

Tortoise

manual version 2.2





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Tortoise TOP PANEL

TX1 & TX2:

XMIT(Green)- Lit when the associated transmitter is on.

XMIT(Flashing Green)- Power adjusting to set level

UNLOCK(Red)- is lit if the associated transmitter has an RF problem - contact factory.

CONTRAST SLIDE CONTROL:

Adjusts the contrast of the LCD display.

AUDIO SPEAKER:

Outputs tones that indicate Tortoise functions.

128 x 240 PIXEL LCD DISPLAY

KEYPAD:

1-9,0 are used for frequency and channel entry.

ENTER is used to initiate parameter entry in the main screen and to display unit information in the main menu.

ESC is used to exit entry and to enter the main menu. It is also used to exit menus to return to the main screen.

TX1 is used to turn on and off transmitter 1.

TX2 is used to turn on and off transmitter 2.

RECALL functions as an UP ARROW in menus.

SAVE functions as a DOWN ARROW in menus.

MAIN POWER ON/OFF SWITCH

POWER/FREQUENCY KNOB:

Is used to change selected transmitter parameters (frequency or power), the current parameter controlled by the knob is displayed on the last line of the main screen and selected using the main menu.



TORTOISE REAR PANEL

TX1 transmitter module 1 output

TX2 transmitter module 2 output

GPS GPS antenna input

ETHERNET 10/100 Mbit ethernet comm port

USB USB 2.0 comm port

SERIAL DB9 serial comm port

12V 12VDC power input

FUSE user replaceable fuses

AC/DC AC or DC input switch

120-240 VAC 120-240 VAC power input



All control and setting of operating parameters for the TORTOISE TRANSMITTER are accomplished using the top-panel keypad/knob combination. All valid parameters are saved by the TORTOISE and are the parameters used whenever the unit is powered up.

TORTOISE KEYPAD AND KNOB

The current TORTOISE parameter that can be modified by the keypad or knob is indicated by the marker shown on the left hand side of the TORTOISE main display. The RECALL (UP) and SAVE/CLEAR (DOWN) buttons can also be used to scroll within menu screens.

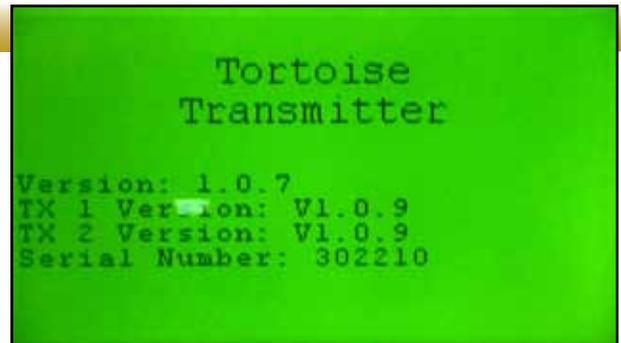
The ENTER button selects the currently chosen option while the ESC button backs out to previous screen.



STARTUP

This is the first screen you will see upon startup. It identifies the firmware version of your Tortoise unit, TX 1 version, TX 2 version and serial number. This screen stays on about 10 seconds.

If you encounter any problems and need BVS technical support, be sure to write down these numbers before contacting support. You will be asked to provide these version numbers to help diagnose any problems.



MAIN PARAMETERS

This screen displays and also allows control over all main parameters such as TX, frequency, power and modulation status so it is the MAIN display you will probably see most.

Note: Users will not be able to adjust any of these settings while the Tortoise is actively transmitting any signal.

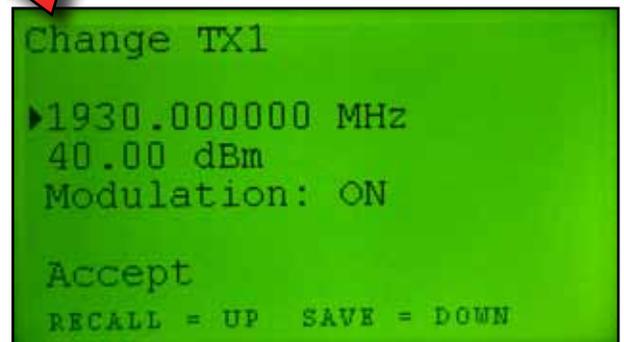
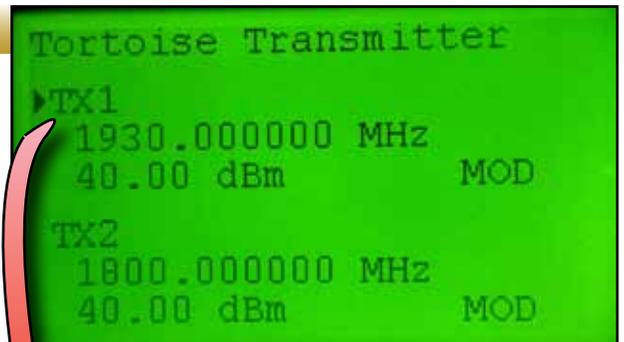
TX1 MHz indicates the current frequency setting of transmitter 1.
dBm indicates the current power output of transmitter 1.
MOD indicates if optional modulation is enabled if installed.

See Power Conversion at the end of this manual for dBm to Watts.

Use the KNOB or KEYPAD to scroll through menu and adjust changes.

Select the TX output you wish to adjust and press ENTER. This brings you to the CHANGE screen allowing only adjustments for the selected TX. Use the RECALL (UP) button and SAVE (DOWN) button to choose the parameter to edit. Make changes using the KNOB or KEYPAD and choose ACCEPT by pressing the ENTER key.

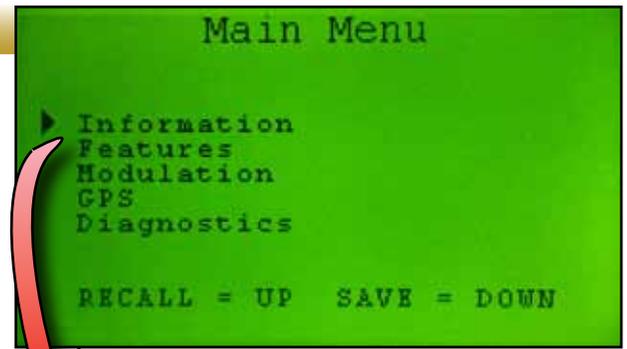
When adjusting dBm or frequency, the step size will increase or decrease according to user setting in the SET & EDIT INCREMENTS menu screens.



Note: Once you finish settings, be sure that output(s) are properly terminated and/or antennas connected BEFORE starting transmission.

