

# **xBase**

## **Operational Description**

**Document Revision: R1.1**

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# 1 Revision History

Revision Number	Change Description	Revision Date	Author
R1.0	Initial Release	4/04/2023	BWL
R1.1	Added section 3.1: Cellular Radio Operations	4/18/2023	BWL

## 2 Introduction

The purpose of this document is to describe the operations of the xBase. The xBase is a battery powered Bluetooth Low Energy device that uses a 2.4 GHz radio for wireless communications. The radio uses Bluetooth Low Energy in the 2400 – 2500 MHz ISM band.

The Texas Instruments CC2640R2L, operates the 2.4 GHz radio.

The xBase uses a Quectel BG77 cellular module for GNSS and cellular communications.

A primary non-rechargeable battery is used to power the device. The device has an additional sensor on the board to provide telemetry data over the wireless interfaces.

## 3 Radio Operations

### 3.1 2.4 GHz Radio Operation

The CC2640R2L provides the device with Bluetooth Low Energy radio operations in the 2.4 GHz ISM band. The CC2652R7 is powered from a 3.3V lithium battery. The system is charged via a solar cell or has a 5-17VDC optional input for charging the battery.

The CC2640R2L has a differential RF output. The max transmit power is 5 dBm. This differential output is fed to a discrete balun towards a chip antenna. The chip antenna has a gain of 1.1 dBi. The 2.4GHz interface uses 40 channels, each separated by 2 MHz. Each channel transmits with an approximate 1 MHz, 6dB bandwidth, signal. The channels used by the device can be found in **Table 1** below.

All wireless communication follows the Bluetooth Low Energy standard.

**Table 1: BLE Channels**

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2404	16	2438	32	2470
1	2406	17	2440	33	2472
2	2408	18	2442	34	2474
3	2410	19	2444	35	2476
4	2412	20	2446	36	2478
5	2414	21	2448	37	2480
6	2416	22	2450	38	2482
7	2418	23	2452	39	2484
8	2420	24	2454		
9	2422	25	2456		
10	2424	26	2458		
11	2426	27	2460		
12	2428	28	2462		
13	2430	29	2464		
14	2432	30	2466		
15	2434	31	2468		

### **3.2 Cellular Radio Operation**

The Quectel BG77 provide GNSS and LTE cellular communications capabilities to the device. The Quectel BG77 is an FCC recertified cellular module (FCC ID: XMR201912BG77). The BG77 is powered from the 3.3V lithium battery.

The cellular module operates on Verizon LTE bands 13 and 4. They operate on 776 - 787 MHz and 1710 – 1755 MHz frequency band respectively.

The cellular module has a maximum transmit power of 21 dBm. The cell module uses the Pulse W3796 chip antenna with an average gain of -2.5 dBi for band 13 and -2 dBi for band 4.

While not common, it is possible for both the cellular module and the 2.4 GHz radio to transmit at the same time.