

BRB900 GPS Telemetry System

August 2013

Version 0.06



As of January 2013, a new model of the BRB900 has been introduced. The key differences are listed below.

1. **U-blox GPS Chipset:** The Trimble Lassen IQ gps module has been replaced with a u-blox NEO-6. This new chipset offers higher sensitivity and quicker lock times. However, it lacks non-volatile memory to store configuration information so it must be configured at poweron. For this reason, the “smart” version is required. The basic version is no longer available.
2. **Larger On-board memory:** The on-board memory has been upgrade to 1 megabit. This is eight times larger than the original, and can store almost 2 ½ hours of data at a 1 Hz rate.
3. **No G-switch:** The G-switch that was previously used to detect launch has been eliminated. With the larger memory mentioned above, positions will be recorded for 2 ½ hours after the unit is powered on until the memory fills and recording stops. Or, if the “wrap” option is set, 2 ½ hours before the end is reached and recording starts again at the beginning.
4. **No integrated ‘rubber duck’ antenna:** The option to mount an RP-SMA antenna directly to the transmitter board has been eliminated. This mounting option often resulted in broken transmitters due to the stress caused during launch, landing, or ejection events. The recommended antenna option is now a simple wire whip. A u-fl cable + RP-SMA antenna is also available.
5. **Configuration Program:** Because of the larger on-board memory, a new windows program is required. Until these changes get integrated into one program, please use the ‘xb3.exe’ version instead of ‘brb900.exe’.

1. Overview:

The BRB900 Telemetry System consists of a GPS receiver and RF transmitter paired with a matching RF receiver. The GPS transmitter is placed in the object to be tracked, and the receiver is located at the base station. The GPS onboard the transmitter computes the position of the object being tracked and transmits this information over the RF data link. The receiver decodes the data, which shows in real time, the precise location of the object being tracked.

2. Quick Start Guide:

All BRB900 transmitters and receivers arrive preconfigured and ready to run OUT OF THE BOX, no additional configuration necessary. Simply apply power to the transmitter and make sure the GPS module has a clear view of the sky (initial lock times may take as long as 15 minutes). Turn on the LCD receiver (push the switch UP turn it on) or plug the USB only receiver into your PC to start receiving packets.

For the USB receiver without the LCD, you will also have to run some terminal emulation (e.g. Hyperterm or TeraTerm) program to view the GPS data stream. Baud rate should be set to 9600-8-N-1.

3. Configuration:

Each transmitter and receiver are “paired” by programming a common transmit ID into the transmitter and receiver. Receivers can only receive data packets from transmitters with the same transmit ID, other transmitters will be ignored. It is possible to have multiple transmitters with the same transmit ID. They can be distinguished from each other by the unique serial number that is embedded in the transmit packet.

4. BRB 900 Transmitter

The transmitter consists of a GPS receiver, 900 MHz spread spectrum transmitter, and battery regulator circuitry.

Power is supplied by connecting J2 to J3. The LED will flash rapidly for several seconds and stop until GPS lock is obtained. Then it will blink at 1 Hz when lock is obtained.

The LED will blink when GPS lock is obtained.

To use the software to configure the transmitters, follow this steps:

- a) Plug in the USB interface to the PC
- b) Start the software and select the proper com-port
- c) Apply power to the device. Note that the LED will begin to flash rapidly
- d) Connect the 5-pin headers together.
- e) WHILE THE LED IS STILL RAPIDLY FLASHING, click on “read”

5. BRB900 Receiver

The base level receiver consists of a 900 MHz spread spectrum radio module with a USB interface that appears as a virtual serial port. Power is provided via the USB interface, and data is transmitted at 9600 baud, 8 data bits, No parity 1 stop bit (9600-8-N-1). The RF transmitter may be configured using the X-CTU programming software over the USB link.

The LCD version of the transmitter adds a microcontroller and LCD display. The LCD display is battery powered, and can be charged over the USB port. The RF transmitter is configured using the X-CTU programming software over the USB link.

The LCD receiver can be configured to decode two data packet types sent from the transmitter, \$GPGGA and \$BRBTX. Switching between the modes is accomplished by turning the power on while the configuration button is pressed. The receive mode will be stored in non-volatile memory.

It is NOT possible to upgrade from the base level to the enhanced version of the BRB900 Receiver.

