

**Primex Wireless**  
*XR Transmitter*

## **XR Transmitter with Attached Antenna Operations Manual**

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## 1. INTRODUCTION

### 1.1 Purpose

This manual documents the overall operations of the new XR synchronized clock transmitter system.

### 1.2 FCC Information and Requirements

#### 1.2.1 Compliance Statement (Part 15.19)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

#### 1.2.2 Warning (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

#### 1.2.3 Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

#### 1.2.4 FCC Caution Statement

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

#### 1.2.5 FCC License Requirements

Operation of the XR transmitter requires an FCC operating license which must be applied for by the operator of the equipment. The XR models with attached whip antennae require a mobile license. Prior to operating the XR transmitter, an application must be filed with the FCC and a license granted from the FCC. The filing and receipt of the FCC license should be complete before the transmitter is delivered whenever possible. Please contact Technical Support at 1-800-404-8112 if you have any questions about licensing.

#### 1.2.6 FCC Part 90 Statement

To comply with FCC's RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

## 1.3 Canada IC Information and Requirements

### 1.3.1 RSS-119 Statement

To comply with Industry Canada's RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

### 1.3.2 Industry Canada Statement per Section 4.0 of RSP-100

The term "IC:" before the certification / registration number only signifies that the Industry Canada technical specifications were met.

### 1.3.3 Section 7.1.5 of RSS-GEN

Operation is subject to the following two conditions:

- 1) this device may not cause harmful interference, and
- 2) this device must accept any interference received, including interference that may cause undesired operation.

### 1.3.4 Section 7.1.4 of RSS-GEN

This device has been designed to operate with an antenna having a maximum gain of 0dB. Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms."

### 1.3.5 Section 7.1.5 of RSS-GEN

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that required for successful communication.

### 1.3.6 Section 2.6 of RSS-102

This portable transmitter with its antenna complies with Industry Canada RF Exposure Limits for General Population / Uncontrolled Exposure.

## 1.4 Safety Precautions

It is recommended that standard acceptance procedures be followed prior to operating the transmitter in the proximity of life support systems or critical safety systems. Only the power supply delivered with the transmitter should be used with the transmitter. The usage of other power supplies is not approved and may affect the transmitter's operation. The transmitter is designed for indoor use in a non-condensing, non-wet area. Operating the XR transmitter outdoors is an electrical hazard and may damage the transmitter and devices attached to the transmitter, and may void the warranty. Personnel should not come within 20cm of the attached antenna when the transmitter is operating.

## 1.5 Equipment Precautions

To avoid possible damage to the XR transmitter, never operate the transmitter without the antenna connected first. Power must not be applied without first ensuring that the antenna is connected.

Operating an XR transmitter without the antenna connected can permanently damage the transmitter. Avoid touching the antenna when the antenna is installed on the transmitter. Do not touch the antenna connector on the top of the enclosure before the antenna is attached. Altering the antenna is prohibited by FCC regulations. FCC also requires that the antenna be attached to the case (for attached antennae versions) and that the antenna is vertical with respect to the earth.

Do not remove the cover of the transmitter or alter the internal electronics of the transmitter in any manner. This could lead to an unsafe condition, a violation of FCC regulations, and a transmitter that doesn't function, or void the warranty.