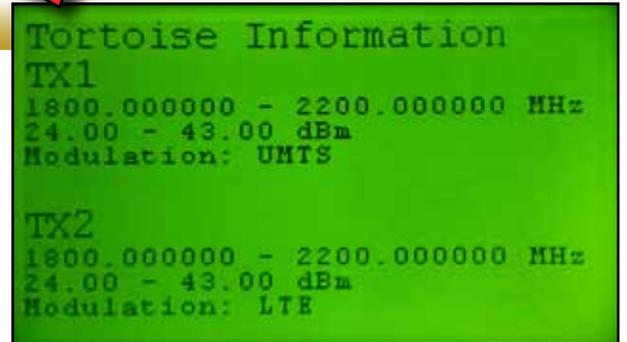
MAIN MENU

Press **ESC** to enter this **MAIN MENU**. Users may select and view **Information**, **Features**, **Modulation**, **GPS** and **Diagnostics** using the **KEYPAD** buttons **RECALL (UP)** and **SAVE (DOWN)** as arrow keys. Press **ENTER** to make a selection or **ESC** to go back to **MAIN PARAMETERS** screen.



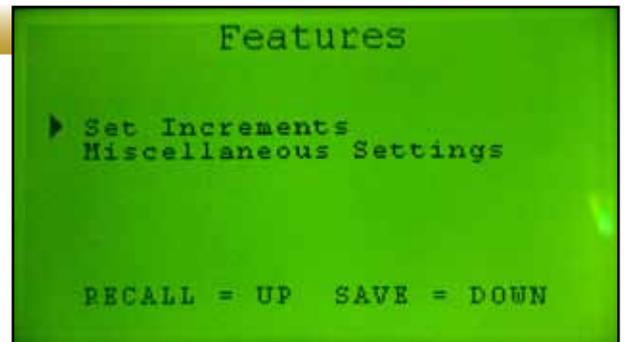
INFORMATION

The **INFORMATION** screen displays the currently installed **TX** modules and their respective frequency ranges (**MHz** or **GHz**), power output ranges (in **dBm**) and optional modulation schemes (**UMTS**, **LTE**, **CDMA**, **WiMAX**, etc.)



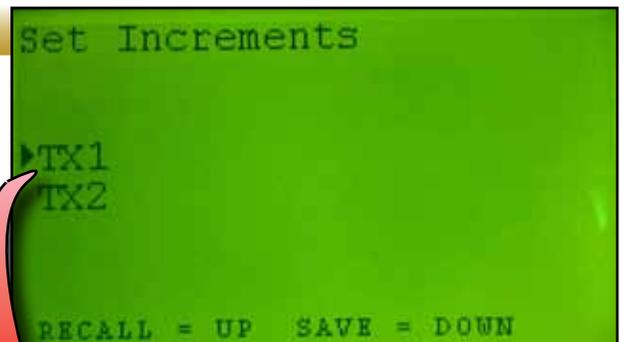
FEATURES

The **FEATURES** menu allows the user to set increments or step sizes in output frequency and power levels. Use the **KEYPAD** buttons **RECALL (UP)** and **SAVE (DOWN)** as arrow keys. Press **ENTER** to make a selection.

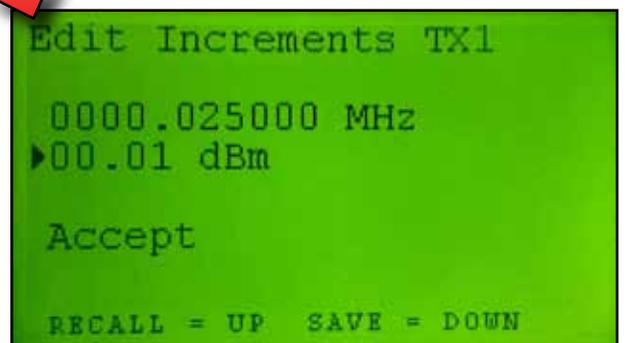


SET INCREMENTS

Within the **SET INCREMENTS** menu, choose your **TX** first. Use the **KEYPAD** buttons **RECALL (UP)** and **SAVE (DOWN)** as arrow keys. Press **ENTER** to make a selection.



Once in the **EDIT INCREMENTS** menu, use the **KNOB** or **KEYPAD** buttons **RECALL (UP)** and **SAVE (DOWN)** as arrow keys. Once you have made the changes, scroll down to **ACCEPT** and press **ENTER** to make save settings.



MISC SETTINGS

MISC SETTINGS contains ON / OFF toggles for audible keypad “beeps”, Rev Power Shutdown and Power On Resume.

The Key Beeps are just audible indicators for keypad entry using the Tortoise’s built-in speaker.

Rev (Reverse) Power Shutdown monitors the power being reflected by the antenna. If it exceed a certain threshold, the power amplifier is shut down to protect it from overheating. The threshold can be exceeded if the Tortoise is transmitting at high power into an unmatched load, such as a damaged (or missing) antenna. This setting is set to ON by default.

Note: Users should consult with BVS technical support before turning this setting OFF as it could damage the unit.

The Power On Resume toggle is for unexpected power outages. If either or both transmitters is ON when the unit loses power (or is manually turned off) and TX Resume is ON, the transmitter(s) that were on when power is restored will resume transmitting.

Misc Settings

```
►Key Beeps: ON
Rev Power Shutdown: ON
Power On Resume: OFF
Accept
```

RECALL = UP SAVE = DOWN

DIAGNOSTICS

The Tortoise DIAGNOSTICS screen displays the current temperature, power (watts and amps) and ON / OFF status of each TX amplifier. Press ESC to return to the previous menu screen.

GPS DATA

Once the GPS receiver has synced to satellites, you should receive GPS details including date, time, satellites, status, latitude, longitude and height. The GPS receiver is optional so contact sales@bvsystems.com or call 732-548-3737 if you require GPS data.

Diagnostics

```
Temperature      30.50 °C
Voltage          12.67 V
PA1:
  Current        0.00 A
  Temperature    25.00 °C
  Status         OFF
PA2:
  Current        0.00 A
  Temperature    22.35 °C
  Status         OFF
```

UMTS MODULATION

The MODULATION menu displays all installed TX modules and allows the user to choose one for more information. All modulation is optional so if you need a CDMA, LTE, WiMAX, UMTS or custom scheme, contact sales@bvsystems.com or call 732-548-3737.