6. Transmit Modes

There are two transmit modes:

§BRBTX Summary: §BRBTX sentence is sent over the RF link at a user defined rate. This mode results in the lowest power consumption and minimal use of the RF bandwidth. *This is the recommended mode of operation.*

Echo RAW GPS Data: The microcontroller echoes all sentences from the GPS module to the RF transmitter.

A user selectable firmware option determines whether the RAW NMEA sentences are echoed, and/or the §BRBTX packets are sent.

7. Receive Modes

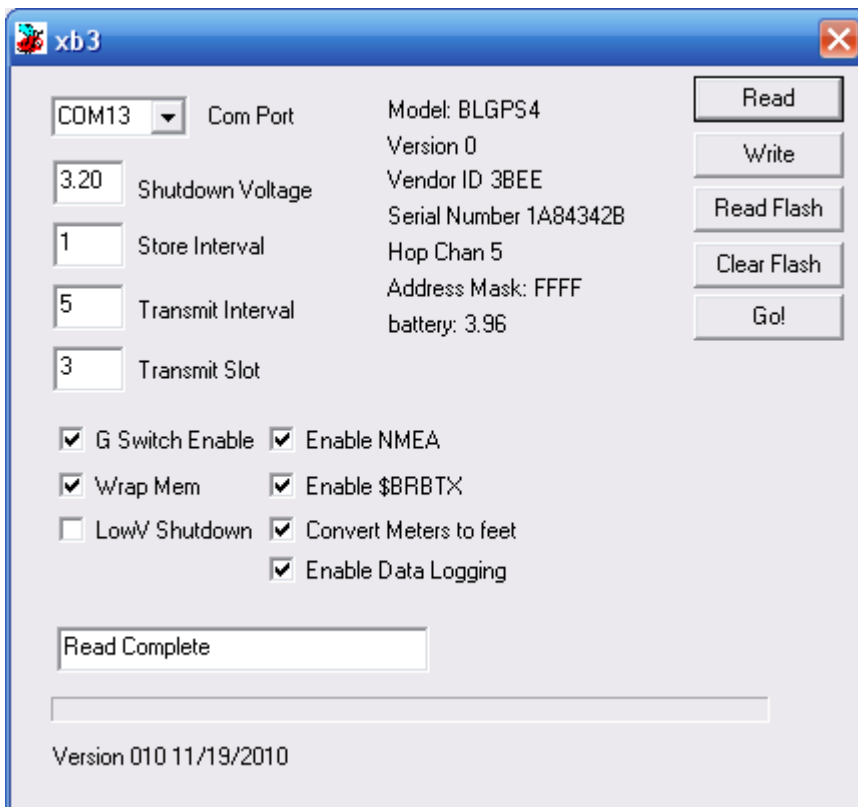
The receiver has a USB data port and an optional LCD display.

USB data port: All received data packets are echoed to the USB Data port. This includes the NMEA sentences as well as the special §BRBTX packet. No interpretation ordering or filtering of packets is performed by the receiver. If multiple transmitters are present (and the routing parameters set so that the receiver does not discard them) the data from all will be echoed on the USB port. In this mode, it is not possible to differentiate between data packets received from two different transmitters.

LCD Display: The receiver will look for §BRBTX sentence and display the contents of the summary packet on the LCD display. It will remember the unique identifier from the first §BRBTX sentence received, and ignore any §BRBTX data from other transmitters. It is not possible to differentiate between data packets received from two different transmitters unless the BRBTX packet is present

8. Programming Software

The programming software for the BRB900 TX is pictured below along with a description of the fields.



Com Port: Serial or USB Virtual serial port identifier.

Shutdown Voltage: Default: 3.4 Volts. The BRB900 Transmitter contains battery monitoring circuitry and will shutdown the transmitter if the voltage falls below the programmed level.

Store Interface: Approx 1200 data points can be saved in the on board non-volatile memory. Data is stored every “N” seconds, in this case 1.

Transmit Interval: the \$BRBTX data packet is transmitted every N seconds, in this case, 5.

Wrap Mem: Flight data will be continuously logged to memory, wrapping around to the beginning when the end is reached. If this box is not checked, data logging will stop when the end of memory is reached.

Enable NMEA: The raw NMEA sentences from the GPS are echoed onto the RF Data Link (*this option should not be enabled*)

Enable \$BRBTX: The \$BRBTX sentence is sent on the RF data link every “N” seconds as indicated by the Transmit Interval

Read: Read the device parameters. Make sure to select the proper COM port. Always begin a programming session with a Read command

Write: Write the device parameters

Read Flash: Read the contents of the flight data logged in non-volatile memory.