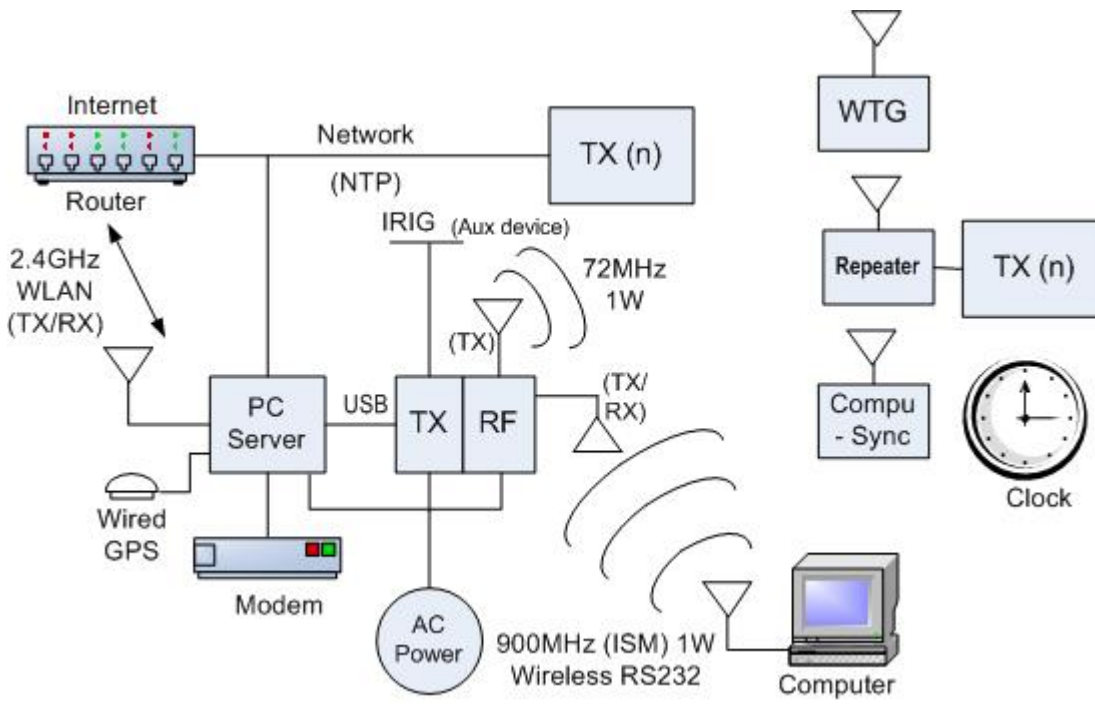
## 1.6 General Overview

This product is an enhancement of our existing 14000 Master Transmitter with GPS receiver. A basic pictorial is provided below of our new transmitter

### Acronyms:

- Compusync – NTP server for remote networks
- GPS – Global Positioning System. Precise satellite time source.
- GMT – Greenwich Mean Time, previous standard 0 time zone set at longitude = 0 also know as the prime or Greenwich meridian. This has been replaced by UTC.
- IRIG = Inter-Range Instrumentation Group, a set of time code formats and standards
- NTP – Network Time Protocol.
- RF – Radio Frequency
- RX – Receive.
- TX – Transmit or Transmitter (referring to our XR Transmitter)
- UTC – Universal Coordinated Time, a.k.a. Coordinated Universal Time. Replaces the previous GMT standard.
- WTG = Wireless Tone Generator

**Figure 1 XR System (Server is Optional):**



## 2. XR TRANSMITTER PRODUCT OPERATION

### 2.1 XR Hardware Definitions

#### 2.1.1 Back Panel Picture

This is a picture of the back panel label that shows the input connector positions and control switch positions described in sections 2.1.3 and 2.1.4.



Figure 2 – Rear Panel of XR Transmitter

#### 2.1.2 Front Panel Picture

This is a picture of the front panel that is defined section 2.3.2.



Figure 3 – Front Panel of XR Transmitter After Time Synchronization

#### 2.1.3 Overall Picture of the XR Transmitter

This a picture of the transmitter which shows the whip antenna attached to the NMO mount on the case top.