Modulation

```
► TX 1
TX 2
```

RECALL = UP SAVE = DOWN

Modulation TX1

Type: UMTS

```
Scram Group: 1
Scram Pri Code: 2
```

UMTS Modulator Specifications for Tortoise Transmitter

UMTS Release 11

Spread Spectrum Modulation that SIMULATES UMTS Base Station Transmissions

5 MHz Channel Bandwidth

3.84 Mcps Modulating Chip Rate

Pilot signal (P-CPICH) with modifiable scrambling code, (Sdl,n)

10 mSec Radio Frame Data Buffer

25 kHz step size

10 Watt class A power output

Simulated Base Station DownLink with physical channels:

- Cscramb Settable (Sdl,n)

- P-CPICH (Cch,256,0)
 Selectable Gain (G1)

- S-CPICH (Cch,256,n)
 Selectable code number (n)
 Selectable Gain (G2)

- P-CCPCH Pseudo random data
 Selectable code number (n): (Cch,256,n)
 Selectable gain (G3)

- P-SCH Spreading code (PSC)
 Settable gain factor (Gp-SCH)

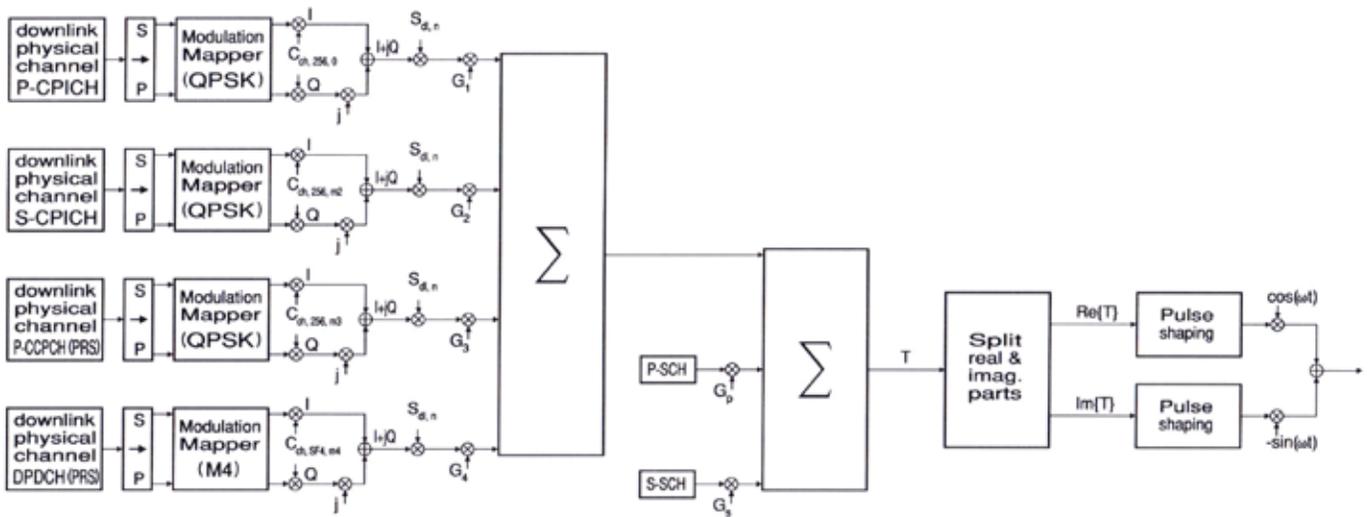
- S-SCH Selectable spreading code (SSC)
 Settable gain factor (Gs-SCH)

- DPDCH Pseudo random data
 Selectable spreading factor (SF)
 Selectable code number (n): (Cch,SF,n)
 Selectable gain (G4)
 Selectable Modulation (QPSK, 16-QAM, 64-QAM)

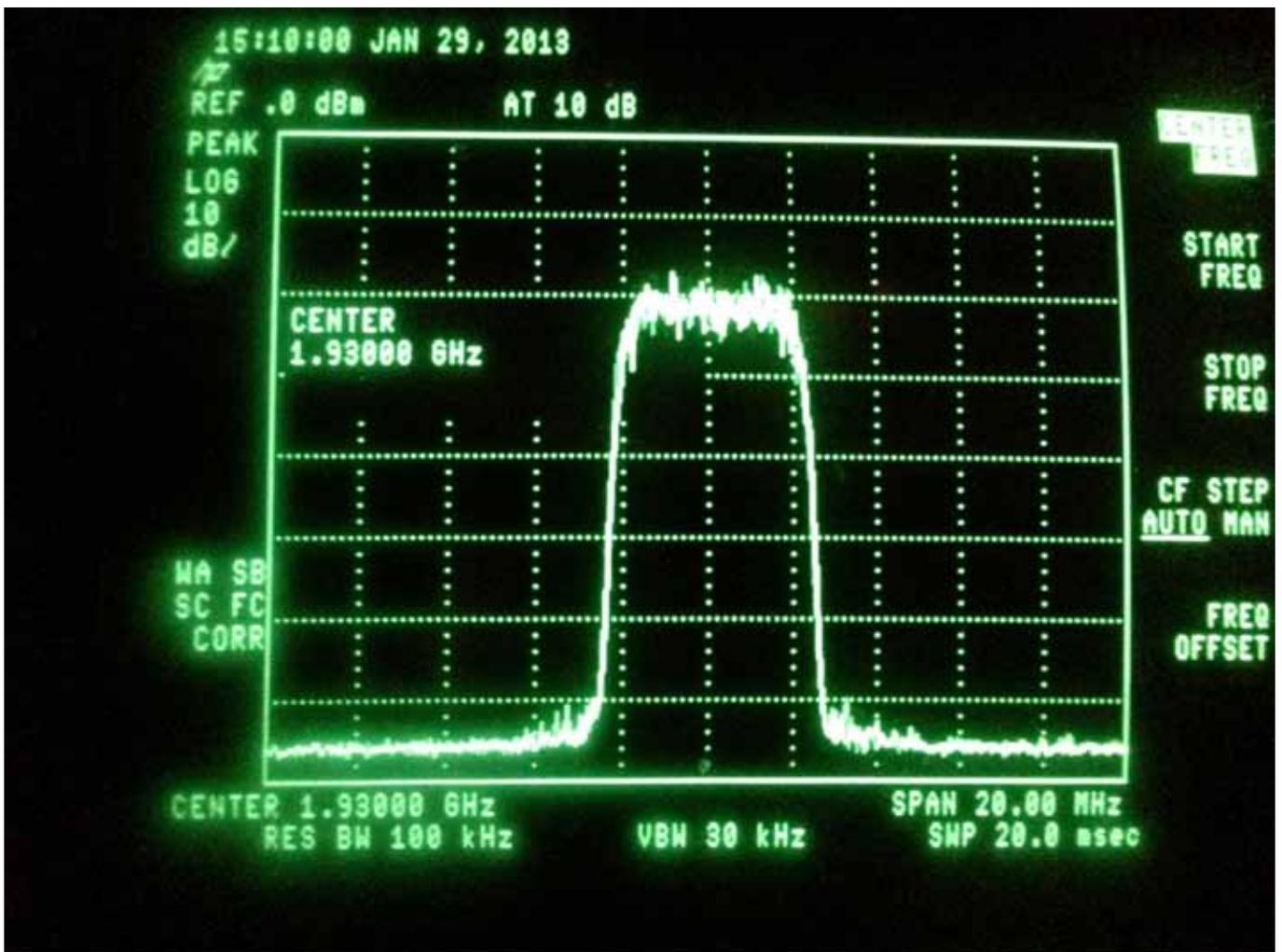
Notes:

