

TX600/TX618/TX623/TX630 2.4GHz Video Transmitters

User's Guide & Operating Manual

**AV030201/1-000
REV. C2 - 1 October 2003
FCC ID: Q7ITX600-18-23-30**

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FCC INFORMATION

FCC ID: Q7ITX600-18-23-30

This unit complies with Parts 74 & 90 of the FCC regulations.

Maximum Permissible Exposure

Any Wireless Equipment can pose health hazards if precaution is not exercised in its use/operation, especially its proximity to the human body. Excessive absorption of RF energy in the body is known to cause Cancer and/or other diseases. The FCC has issued guidelines to determine the safe distance of a transmitting antenna from the human body, to limit absorption to safe levels. Please follow the instructions given in this manual.

WARNING: Refer to Table 4 in Section 3 (*Operating the transmitter*) to determine the MINIMUM DISTANCE the Transmitter with Antenna mounted, or the Antenna itself (if connected via coax to the transmitter), must be placed away from the body to minimize the health hazard. Also, note the Warning for TX630 after Table 4. User's failure to comply with the instructions in this manual voids the site license granted.

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1. General

The TX600 series rugged transmitters are intended for use in military, homeland security, mobile security, broadcasting and motion picture production.

The TX600 Series is an FM modulated transmitter with a tuning range of 2.4GHz-2.483GHz and an optional extended range of 2.15GHz-2.5GHz.

The following table details the RF output power of the various models:

Model	Output Power
TX600	1mW
TX618	70mW
TX623	200mW
TX630	900mW

Table 1 – Model/Output Power

Each Transmitter is available with a choice of 2 types of **End Connector's**:

Suffix 'B' is Broadcast style and comes with LEMO connectors.

Suffix 'S' is Security style and has only a DB15 connector.

Refer to Figure 'A' for connector style.

The type of connector is primarily a matter of preference for the user, with only 1 audio being a limitation of the 'Security' type. The Broadcast industry also prefers to use the LEMO connector for its robustness for connect-disconnect applications, typical to that industry. LEMO connectors are also expensive connectors.

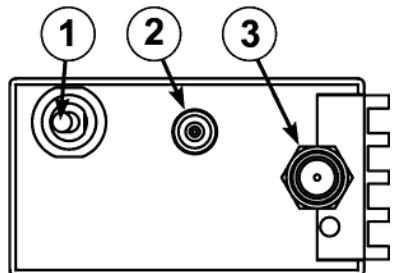
While ordering, please specify the desired style with the above suffix e.g. TX630B for LEMO connectors.

All transmitters offer the following features:

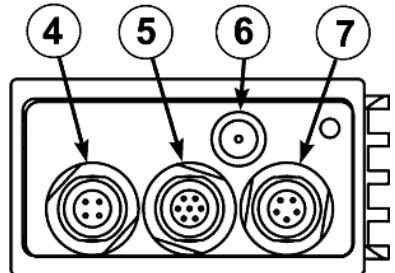
- A single broadcast quality video channel with no delay.
- One/Two broadcast quality audio channels depending on model.

Optional features (each ordered individually).

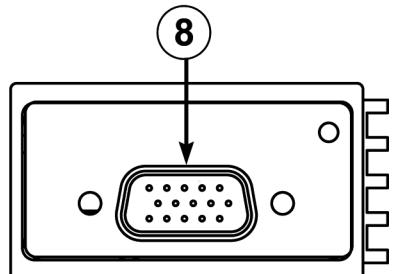
- Two-way Wireless Data Link (WDL) to a DX series receiver.
- Talk back audio channel.
- Alarm/Motion sensor interface.
- Telemetry inputs.



Top View	
1	Power Switch
2	WDL Antenna
3	Main Antenna



Bottom View – Broadcast	
4	Power/Video Input – see Figure C
5	Data Input – see Figures F
6	Video Input – see Figure D
7	Audio Input – see Figure E



Bottom View – Security	
8	Power/Video Input – see Figure B

Side Views	
9	Power LED Indicator
10	Channel Select Dip Switch

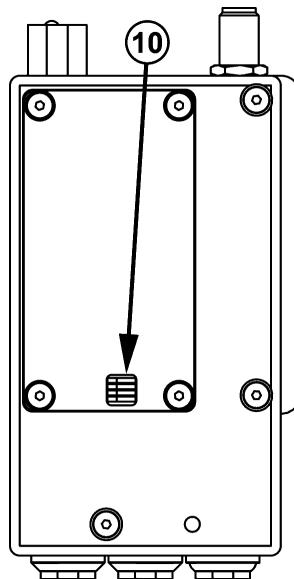
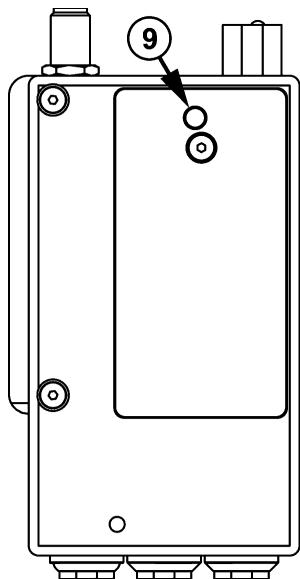


Figure A – TX600 Series Controls and Connectors

1.1 Video.

The video input is buffered, combined with the two audio subcarriers, then DC level restored, limited by a white level clipping circuit, pre-emphasized and FM modulates the transmitter RF carrier.