Figure 4 – Overall Picture of XR Transmitter Showing the NMO Antenna Mounted

### 2.1.4 Connector and Peripheral Definition

<b>Figure 5 - External Hardware Connections RF Board based</b>		
<b>Connector</b>	<b>Description</b>	<b>Connector type</b>
GPS IN	Input from GPS receiver	7 pin mini-DIN
NETWORK LAN	Network connection, connects to Lantronix serial port internally. This is a population option with the next connector.	RJ45
WIRELESS NETWORK ANTENNA	Wireless bulkhead antenna mount. This a population option with the previous connector.	SMA
SCHEDULER	Com 1/Auxiliary Port/Scheduler Programming	RS232 DB9 Fem.
GPS OUT	Serial port with 1PPS to drive NTP input for the server	RS232 DB9 Male
SERVER CONNECT	USB 2.0	USB Type B device connector
BASEBAND / MONITOR	Serial JTAG in for programming the micro; input line for monitoring a high power amp RF power; input line for monitoring VSWR on a high power RF amp (neither used in this model); non-inverted baseband output – a digital output of the pre-modulated baseband for external systems	9 pin Mini-DIN socket
TX RF	Main RF Output, found on top of the enclosure for this model	NMO antenna mount
Power	Connector from wall supply. DC output is 9V at 2.7A	Two prong AC, DC is 2.5 mm pin size
EXTERNAL ANTENNA	Not populated for this model, when populated, the TX RF NMO antenna mount on top is depopulated	N-Type Bulk-head

All connections are intended to be industry standard but differentiated such that user error is minimized. All connections are on the rear panel. Note – due to I/O limitations on the microprocessor, the Lantronix Serial port, the USB port, and the Aux/Com 1 port are shared so you can connect through only one of those three connectors at a time.

To select the Lantronix RJ45 as the input, you must flip the Network DIP switch to the “LAN” position. This option is selected if the transmitter must talk to a remote server.

To connect to the USB or Aux/Com 1 port, you must flip that switch to the “Local” position. This option is selected if the transmitter will run stand-alone, or connected to a local server through the USB port.

When the switch is in the “Local” position, the USB dominates because the transmitter will detect the power voltage and automatically switch the internal connection to the USB port, so if the transmitter is connected to a server locally through the USB connection, the Aux/COM 1 port is deactivated. If a standard RS232 cable is plugged into the Aux/Com 1 port, that port then is the input, as long as the switch is in the “Local” position and there is no USB cable attached.

<b>Figure 6 - Control Inputs</b>		
<b>Input</b>	<b>Description</b>	<b>Interface type</b>
Channel Number	Select RF Operating Frequency	X2 Rotary BCD Switches with shaft and knob
Time Zone	Needed to adjust for 24 time zone offsets	Rotary Hex switch with screwdriver activated knob
GPS/NTP	Used to switch time source from the GPS to the Lantronix module port 2 SNTP connection, which allows the transmitter to synchronize with an NTP time server on it's network	Dip Switch
LOCAL / LAN	LAN or Local (Local means a serial connection to the SERVER CONNECT or SCHEDULER connector)	Dip Switch
AUX 3	Not currently assigned	Dip Switch
AUX 4	Not currently assigned	Dip Switch
OFF/-30M	½ hour offset for some countries when in the -30M position	Dip Switch
-UTC/+UTC	-UTC = Time Zone is subtracted from UTC. +UTC = Time Zone is added to UTC.	Dip Switch
DST/ST	DST = DST enabled. ST = Standard Time or DST disabled.	Dip Switch
12H/24 H	Output time in 12/24 hour format	Dip Switch
Diagnostics and configuration	Menu Driven Status	5 button tactile dome switches and LCDs for display – On Membrane

Note - default positions for the dip switches are all down and are:

1. GPS/NTP = GPS.
2. LAN/LOCAL = Local (through the USB or serial port DB9).
3. No ½ hour offset (-30M set to OFF).
4. -UTC offset.
5. DST/ST = DST enabled.
6. 12H/24H = 12 hour format.



## 2.2 XR Transmitter Set Up

### 2.2.1 General Set Up Considerations

The XR transmitter should be located in an area that maximizes the propagation of the signal to the largest area in the facility. The FCC license needs to be applied for and granted before the equipment can be set up and operated. The channel switch setting on the back of the transmitter must match the channel authorized by the license.

Set the transmitter on the supplied shelf, if purchased, or on another rack or mounting device as desired. If the rack mount option is used and the transmitter is mounted in a rack, the transmitter must be on the top of the rack and the rack must not have a top cover or it will interfere with the operation of the transmitter.

For better transmission it is recommended that the XR transmitter be located a minimum of 3 feet above the floor and away from large metal objects, such as lockers, cabinets, ladders, power distribution panels, communications or computer racks, metal or shielded walls, etc. The antenna radiates in a circular pattern, therefore the coverage for an area will be better when the transmitter is more centrally located than when the transmitter is in the corner of a building. In a multi-story building, locating the transmitter nearer to the top of the building often gives the best coverage.