Clear Flash: Clear the non-volatile memory. It is recommended to clear the memory before each flight.

Go: Exit command mode.

9. Networking Parameters

In addition to the unique identifier contained in the \$BRBTX sentence, the transmitter and receiver use several identification parameters that determine which RF packets will be decoded by the receiver. These include a Vendor ID, Hopping Channel, and Destination address. By default, each receiver is programmed to recognize up to 4 different destination addresses. Each transmitter must have a matching Vendor ID, Hopping Channel and group of destination addresses.

It is possible to modify the networking parameters of the RF transmitter. This functionality is enabled by invoking the BRB900 Communicator with the “-rf” command line option.

The parameters of the receiver can be made using the X-CTU software from digi.com

These parameters can be modified so that all packets matching the Vendor ID and Hopping Channel are displayed. Additionally the Vendor ID and Hopping Channel can be modified to match other vendors.

Default Settings for Address Parameters:

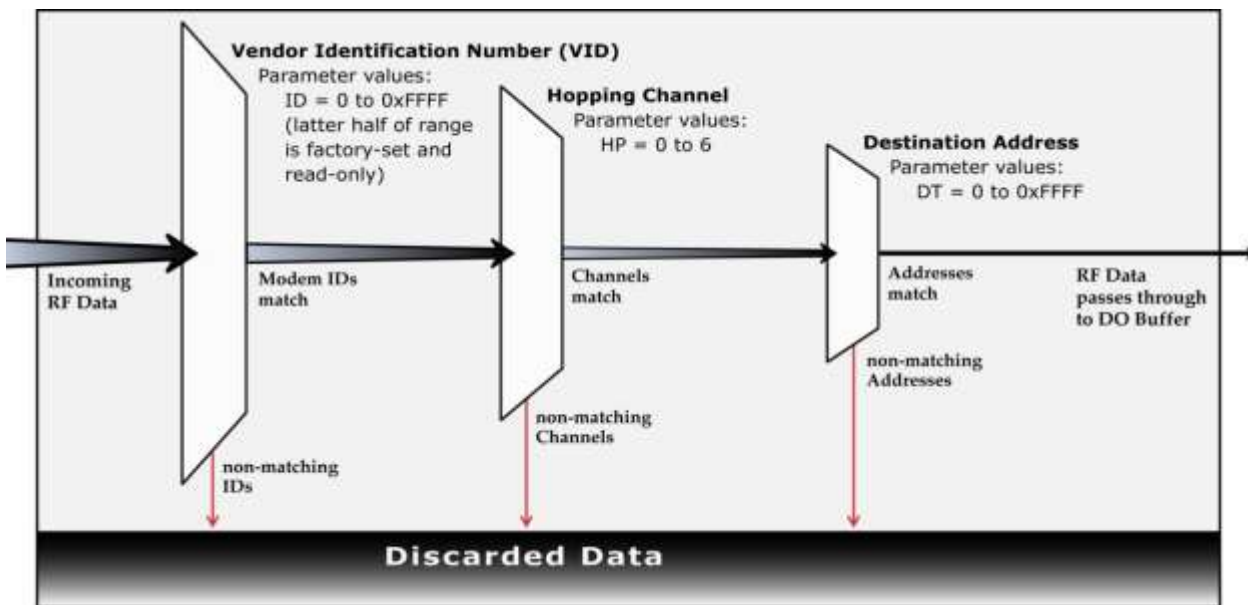
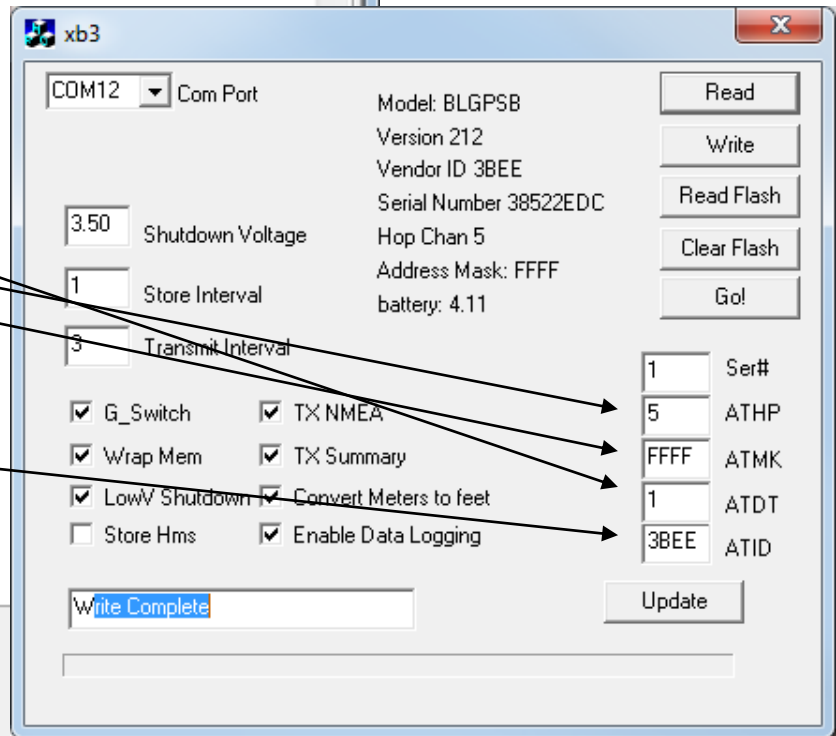
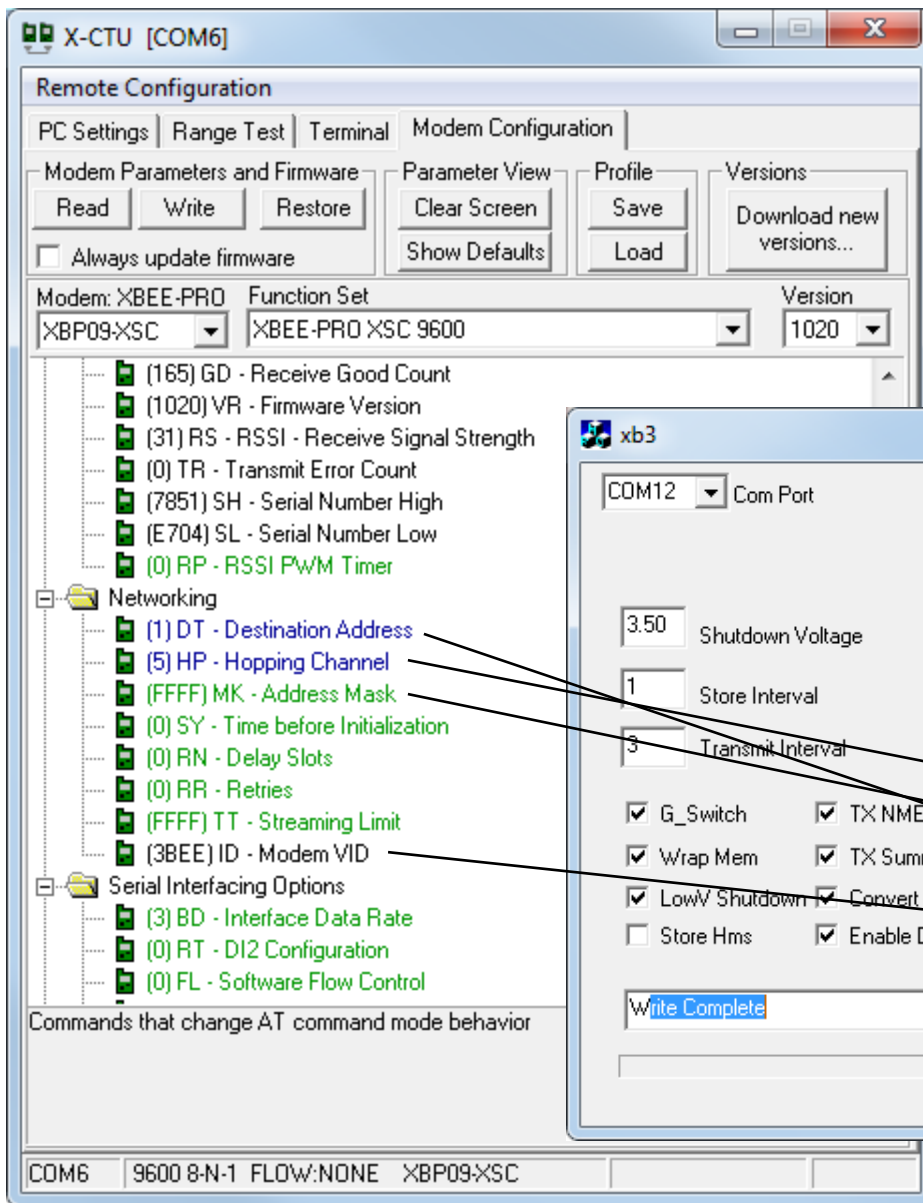
Hopping Channel (ATHP): The default hopping channel for the BRB900 transmitter and receiver is 5, and should not be changed.

