) software provided by Quuppa. This software suite provides tools for deploying, managing, and configuring Quuppa-compatible tag devices and visualizing them within a map of your location.

This application note details the functionality of the BT720 and how to register and configure the devices in the QSP.

2 Overview

Our BT720 tag is a Quuppa compatible tag suitable for use in a Quuppa RTLS network. Its functionality extends that of basic tag's location information by providing multiple modes of annunciation to alert end users to alarm and warning conditions as it is programmed. It is assumed the reader is familiar with the use of a Quuppa system and its terminology.

3 Tag Operation

The BT720 tag is shipped with a CR2477 battery installed in a low-power shipping mode. Enable the tag for operation by pressing the button on the front face for 5 secs to wake up the tag. It will provide feedback and be ready for configuration in a user's Quuppa system.

The tag must be configured into the Quuppa system before use to enable the Quuppa system to recognize the tag. Use the Quuppa Tag Configuration Tool to configure Laird Connectivity's BT720 tags.

The tag provides annunciators to provide end user feedback as visual, aural or haptic indications. Tag annunciator sequences are preprogrammed in the firmware and are invoked utilizing the temporary command API as outlined in Quuppa documentation.

3.1 Visual Indications

The prototype tag firmware supports preprogrammed visual LED alert patterns on four red LEDs at 12, 3, 6, and 9 o'clock positions on the tag. Additionally, an RGB LED provides indications in various colors and patterns.

3.2 Aural Indications

The tag firmware supports preprogrammed audio tone sequences to alert end users.

3.3 Haptic Indications

The tag firmware additionally supports haptic feedback with preprogrammed vibration sequences.

4 Temporary Mode Commands

The tag supports the Quuppa temporary mode API as this the simplest and most direct way to invoke tag operations from the Quuppa Positioning Engine (QPE) in a Quuppa system. Tag temporary mode commands are defined in the Quuppa Tag Configuration Tool. The BT720 utilizes the temporary I/O byte and the user data bytes available in the temporary command to affect the annunciators.

4.1 Laird Connectivity Developer ID

The Laird Connectivity Developer ID, **0x0073**, is required to utilize the user data bytes in messages sent to our BT720 tags.

4.2 I/O Data Byte

The bit definitions for the I/O data byte are as follows. The upper 4 bits (7-4) are reserved for future use and should always be set to 0. The lower 4 bits are divided into 2 groups of 2 bits. The Red_LED group selects red LED patterns and the Buzzer

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group selects the sound pattern to play from the buzzer. All patterns are predefined in the tag firmware. Each pattern is played once each time a temporary mode command message is received by the tag.

I/O Data Byte								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Function	RFU	RFU	RFU	RFU	Red_LED1	Red_LED0	Buzzer1	Buzzer0
Default	0	0	0	0	0	0	0	0

Table 1: Detail - Red_LED Select Bits

I/O Data Byte – Red_LED Select Bits		
Red_LED1	**Red_LED0**	**Function**
0	0	Red LEDs off
0	1	Red LED Pattern 1
1	0	Red LED Pattern 2
1	1	Red LED Pattern 3

Table 2: Detail - Buzzer Select Bits

I/O Data Byte – Buzzer Select Bits		
Buzzer1	**Buzzer0**	**Function**
0	0	Buzzer off
0	1	Buzzer Pattern 1
1	0	Buzzer Pattern 2
1	1	Buzzer Pattern 3

4.3 User Data Bytes

There are three User Data Bytes of which only one can convey user defined data. The first two bytes must be set to the Developer ID, which is **0x0073** for the BT720 tag, and stored LSB:MSB as **0x7300**.

The third User Data Byte transmits user defined data controlling mode of operation for RBG LED, the color of the RGB LED and the Vibration pattern. The RGB mode determines the duration and frequency of RGB LED illumination. The Vibration pattern selects a vibration pattern. All patterns are predefined in the tag firmware. Each pattern is played once each time a temporary mode command message is received.