### 2.2.2 Hardware Set up

Prior to plugging the supply into the wall outlet and the jack into the back of the transmitter, the following set up steps must be performed:

1. Connect the 46" whip antenna to the top of the XR transmitter on the NMO antenna mount. Be very careful to start the antenna base square and not to cross-thread the antenna base onto the connector. When connected properly, the antenna base will seat flat against the transmitter case top.
2. Set up the time synchronization input for the transmitter to one of the following options:
  - a. If this is a GPS synchronized master transmitter, install the GPS receiver outside using the supplied mounting hardware, or in a window near the transmitter if the GPS will not be mounted outside. The GPS receiver should have a full view of the sky whenever possible to get the best signal and the quickest synchronization time possible. **NOTE – the GPS receiver will not receive a signal through Low E Glass.** Make sure the NTP/GPS switch on the back of the XR transmitter is in the GPS position. The 7-Pin MiniDIN connector from the GPS receiver or extension cables must be plugged into the GPS IN connector on the back of the XR transmitter.
  - b. If this is a satellite transmitter synchronized by a repeater, mount the repeater on the wall as far away from the transmitter as possible. The transmitter/repeater combination should be located within receiving distance of the master transmitter. You can determine if the repeater is receiving the signal if the master GPS transmitter is broadcasting by powering up the repeater. After approximately 20 seconds, the green LED on the repeater should be flashing indicating that it received the signal from the master GPS transmitter. Make sure the NTP/GPS switch on the back of the XR transmitter is in the GPS position. The serial cable from the repeater must be plugged into the GPS IN connector on the back of the XR transmitter.
  - c. If this is a network synchronized transmitter with a wired network connection, you need only connect the supplied CAT 5 patch cable to the NETWORK LAN connector on the back of the transmitter and then to the RJ45 wall jack that was set up for the transmitter's network connection. Make sure the NTP/GPS switch on the back of the XR transmitter is in the LAN position.
  - d. If this is a network synchronized transmitter with a wireless connection, you need to make sure that there is a wireless access point within receiving distance of the XR transmitter. Make sure the NTP/GPS switch on the back of the XR transmitter is in the LAN position.

- 
- e. If this transmitter is to be locally connected to an XR server, the CAT 5 cable from the server must be plugged into the NETWORK LAN CONNECTOR on the back of the transmitter. Make sure the NTP/GPS switch on the back of the XR transmitter is in the LAN position.
3. Set up the communications configuration:
    - a. If this is a standalone transmitter with no network connection, set the LAN/LOCAL switch to LOCAL.
    - b. If this transmitter has a network connection, wired or wireless, and the scheduling and other communications will be done via the network connection, then set the LAN/LOCAL switch to LAN.
  4. Make sure the rotary CHANNEL NUMBER switches are set to the channel number that is authorized for this transmitter by the FCC license.
  5. Set Up the remaining switches to match your locale and desired set up for time calculations:
    - a. The TIME ZONE switch should be set to the time zone offset for the locale.
    - b. The -30M/OFF switch should normally be in the OFF position unless you want a -30 minute offset calculation to the time.
    - c. The UTC+/UTC- switch should be set as follows:
      - i. The UTC+ position is for time zones east of the prime meridian and west of International Date Line.
      - ii. The UTC – position is for time zones west of the prim meridian and east pf the International Date Line.
    - d. The ST/DST switch should be set to the ST position if you are in a locale that does not follow standard USA Daylight Savings Time practices and to the DST position if you’re in a locale that does follow standard USA Daylight Savings Time Practices.
    - e. The 24H/12H switch should be set to the 24H position if you want to see time in the 24 hour military time format and to the 12H position if you want to see time in the 12 hour time format with AM and PM indicators.
    - f. Example for an XR transmitter set up in the Central Time Zone with DST enable in 12 hour format would be:
      - i. The TIME ZONE switch set to 6 since Central time is UTC -6.
      - ii. The -30M/OFF switch is set to OFF (down).
      - iii. The UTC+/UTC- switch is set to UTC- (down).
      - iv. The ST/DST is set to DST (down).
      - v. The 24H/12H switch is set to 12h (down).
  6. Plug the supplied AC adaptor into a 120VAC outlet, then plug the DC output jack into the POWER connector on the back of the transmitter.