Address Mask (ATMK): The default address mask is 0xFFFF and should not be changed.

Destination Address (ATDT): Each transmit/receive pair is shipped with a unique/matching destination address. In order for the Receiver to decode the transmitter packets, the Destination addresses must match. If you purchase additional transmitters, you can change the Destination Address to match your existing receiver.

Vendor Identification (ATID): The default Vendor ID is 0x3BEE, and should not be changed.

UPDATE: The update button will modify the BRB900 Transmitter parameters. Use extreme caution when modifying these settings



*The RF parameters cannot be modified while the transmitters is installed in the base level transmitter

10. Special Sentence Format

\$BRBTX

BigRedBee Summary Information

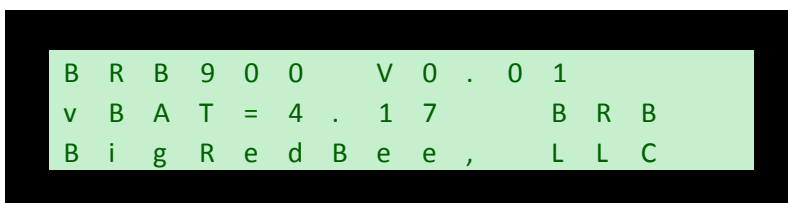
\$BRBTX, ID0001,*,033618,3412.3456N,12345.6789W,04,2.69,012345,1.24,2F0

Where:

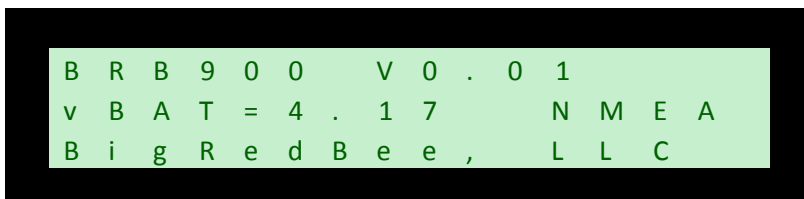
\$BRBTX	BigRedBee Summary Packet
ID0001	Unique identifier string
*	BRB Status Flag
033618	fix taken at 033618 UTC Time
3412.3456N	Latitude 34 degrees 12.3456 minutes North
12345.6789W	Longitude 123 degrees 45.6789W minutes West
04	4 satellites user to compute position
2.69	HDOP
012345	Altitude in Meters or Feet
1.24	VDOP
2F0	Raw A/D conversion of onboard battery voltage

11. LCD Display

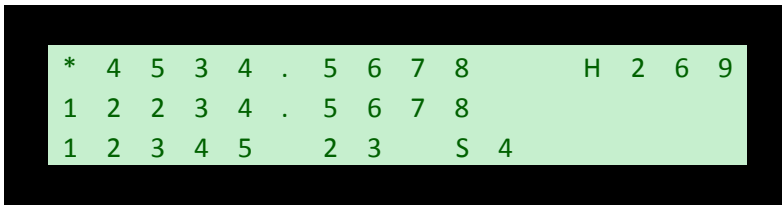
When the power switch is turned on, the LCD will display the following information: The firmware version (V0.01) and the battery voltage of the receiver are displayed. The BRB-LCD can be configure to display the information from the \$GPGGA sentence, or the \$BRBTX sentence. Switching between modes is accomplished by holding the configuration button while the unit is powered on.



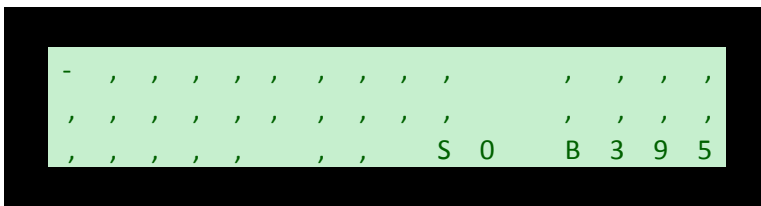
If the configuration button is held when power is applied, the NMEA mode will be toggled.