Avalon RF offers the following video indices of modulation:

- Industry standard frequency deviation of 4MHz.
Compatible to GMS, Coherent and others.
This option offers longer range at reference quality.
- Wide frequency deviation of 6MHz.
Compatible to Dynapix, Trango and others.
This option offers broadcast quality but with slightly shorter range.

1.2 Audio.

The two audio inputs are buffered and FM modulated on two subcarriers. The factory preset subcarrier frequency is 6MHz and 6.5MHz but may be programmed to any frequency from 5MHz to 7.5MHz.

1.3 Talk Back Audio Channel (optional).

The talk back audio channel allows the camera operator (on the transmit side) to receive instructions from the operator at the receiver's side. It drives an earpiece.

1.4 Two Way Wireless Digital Link (WDL) (optional).

The WDL serves as a Pan-Tilt-Zoom (PTZ) / general-purpose two-way RS422/RS485 digital link.

1.5 Alarm/Motion Sensor Input (optional).

The motion sensor option turns the transmitter on whenever a dry contact relay closes an external circuit and controls a remote relay in the receiver.

1.6 Telemetry Inputs (optional).

The telemetry input has 3 analog inputs. These inputs are sampled and transmitted out to the receiver through the WDL.

1.7 RF Outputs.

The transmitters have two RF outputs (Only 1 for a standard unit, without WDL or Talk Back Audio Option). A female SMA connector for the main transmitter and a MCX for the WDL.

Both outputs feed antennas, either directly or through a cable.

2. Specifications

2.1 User Interface.

a) On/Off Switch.

The TX600 series transmitter has an on/off switch. This shuts off power to the entire transmitter.

b) Power on LED.

This LED has the following states:

- i) **Green** when power is on.
- ii) **Red** when the transmitter is on air.

c) Hands Free Back Channel (optional).

This option allows the receiver operator to communicate with the transmitter operator via a headset that includes an earpiece and a microphone, when the transmitter is on air.

2.2 Setup.

The TX600 series transmitters have the following setups:

- a) Video carrier frequency (2.4GHz to 2.483GHz(*)).
- b) Audio 1 sub-carrier frequency (5MHz to 6MHz).
- c) Audio 2 sub-carrier frequency (6MHz to 7.5MHz).

(*) Option 04 extends the tuning range. See Section 4.

2.3 Electrical Interface.

The transmitter has the following interfaces:

2.3.1 Power Input

- a) The transmitters operate off a 9Vdc-16Vdc unregulated voltage source.
- a) This input is switched and protected against reverse polarity.
- b) Typical power input current consumption for the basic configuration is (with video present):

Model	Input Current
TX600/TX618	<200mA
TX623	350mA
TX630	450mA

Table 2 – Current Consumption

‘Video Presence’ detection circuitry will turn off the power amplifier if no video is detected. This conserves power considerably and reduces the RF output by more than 30 dB (1000 times less), if no video is present.

Addition of option 11 (WDL) will increase the current draw by a maximum of 170mA.

2.3.2 Video Input.

- a) The video input accepts RS170, CCIR, NTSC or PAL signals.
- b) Input voltage is 1Vp.p with a negative sync tip of 0.3V.
- c) The input impedance is 75 Ω (ohm).

2.3.3 Audio 1 and Audio 2 Inputs.

The audio inputs accept signals of 1Vp.p. and have an input impedance of 600 Ω (ohm).

2.3.4 "Talk back" audio channel to the transmitter operator (optional).

The “talk back” output drives an electromagnetic earpiece.

2.3.5 Two Way Wireless Digital Link (WDL) (Option 11)

The WDL is a 9.6KBaud (standard, other Baud rates are supported) Half-Duplex RS485 compatible serial interface.

2.3.6 Main RF output to antenna.

- a) The main RF output connector is a 50Ω (ohm) female SMA receptacle.
- b) The RF output power is as follows:

Model	Output Power
TX600	1mW at VSWR of 1.5:1
TX618	70mW at VSWR of 1.5:1
TX623	200mW at VSWR of 1.5:1
TX630	900mW at VSWR of 1.5:1

Table 3 – Power Output

2.3.8 Wireless Digital Link (WDL) RF output.

The WDL RF output is via a 50Ω (ohm) MCX connector. Maximum output power is 10dbm.

The main RF and the WDL RF outputs are identical on all the transmitter versions.