Set up is complete.

## 2.3 XR Transmitter Operation

### 2.3.1 Scope

This manual defines the operation of the XR transmitter with case-attached whip antenna. It does not include the operation of the following:

- High power transmitters or transmitters with external antennae.
- Clocks, timers, repeaters, or switches.
- The XR server or any of its software.
  - The network connection process for the transmitter to the server.
- The Compusync switch or software.
- The Scheduler software for bell schedules or transmitter intermittent operation schedules.

### 2.3.2 Power Up Sequence and the Front Panel

Once power is applied, the three LEDs on the front panel shown in Figure 3 in Section 2.1.2 will all light up for approximately two seconds. After that, they will operate as follows:

- Green LED.
  - Off when the transmitter is waiting to be synchronized or the output power amplifier has failed.
  - On when the transmitter is broadcasting.
  - Off when the transmitter was in a blinking green situation and power is cycled.
  - Flashing when the transmitter is disabled by the server or an internal schedule for intermittent operation
- Yellow LED.
  - Off means the transmitter is synchronized with a time source correctly.
  - Flashes when the XR transmitter has not received valid GPS, Repeater, or NTP time for 48 hours or at initial power up until synchronization occurs.
- Red LED.
  - Off means there are no errors recorded in the internal error log.
  - Flashing means there is an error recorded in the internal error log. Errors can be viewed in the error logs by following the instructions in Section 2.3.2 under Menu 1 for Diagnostic Error Codes.

After power is applied the LCD screen on the front panel of the XR transmitter will light up. The display will look different depending on the start up conditions:

- If the XR transmitter has not recently been powered up, the time will start at 00:00:00 if in the 24 hour mode or at 12:00:00 am if in 12 hour mode and there will be no parentheses to the right of the GPS tower symbol which indicate that the transmitter is synchronized and the green LED will be off indicating that the transmitter is not broadcasting.
- If the XR transmitter was recently powered up, within the last 8 hours, the internal battery back up clock will set the time immediately, and the LCD will come up with the correct time and date, there will be parentheses to the right of the GPS tower symbol, and the green LED will be ON, indicating the transmitter is broadcasting.
- If the XR transmitter is hooked up to a repeater, the GPS tower symbol will be replaced by an “R”.
- If the XR transmitter is loaded with a transmitter intermittent operation schedule and during this time period the transmitter is scheduled to be disabled, then even if the transmitter is synchronized, the green LED will be flashing, indicating that the transmitter power output is good but is not currently broadcasting.

- If an error condition has occurred (the Red LED is flashing) the bottom line will have a scrolling error message instructing the operator to look at the diagnostic menus or to call Technical Support.

### 2.3.3 Detailed Panel and Menu Operation

#### Normal Display – 2 rows of text:

1. Time (HH:MM:SS format) – am or pm on display if in 12 hour format
2. Date (Day of week, month, and year format)
3. Standard time (ST) or Daylight savings time (DT)
4. Time zone (P for Pacific, M for Mountain, C for Central, E for Eastern). Display would read CST for Central Standard Time and CDT for Central Daylight Savings Time.
5. Antenna symbol when connected to GPS or an R displayed when connected to a repeater
6. Parenthesis when receiving time data
7. Channel #
8. Version #
9. LP when output power is low
10. Any error that causes a flashing Led will pop this message into the bottom line: “Call Tech Support 1-800-404-8112 or Use Diagnostic Error Codes Menu”. This message can be on two lines and flip between the two lines at 5 second intervals.

#### Navigation Buttons:

- Pressing right arrow button of keypad while in normal display mode opens main menu.
- Pressing the right arrow advances to the next level down of menu.
- ← Pressing the left arrow backs out of the menus one level at a time.
- ↑ ↓ Pressing the up and down arrows allows up and down scrolling within a menu.
- ENTER Pressing the Enter button while in a menu acts as the Enter button, selecting an option.