- Cscramb Scrambling Code
- P-CPICH Primary Common Pilot Channel
- S-CPICH Secondary Common Pilot Channel
- P-CCPCH Primary Common Control Physical Channel
- P-SCH Primary Synchronization Channel
- S-SCH Secondary Synchronization Channel
- DPDCH Dedicated Physical Data Channel

UMTS Modulated Tortoise Transmitter Channel Structure UMTS Release 11



Note: (PRS) - Pseudo Random Sequence



Typical UMTS Output Spectrum

LTE MODULATION

The MODULATION menu displays all installed TX modules and allows the user to choose one for more information. All modulation is optional so if you need a CDMA, LTE, WiMAX, UMTS or custom scheme, contact sales@bvsystems.com or call 732-548-3737.

```
Modulation
▶ TX 1
  TX 2

RECALL = UP  SAVE = DOWN
```



```
Modulation TX2

Type: LTE

          NID: 0
    Bandwidth: 20.0 MHz
          Mode: FDD
        Ext. CP: NO
TDD Config #: 3
Sp. SF Config: 0
        Data Mod: QPSK
```

LTE Modulator Specifications for Tortoise Transmitter

LTE Release 8

OFDMA Modulator that SIMULATES LTE Base Station Transmissions

Channel band-widths: 20 MHz, 15 MHz, 10 MHz, 5 MHz, 3 MHz and 1.4 MHz

10 mSec Radio Frame Data Buffer

25 kHz step size

10 Watt class A power output

Simulated Base Station DownLink:

Physical Layer Identity (P-SCH)

PHY Layer Cell Identity Group (S-SCH)

PHY Layer Cell Identity

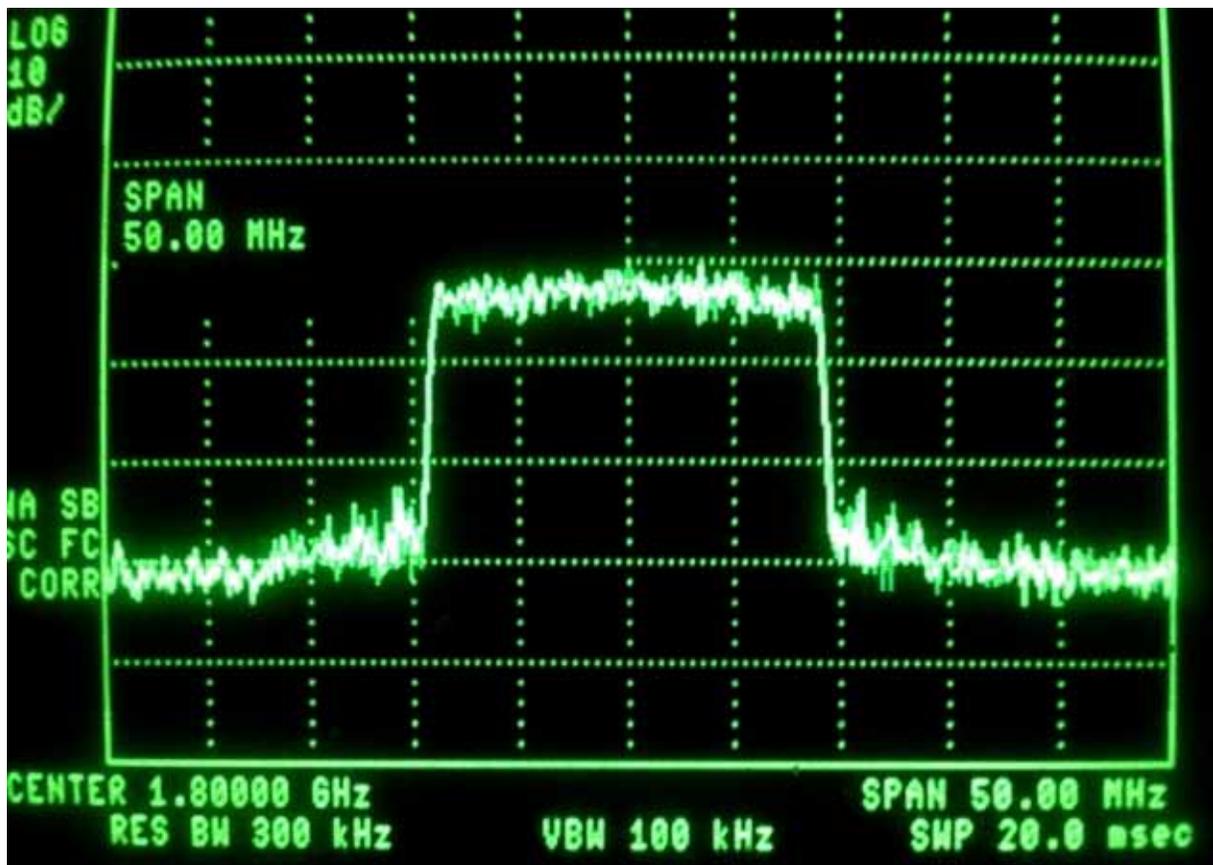
Reference Signal (RS)

FDD/TDD System

TDD Configuration Number

Normal/Extended CP

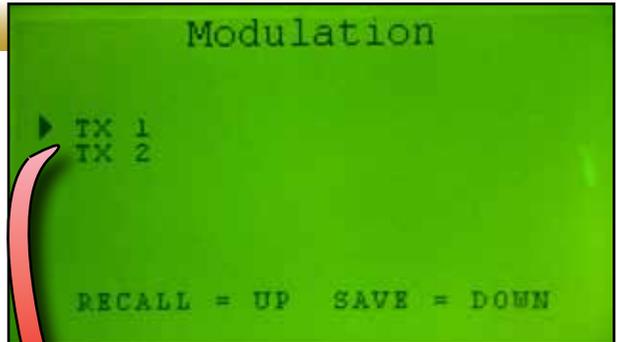
Pseudo Random Modulated OFDMA symbols with selectable modulation: BPSK, QPSK, 16-QAM, 64-QAM



Typical LTE Output Spectrum

CDMA MODULATION

The MODULATION menu displays all installed TX modules and allows the user to choose one for more information. All modulation is optional so if you need a CDMA, LTE, WiMAX, UMTS or custom scheme, contact sales@bvsystems.com or call 732-548-3737.