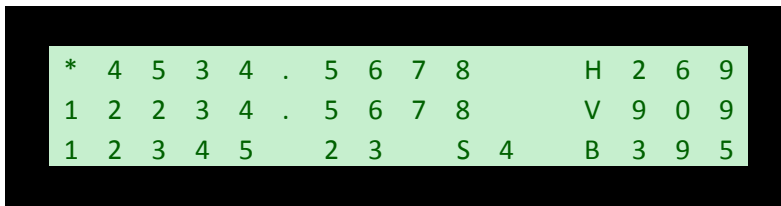
The 16x3 line LCD display contains the following information when decoding the \$GPGGA NMEA sentence



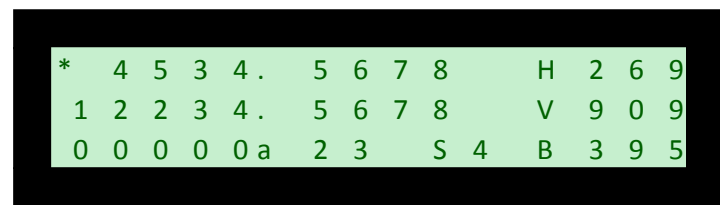
The 16x3 line LCD display contains the following information when decoding the \$BRBTX Summary sentence before the GPS has locked. Note that the battery voltage and # of satellites are valid.



The 16x3 line LCD display contains the following information when decoding the \$BRBTX Summary sentence.



Altitude in this mode is “MSL”. If the configuration button is held, the LCD receiver will “lock in” the currently altitude as the “base” altitude, and report all future altitudes as “AGL”. Negative altitudes will be displayed as “0”.



*	Status Character: ‘*’
4535.567	Latitude: 45° 34.5678”
12234.5678	Longitude: 122° 34.5678”
12345	Altitude: 12345
H269	Horizontal Dilution of Precision (HDOP): 2.69
V909	Vertical Dilution of Precision (VDOP) 9.09
23	Time of Day (Seconds only): 23
S4	Number of satellites in view: 4
B395	Voltage of Battery on Transmitter 3.95V

12. BigRedBee USB Interface and Charger

The BigRedBee USB interface integrates the functionality of two separate devices; a USB data interface, and a single cell lithium poly battery charger. The charger and programming interface functions should not be used at the same time. When programming the device, the battery must be used to provide power. Power is NOT provided via the USB interface. Do not attempt to charge the battery and modify the device parameters at the same time.



12.1 Single Cell Lithium Poly Charger

Plug the USB cable into the USB interface board and connect to your computer’s USB port. Plug the battery into the three pin connector. The LED will remain on while the battery is charging, and turn off once it is fully charged. Charge rate is 100 milliamps per hour.

The battery charger function is independent of the data interface. The battery WILL NOT CHARGE unless it is connected directly to the 3-pin header on the USB / charger interface.

12.2 USB Data Interface

Apply power to the transmitter. Plug the USB cable into the USB interface board and connect to your computer's USB port. If this is the first time you have used this type of USB interface, Windows will need to install the drivers for it.

Once Windows has recognized the device, plug the 5-pin connector on the USB adapter into the Beeline transmitter. Now you can use the BeeLine Communicator to modify the device parameters. Make sure to select the proper COM port

Drivers are located here: <http://www.ftdichip.com/FTDrivers.htm>

13 Misc Info

Transmitter Dimensions: 1.25" wide x 2.85" long, excluding transmit antenna.

Antenna: Reverse Polarity SMA, 3dbi gain approx 4.25" long

GPS Module: u-blox Neo 6Q. Altitude and speed may exceed 18,000 meters or 515 meters/second, but not both.

RF Transmitter: 250 mw 900 Mhz Spread Spectrum.

Receive Current : 115mA

Transmit Current: 315mA

Power supply: Single cell Lithium Poly battery (3.5 to 4.2 Volts)

14 Board Description and Connectors

Turning on the Transmitter:

Plug battery J3 into board J2

Programming:

Plug J4 into J1, aligning pin 1. Power must be applied as described in section 14.2 while programming

Battery Charging

Plug J3 into J5, and the USB connector into the PC using the supplied cable. The connectors are keyed, and can only be installed in one direction.