#### Main menu:

2 rows of text including any sub-menu. Can be laid out with more than one menu item on a line if it fits and the text is understandable. For menus with more than two lines, scrolling up and down will be used to navigate.

1. Whenever a change is being made to a variable, a dialog will open asking yes or no. If the user selects Yes, the change is made. If no is selected, the menu goes back to its previous location.
2. After inactivity, the menu times out and returns to normal display.
3. Transmitter operation does not stop when navigating through main menu.
4. All values within a menu are dynamically updated when switch settings are changed or conditions change.

#### Panel Menus:

1. Diagnostic Error Codes
  - a. Bad output power (will show BCD value in dB here)
    - i. Clear Error
      1. Yes or NO confirmation after clearing.
  - b. PLL Diagnostics
    - i. Clear Error
      1. Yes or NO
  - c. No GPS or Repeater connected
    - i. Clear Error
      1. Yes or NO
  - d. No GPS in 48 Hours
    - i. Clear Error
      1. Yes or NO
  - e. VSWR Errors (enabled only for high power versions, not this version)
    - i. Clear Error
      1. Yes or NO
2. Switch Settings – displays the switch position for the following switches
  - a. Channel
  - b. Time Zone

- c. DST Switch (same as the ST/DST switch)
  - d. 12/24 Hour Format (same as the 24H/12H switch)
  - e. GMT Offset (same as the UTC+/UTC- switch)
  - h. LAN/LOCAL
  - i. NTP/GPS
- 3. Diagnostics
    - a. Firmware Rev
    - b. Time Since Last GPS
    - c. Hardware Revi
    - d. GPS/Repeater
    - e. Last Rptr Update
    - f. Serial Number
    - g. MAC Address
  - 4. GPS Setup
    - a. Garmin GPS 16 Garmin GPS 18
    - b. TBD 1
    - c. TBD 2
    - d. TBD 3
    - e. TBD 4
  - 5. Tech support info
    - a. 1-800-404-8112
    - b. techsupport@primexwireless.com

**Diagnostic Error Codes:**

- 1. When an error occurs, a Diagnostic Code red LED on the front of the panel flashes, informing the user of an error, along with the error message on the second line of the normal display. They will then have to go into the main menu, then the diagnostic menu to determine the error code. The different error codes that are active will be shown by highlighting the menu item such as different color, flashing, check mark, or some other obvious means. Give us some feedback as to the easiest method of highlighting.
- 2. The first 10 of each type of error will be stored in the TX, along with a time and date stamp for each of these errors.
- 3. The TX will transmit each occurrence of an error to the server as it occurs, with a time/date stamp.
- 4. Errors and the error LED can be cleared by selecting individual errors and clearing them (with yes or no confirmation as to if they really want to clear the error)

**Other LEDs:**

- 1. Full output power (green LED lights up when transmitting correctly). This light flashes when the power amplifier disabled by the repeater or by a transmitter OFF command or by a transmitter on/off schedule.
- 2. No receiver GPS or repeater (flashing yellow after 2 days of no receipt).

### 3. PRODUCT SPECIFICATIONS

#### Parameter

#### Specification

Frequency Range	72.02 to 75.98 MHz
Transmission Range	1 mile open field
Radio Technology	Narrowband FM
Modulation	FSK
Number of Channels	50 Mobile under Part 90.35 48 Fixed under Part 90.257(a)
Channel Bandwidth	20KHz
Transmission Mode	Simplex
Data Rate	2KBPS
Data Protocol/Duty Cycle	Manchester
Operating Temperature	0° C to 70° C non-condensing environment
Transmitter Output Power	+30dBm (1 Watt)
Frequency Deviation	3KHz
Carrier Frequency Stability	+/- 5ppm
Transmitter Wall Adaptor Power Requirements	120VAC @ 60Hz
Internal DC Power Requirements	9VDC
Antenna Type	Transmitter Case-Mounted Commercial ¼ wave Whip
Antenna Gain	Unity
Antenna Polarization	Vertical