CDMA Modulator Specifications for Tortoise Transmitter

IS-95 Pilot

CDMA/Spread Spectrum Modulator

Channel band-width: 1.25 MHz

Pilot Frame Data Buffer, 26.66 ms

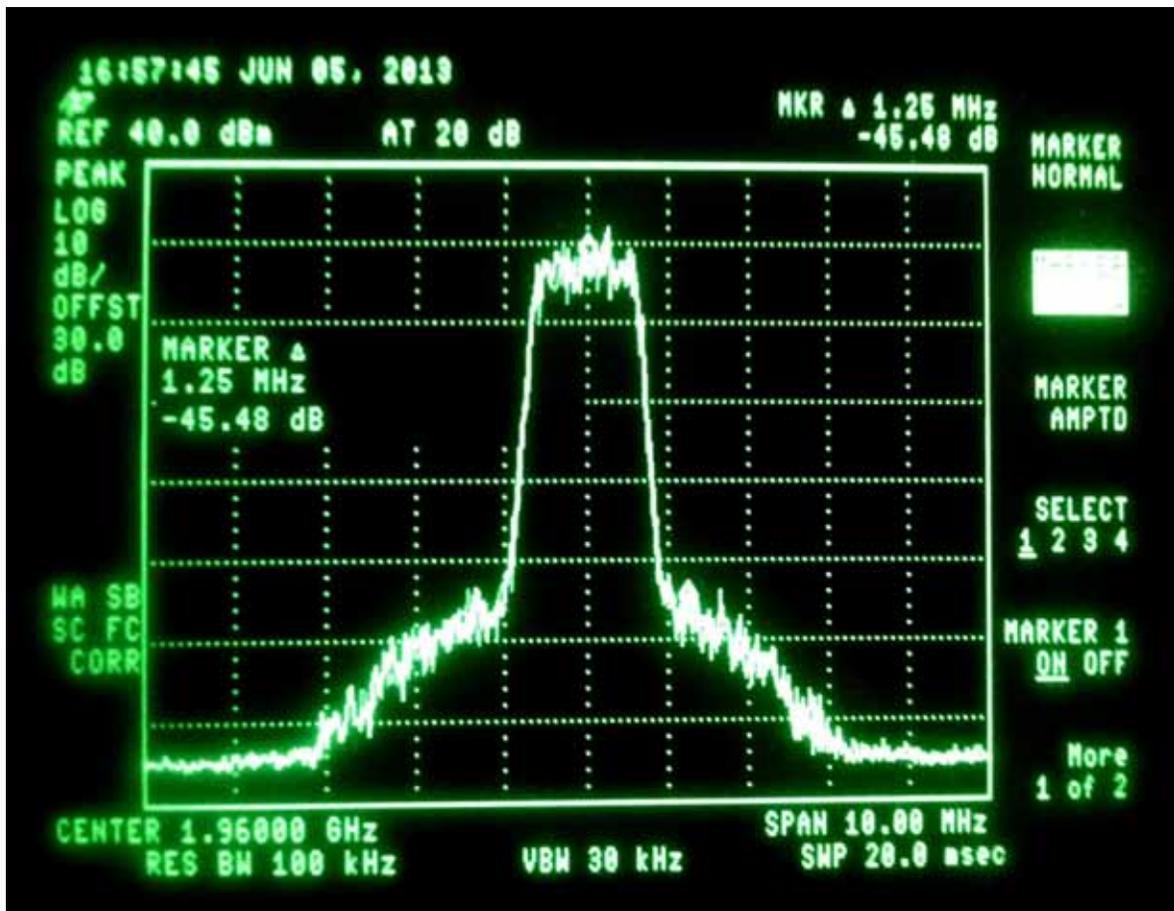
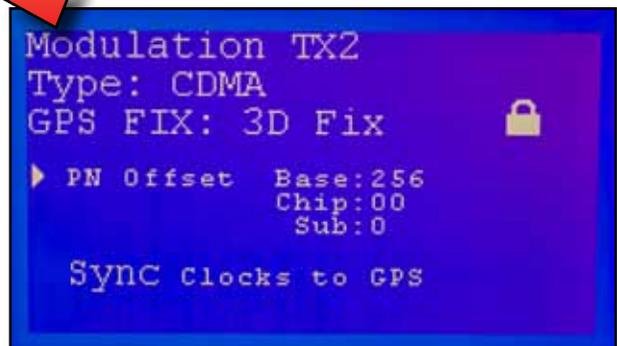
25 kHz step size

10 Watt class A power output

Simulated Base Station DownLink:

Pilot Channel

Base Station Offset



Typical CDMA Output Spectrum

Power Conversion dBm to Watts

	milli
dBm	Watts
26.0	398
26.5	447
27.0	501
27.5	562
28.0	631
28.5	708
29.0	794
29.5	891
30.0	1000
dBm	Watts
30.5	1.12
31.0	1.26
31.5	1.41
32.0	1.58
32.5	1.78
33.0	2.00
33.5	2.24
34.0	2.51
34.5	2.82
35.0	3.16
35.5	3.55
36.0	3.98
36.5	4.47
37.0	5.01
37.5	5.62
38.0	6.31
38.5	7.08
39.0	7.94
39.5	8.91
40.0	10.00
40.5	11.22
41.0	12.59
41.5	14.13
42.0	15.85
42.5	17.78
43.0	19.95
43.5	22.39
44.0	25.11
44.5	28.18
45.0	31.62
45.5	35.48
46.0	39.81
46.5	44.67
47.0	50.12
47.5	56.23
48.0	63.10
48.5	70.79
49.0	79.43
49.5	89.13
50.0	100.00

Return Loss vs. VSWR

Return Loss (dB)	VSWR
32.256	1.05
26.444	1.10
23.127	1.15
20.828	1.20
19.085	1.25
17.690	1.30
16.540	1.35
15.563	1.40
14.719	1.45
13.979	1.50
13.324	1.55
12.736	1.60
12.207	1.65
11.725	1.70
11.285	1.75
10.881	1.80
10.509	1.85
10.163	1.90
9.842	1.95
9.542	2.00
8.999	2.10
8.519	2.20
8.091	2.30
7.707	2.40
7.360	2.50
7.044	2.60
6.755	2.70
6.490	2.80
6.246	2.90
6.021	3.00
5.811	3.10
5.617	3.20
5.435	3.30
5.265	3.40
5.105	3.50