User Data Byte (byte 2)								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Function	Mode2	Mode1	Mode0	Color2	Color1	Color0	Vibe1	Vibe0
Default	0	0	0	0	0	0	0	0

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Table 3: Detail – RGB Mode Select Bits

User Data Byte 2 – RGB Mode Select Bits			
Mode2	**Mode1**	**Mode0**	**Function**
0	0	0	Default, RGB short single blink
0	0	1	RGB long single blink
0	1	0	RGB short double blink
0	1	1	RGB long double blink
1	0	0	RFU
1	0	1	RFU
1	1	0	RFU
1	1	1	RGB short blink, repeated every 5 sec while in temporary state

A short blink is approximately 0.25 sec. A long blink is approximately 1 sec.

Table 4: Detail – RGB Color Select Bits

User Data Byte 2 – RGB Color Select Bits			
Color2	**Color1**	**Color0**	**Function**
0	0	0	RGB LED Off
0	0	1	Red
0	1	0	Orange
0	1	1	Yellow
1	0	0	Green
1	0	1	Blue
1	1	0	Purple
1	1	1	White

Table 5: Detail – Vibration Select Bits

User Data Byte 2 – Vibe Select Bits		
Vibe1	**Vibe0**	**Function**
0	0	Vibe off
0	1	Vibe Pattern 1
1	0	Vibe Pattern 2
1	1	Vibe Pattern 3

5 Example Use

One or more annunciations can be activated simultaneously, creating create light, sound and vibration annunciations as needed in an application.

The Quuppa Temporary Command Editor must be used to create temporary commands that can be saved and uploaded to the project. This project can be accessed by the Quuppa Positioning Engine to understand the commands and send the correct command message to the appropriate tag.

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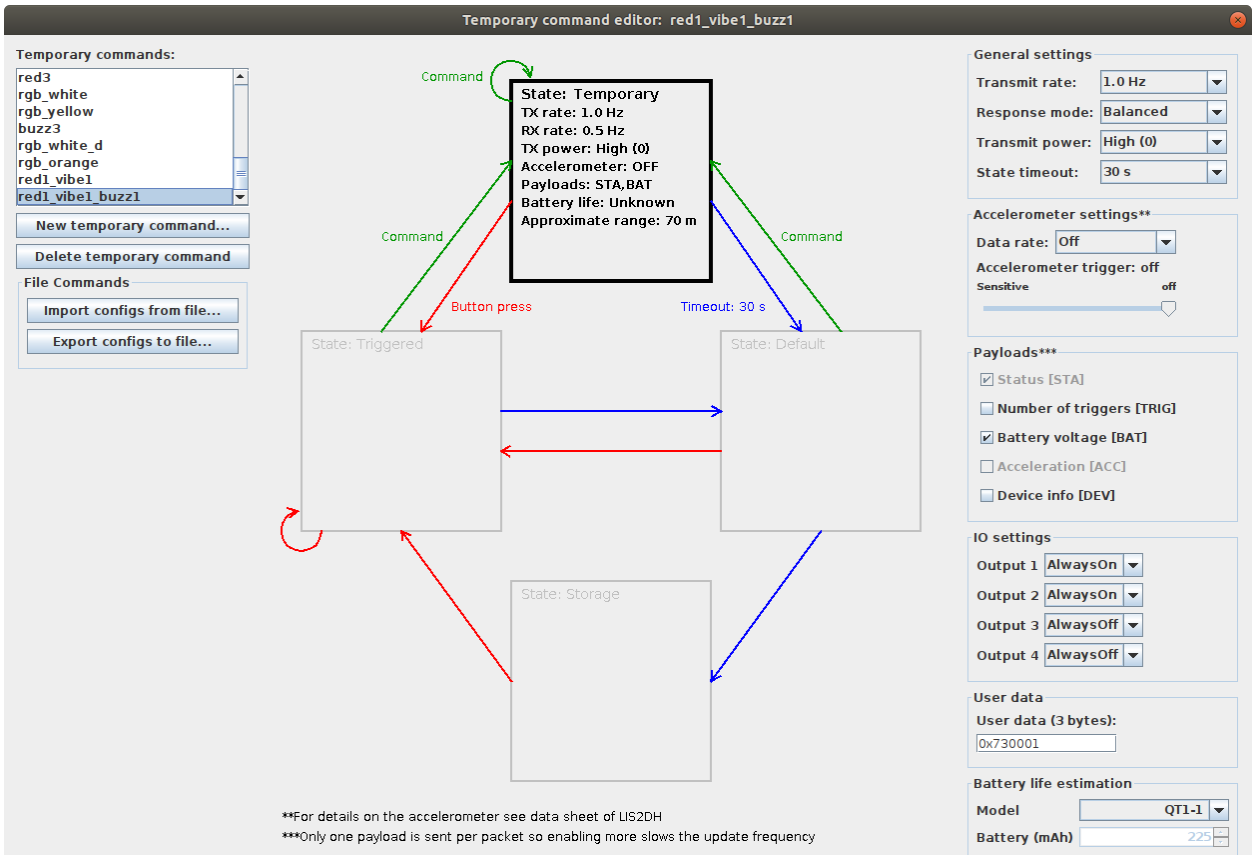