Glossary of Acronyms

AC	Alternating Current
A/D or ADC	Analog to Digital Converter
AGC	Automatic Gain Control
BER	Bit Error Rate
BPSK	Binary Phase Shift Keying
BW	Band Width
CDMA	Code Division Multiple Access - a spread spectrum modulation
DC	Direct Current
D/A	Digital to Analog
dB	deciBel
dBm	deciBels referenced to 1 milliwatt
DOS	Digital Operating System
DSP	Digital Signal Processing
FIR	Finite Impulse Response
GHZ	GigaHertz
GPS	Global Positioning System (satellite based)
GPS diff.	GPS error correction signal which enhances GPS accuracy
IF	Intermediate Frequency
I and Q	In phase and Quadrature
kHz	kiloHertz
LCD	Liquid Crystal Display
LO	Local Oscillator
Mbits	Megabits
MHz	MegaHertz
modem	acronym for modulator/demodulator
PCMCIA	Personal Computer Memory Card International Association
PC	Personal Computer
PCS	Personal Communications Service (1.8 to 2.1 GHz)
PN	Pseudo Noise
QPSK	Quaternary Phase Shift Keying, 4-level PSK
RF	Radio Frequency
RSSI	Receiver Signal Strength Indicator
UTC	Universal Time Code
VAC	Volts Alternating Current
VGA	Video Graphics Array
VSWR	Voltage Standing Wave Ratio
X	horizontal axis
Y	vertical axis

GENERAL SAFETY INSTRUCTIONS

When using your telephone equipment, basic safety precautions should always be followed to reduce the risk of fire, electric shock and injury to persons, including the following:

- 1) Read and understand all instructions.
- 2) Follow all warnings and instructions marked on the product.
- 3) Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
- 4) Do not use this product near water, for example, near a bath tub, wash bowl, kitchen sink, or laundry tub, in a wet basement, or near a swimming pool.
- 5) Do not place this product on an unstable cart, stand, or table. The product may fall, causing serious damage to the product.
- 6) Slots and openings in the cabinet and the back or bottom are provided for ventilation, to protect it from overheating these openings must not be blocked or covered. The openings should never be blocked by placing the product on the bed, sofa, rug or other similar surface. This product should never be placed near or over a radiator or heat register. This product should not be placed in a built-in installation unless proper ventilation is provided.
- 7) This product should be operated only from the type of power source indicated on the appliance. If you are not sure of the type of power supply to your home, consult your dealer or local power company.
- 8) Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.
- 9) Do not overload wall outlets and extension cords as this can result in the risk of fire or electric shock.
- 10) Never push objects of any kind into this product through cabinet slots as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock. Never spill liquid of any kind on the product.
- 11) To reduce the risk of electric shock, do not disassemble this product, but take it to a qualified service facility when some service or repair work is required. Opening or removing covers may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electric shock when the appliance is subsequently used.
- 12) Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
 - A) When the power supply cord or plug is damaged or frayed.
 - B) If liquid has been spilled into the product.
 - C) If the product has been exposed to rain or water.
 - D) If the product does not operate normally by following the operating instructions. Adjust only those controls, that are covered by the operating instructions because improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to normal operation.
 - E) If the product has been dropped or the cabinet has been damaged.
 - F) If the product exhibits a distinct change in performance.
- 13) Avoid using the product during an electrical storm. There may be a remote risk of electric shock from lightning.
- 14) Do not use the telephone to report a gas leak in the vicinity of the leak.

GENERAL INSTALLATION INSTRUCTIONS

1. Never install telephone wiring during a lightning storm.

2. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
3. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
4. Use caution when installing or modifying telephone lines.

GENERAL INSTRUCTION FOR BATTERIES

CAUTION: To Reduce the Risk of Fire or Injury to Persons, Read and Follow these Instructions:

1. Use only the type and size of batteries mentioned in owner's manual.
2. Do not dispose of the batteries in a fire. The cells may explode. Check with local codes for possible special disposal instructions.
3. Do not open or mutilate the batteries. Released electrolyte is corrosive and may cause damage to the eyes or skin. It may be toxic if swallowed.
4. Exercise care in handling batteries in order not to short the battery with conducting materials such as rings, bracelets, and keys. The battery or conductor may overheat and cause burns.
5. Do not attempt to recharge the batteries provided with or identified for use with this product. The batteries may leak corrosive electrolyte or explode.
6. Do not attempt to rejuvenate the batteries provided with or identified for use with this product by heating them. Sudden release of the battery electrolyte may occur causing burns or irritation to eyes or skin.
7. When replacing batteries, all batteries should be replaced at the same time. Mixing fresh and discharged batteries could increase internal cell pressure and rupture the discharged batteries. (Applies to products employing more than one separately replaceable primary battery.)
8. When inserting batteries into this product, the proper polarity or direction must be observed. Reverse insertion of batteries can cause charging, and that may result in leakage or explosion. (Applies to product employing more than one separately replaceable primary battery.)
9. Remove the batteries from this product if the product will not be used for a long period of time (several months or more) since during this time the battery could leak in the product.
10. Discard "dead" batteries as soon as possible since "dead" batteries are more likely to leak in a product.
11. Do not store this product, or the batteries provided with or identified for use with this product, in high-temperature areas. Batteries that are stored in a freezer or refrigerator for the purpose of extending shelf life should be protected from condensation during storage and defrosting. Batteries should be stabilized at room temperature prior to use after cold storage.

BVS Tortoise Transmitter Windows Software User Manual

Software Installation for the BVS Tortoise Transmitter

To install the software for the Transmitter, choose the setup file in the transmitter directory of the SD card. Setup will guide you through installation of the software. If a previous version has been installed, it must be removed prior to installation of the new version.

USB Driver Installation for the BVS Tortoise Transmitter

Installation of the USB driver for the BVS Tortoise Transmitter can be accomplished in one of two different ways.

1. Connect to the transmitter via USB.
2. Power on the transmitter using the toggle switch located above the power cord.
3. A message may pop up stating that you are connected to a BVS Tortoise.
4. If you are requested to choose a driver, simply browse the computer and find the USB driver folder on the supplied SD card.
5. Installation should then automatically proceed.

UPDATING DRIVER

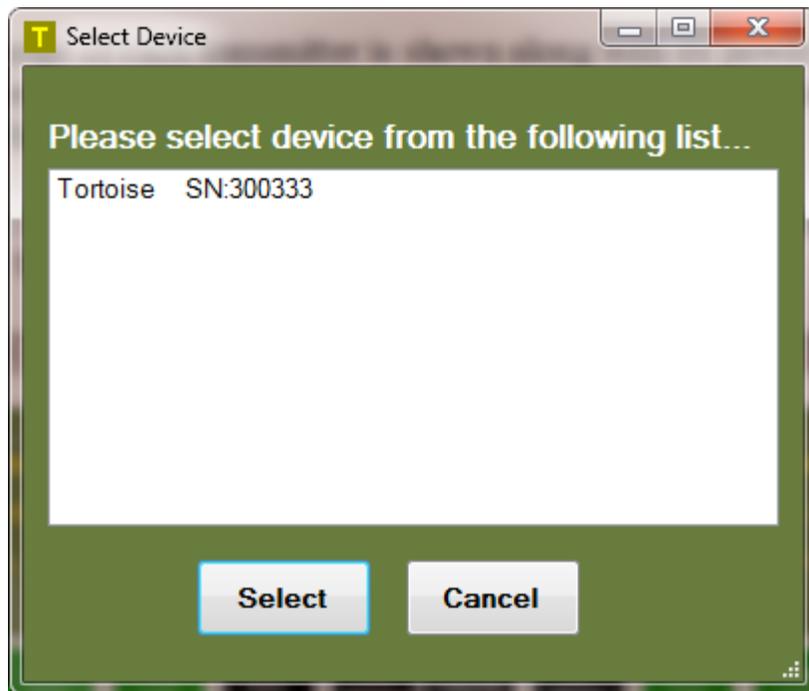
Sometimes you will not be prompted for the driver. In this instance, please follow the below instructions.

1. Open up the Control Panel. (START button in lower left hand corner followed by clicking on the Control Panel.
2. Click on Hardware and Sound.
3. Click on Devices and Printers.
4. Find the icon for the “BVS Tortoise”.
5. Right-click on the icon and choose properties.
6. Choose the hardware tab.
7. Choose “Properties”.
8. Choose “Change Settings”.
9. Choose the driver tab.
10. Click on “Update Driver”.
11. Choose to browse for the driver.
12. Select the folder on the SD card supplied with the unit.

13. Installation should then automatically proceed.

Getting Started

Connect the USB cable to the transmitter and to the PC. Power on the transmitter box with the switch provided on the top panel of the unit. Start the PC software.



Connection Dialog Box

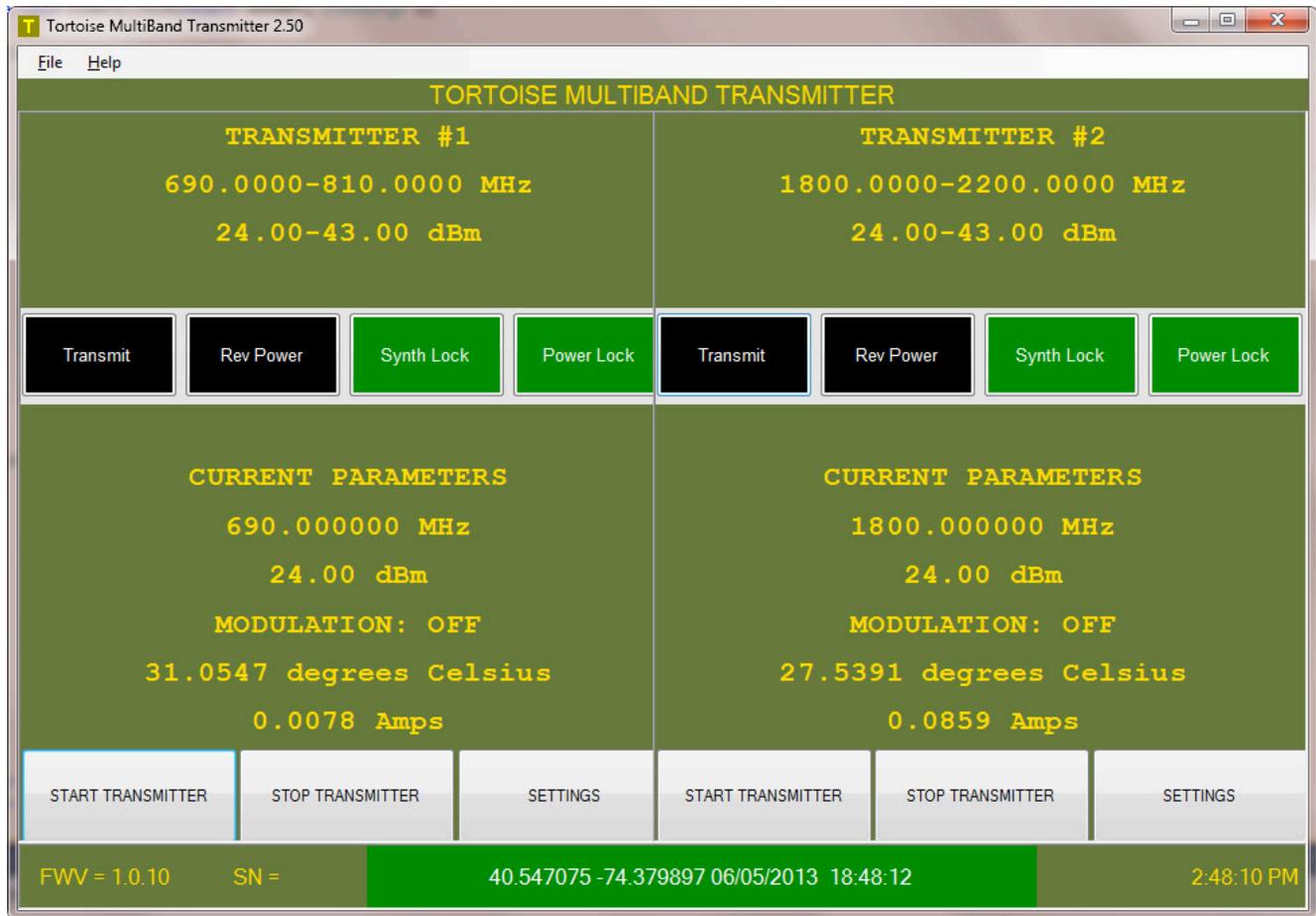
A connection box will appear showing the transmitter to which the software can see and make a connection. Choose the transmitter device. Then simply press the “SELECT” button to connect to the selected transmitters.

Main Window Tour

The main window of the transmitter application is straightforward. The left panel contains information about transmitter #1 and the right panel contains information about transmitter #2 (if installed).

The frequency range of each transmitter is shown along with its power range in dBm. Below this is a series of 4 information lights. The first is the transmit indicator. This will be lit whenever the transmitter is transmitting.

The second light is the reverse power indicator. This will be lit if the transmitter senses too much power being reflected back into the antenna connection.



Transmitter Main Screen

The third light indicates whether or not the synthesizer is locked for the individual transmitter. The fourth light indicates whether or not there is a power lock.

Below the light indicators are the current parameters for the transmitters. The current frequency set is shown followed by the current power level when transmitting. Whether or not the transmitted signal is modulated is shown followed by the current internal temperature in Celsius and the current in Amps.