Figure 1: Detail – Vibration Select Bits

This screenshot from the Quuppa Temporary Command Editor shows a command that selects Red LED pattern 1, vibration pattern 1 and buzzer pattern 1 to be played simultaneously. The temporary mode timeout is set to its default of 30 sec. Note the IO Settings are used to set the I/O Data byte. The I/O Settings work as follows, per Quuppa documentation:

Table 6: Detail – I/O settings bit definitions

	I/O settings byte			
	Output 4	**Output 3**	**Output 2**	**Output 1**
Always Off	00	00	00	00
Always On	01	01	01	01
Blink Slow	10	10	10	10
Blink Fast	11	11	11	11

The desired I/O Data byte must be constructed utilizing the I/O settings bit definitions shown above. Therefore, Red LED pattern 1 and Buzzer pattern 1 each map to '01' which is Always On in the settings table. The upper 4 bits should always be set to zeros, so they are Always Off.

The User Data must contain the Developer ID in the first two bytes as LSB:MSB, therefore it is set to **0x7300**. The third byte contains the remaining settings, in this case **0x01**, corresponding to vibration pattern 1. The RGB LED is not activated.

Remember to upload your project after changing the configuration to use your new configuration.

5.1 Command a tag with a temporary command via browser window

Tag commands are issued to the QPE using JSON strings for defined API. The commands are JSON format. A method to issue temporary command is to send the API command to the running QPE via a browser byte entering the command in the browsers input box. This works well for initial testing but is not suitable for long term use.

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The running QPE is exposed on port 8080 on the platform it is running. Using the Quuppa command API v2.0, a command can be constructed to send to the tag:

```
localhost:8080/qpe/commandTag?tag=ce6762b8802d&id=red1_buzz1_vibe1
```

Where `ce6762b8802d` is the tag address, and `red1_buzz1_vibe1` is the desired temporary command.

The colors are only to help distinguish elements of the command string. Replace the tag address and temporary command name with your values when testing in your system.

6 Firmware Update

The BT720 tag supports over the air secure firmware updates via DFU. To put the tag in firmware update mode, the following QPE API command can be used:

```
localhost:8080/qpe/sendQuuppaRequesttag=ce6762b8802d&requestData=0xFF730000F2
```

Where `ce6762b8802d` is the tag address, and `0xFF730000F2` is the Enter Firmware Update command.

Once the tag is in update mode (the RGB led no longer flashes red if the button is pressed), updated firmware can be downloaded. Firmware can be sent to the tag or tags via the Quuppa locators or individually using Nordic nRFConnect utilities.

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