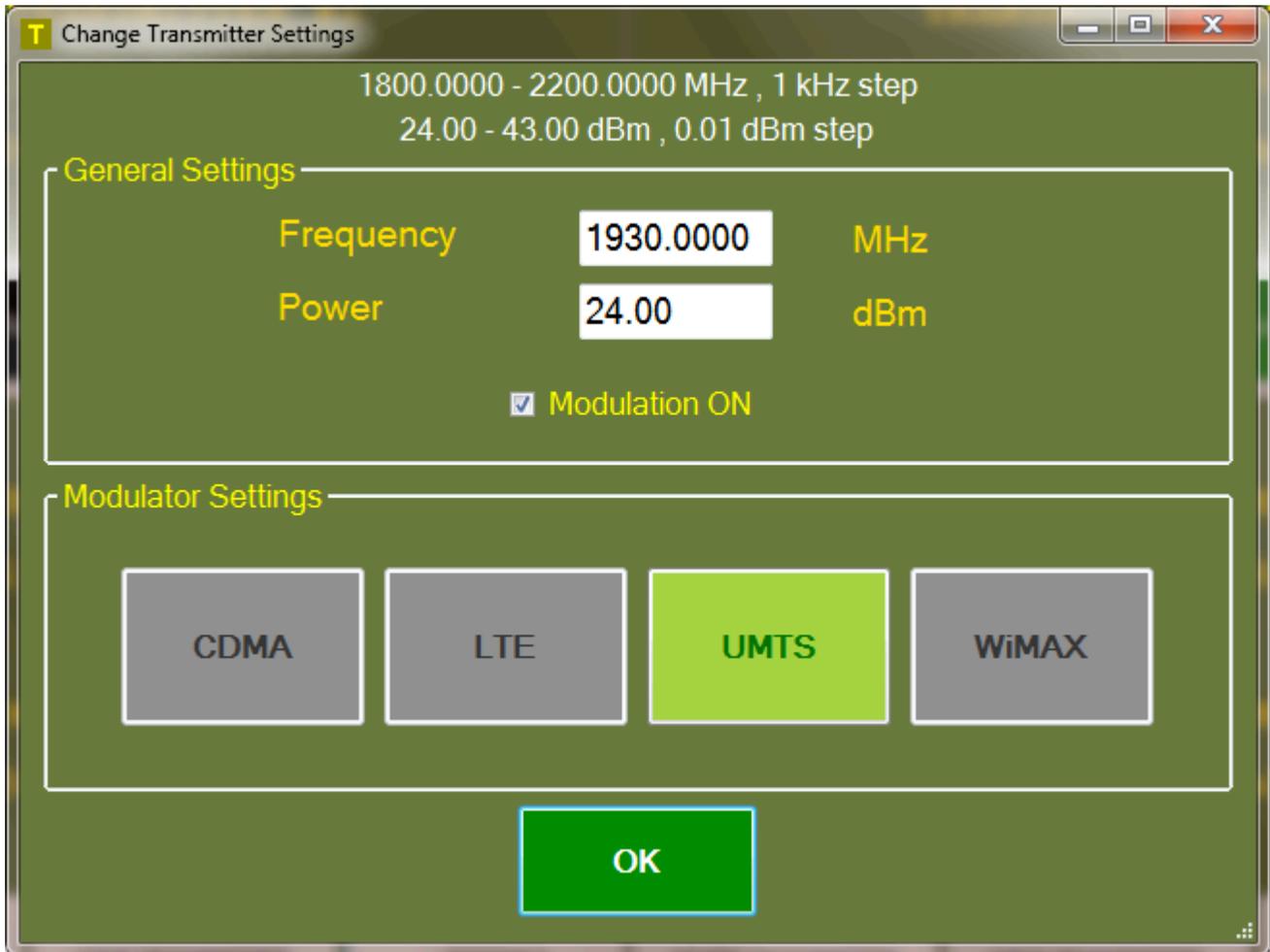
Below the current parameters are buttons to start the transmission and stop the transmission. There is also a button to pull up the settings dialog where the current settings can be changed.

Finally, the bottom status bar shows the firmware and serial number of the unit.

The current system time is also shown on the bottom status bar.

Transmitter Settings

Pressing the transmitter settings button produces the transmitter setting dialog screen. In this screen the frequency and power of the transmitter can be set.



Transmitter Setting Screen

The modulation for the transmitter (if installed) can be enabled or disabled by setting the checkbox for modulation.

There is also a modulator settings box. If the particular transmitter has a modulator, the appropriate button will be lit (CDMA , LTE , UMTS, or WiMAX). Clicking on the lit button will open up a modulator settings dialog. The different modulator settings screen are described in the following sections.

Press "OK" to update the settings.

UMTS Modulator Settings

	<u>GAIN</u>	<u>CHANNEL</u>	<u>SF</u>	<u>MODULATION TYPE</u>
P_CPICH	1.00	0	256	
S_CPICH	0.50	1	256	
P_CCPCH	0.50	100	256	
DPDCH	1.00	26	128	64-QAM
P-SCH - PSC CODE	0.50	0	256	
S-SCH - SSC CODE	0.50	0	256	

P_CPICH Primary Common Pilot Channel
S_CPICH Secondary Common Pilot Channel
P_CCPCH Primary Common Control Physical Channel
P-SCH - PSC CODE Primary Synchronization Channel / Primary Sync Code
S-SCH - SSC CODE Secondary Synchronization Channel / Secondary Sync Code
DPDCH Dedicated Physical Data Channel

SAVE SETTINGS CANCEL

UMTS Modulator Settings Screen

The settings screen for UMTS contains gain settings for six different UMTS channels. Set the gains to the power ratio desired. Set a channel to 0 if it is not to be turned on.

This screen also contains settings for the scram code group and the primary scram code, as well as the ability to set the channel number for three of the channels.

The DPDCH “Dedicated Physical Data Channel” has settings for SF and the modulation type.

After choosing the settings, press “Save Settings”. The new data will be created. A wait message will appear for about 10 seconds. This dialog can now be closed and the frequency and power screen will reappear.

LTE Modulator Settings

NID	0
BANDWIDTH	10.0 MHz
MODE	FDD
EXTENDED CP	Normal CP
TDD CONFIG #	3
SPECIAL SUBFRAME CONFIGURATION	0
DATA MODULATION	QPSK

SAVE SETTINGS **CANCEL**

LTE Modulator Settings Screen

The settings screen for LTE contains settings for the NID, bandwidth, TDD or FDD, Extended or Normal CP, TDD configuration number, special subframe configuration, and the data modulation type.

After choosing the settings, press “Save Settings”. The new data will be created (may take a second or two). This dialog can now be closed and the frequency and power screen will reappear.

CDMA Modulator Settings



CDMA Modulator Settings Screen

In the CDMA settings screen, there are parameters for the PN offset (with a range of 0 - 511), and the chip offset (from 0 - 63). There is also an entry for 1/4 chip offset from 0 to 3.

Adjust these numbers as desired, then press the "SAVE SETTINGS" button. This will send the new parameters to the transmitter. Then, when it is shown that the GPS receiver is locked (from the GPS Status field), press the "SYNC to PPS" button. This will synchronize the clocks to the GPS pulse per second.

A message box will appear showing the clocks have been synchronized. Then simply close the dialog box.