2.3.9 Alarm/Motion Sensor input (optional – Security Type Only).

The Alarm/Motion Sensor input is an interface to a dry contact relay. Whenever the relay circuit is closed, the transmitter goes on air.

2.3.10 Telemetry inputs (optional).

These analog inputs (3 on Security Type, 1 on Broadcast Type) have a $1M \Omega$ (ohm) input impedance and a sampling rate of 500Hz. Resolution is 8 bit.

2.4 Interconnecting.

All interfaces to/from the transmitter are available in one of the following connector configurations:

2.4.1 Security Type - DB15P connector with the following pin-out:

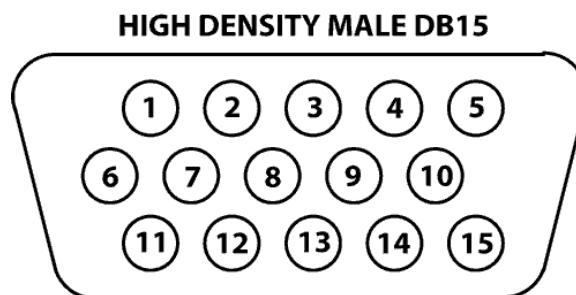


Figure B – DB15

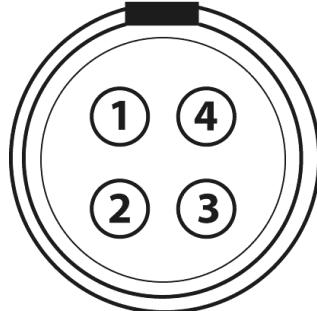
Pin #	Function	Pin #	Function
1	Power Input (+9Vdc to +16Vdc)	9	Signal Ground
2	Video Input	10	Telemetry 1 Input
3	Video Return Ground	11	Alarm/Motion Sensor Input
4	Audio 1 Input	12	RS-485 I/O 'A'
5	Microphone Input	13	RS-485 I/O 'B'
6	Microphone Bias	14	Telemetry 2 Input
7	Earpiece Output	15	Telemetry 3 Input
8	Power Return Ground		

NOTE: This connector option allows for one audio input only, Audio 1 at 6.0 MHz (default factory set).

2.4.2 Broadcast Type - multiple connectors.

a) Power/Video Input.

LEMO ECG.0B.304.CLN
or Equivalent



Pin Number	Function
1	Power Return
2	Video Input
3	Video Return
4	Power Input

Figure C – Power/Video

b) Video Input.

The video signal is input either through the video 75 Ω (ohm) SMB connector (Figure D) or the power connector (Figure C).

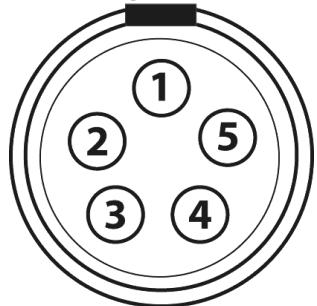
SMB 75 OHM JACK
RECEPTACLE



Figure D – Video

c) Audio Input.

LEMO ECG.0B.305.CLN
or Equivalent

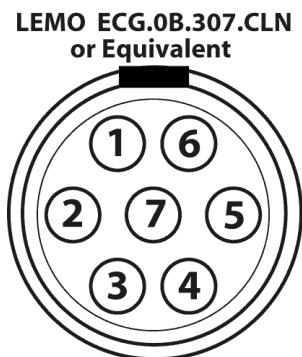


Pin Number	Function
1	Audio Return
2	Audio 1 Input
3	Audio 2 Input
4	N/C
5	N/C

Figure E – Audio

2.4.2 Broadcast Type - multiple connectors (continued).

c) Data Input.



Pin Number	Function
1	Telemetry
2	Microphone Input
3	Speaker Output
4	Microphone Bias Output
5	RS-485 I/O 'A'
6	RS-485 I/O 'B'
7	Ground

Figure F – Data Input

2.5 Mechanical

2.5.1 Mounting.

Mounting can be done in one of the following methods:

a) Clamping.

Clamping (or hard mounting) is the only method of mounting in all fixed installations.

Clamping is the preferred method of mounting in all mobile installations where most electrical interfaces are used. This is due to the heat sinking needed and the weight of the connector's and the cable's.

b) Clip on.

Avalon RF offers a clip on kit. This method is recommended when only one or two interfaces are in use. Not practical for TX623 and TX630.

c) Velcro[®] to a flat surface.

Using Velcro[®] to secure the transmitter is recommended when only a few interfaces are in use. Not practical for TX623 and TX630.

d) Drop-in.

The transmitter can be dropped into a bucket mounted on the side of the video camera, like the ones usually found in ENG service. This can be done for the TX623 or TX630 only if adequate ventilation (for cooling) is available in the bucket and care is taken with other cables/equipment not being damaged from the transmitter heat.

2.5.2 Mechanical Data.

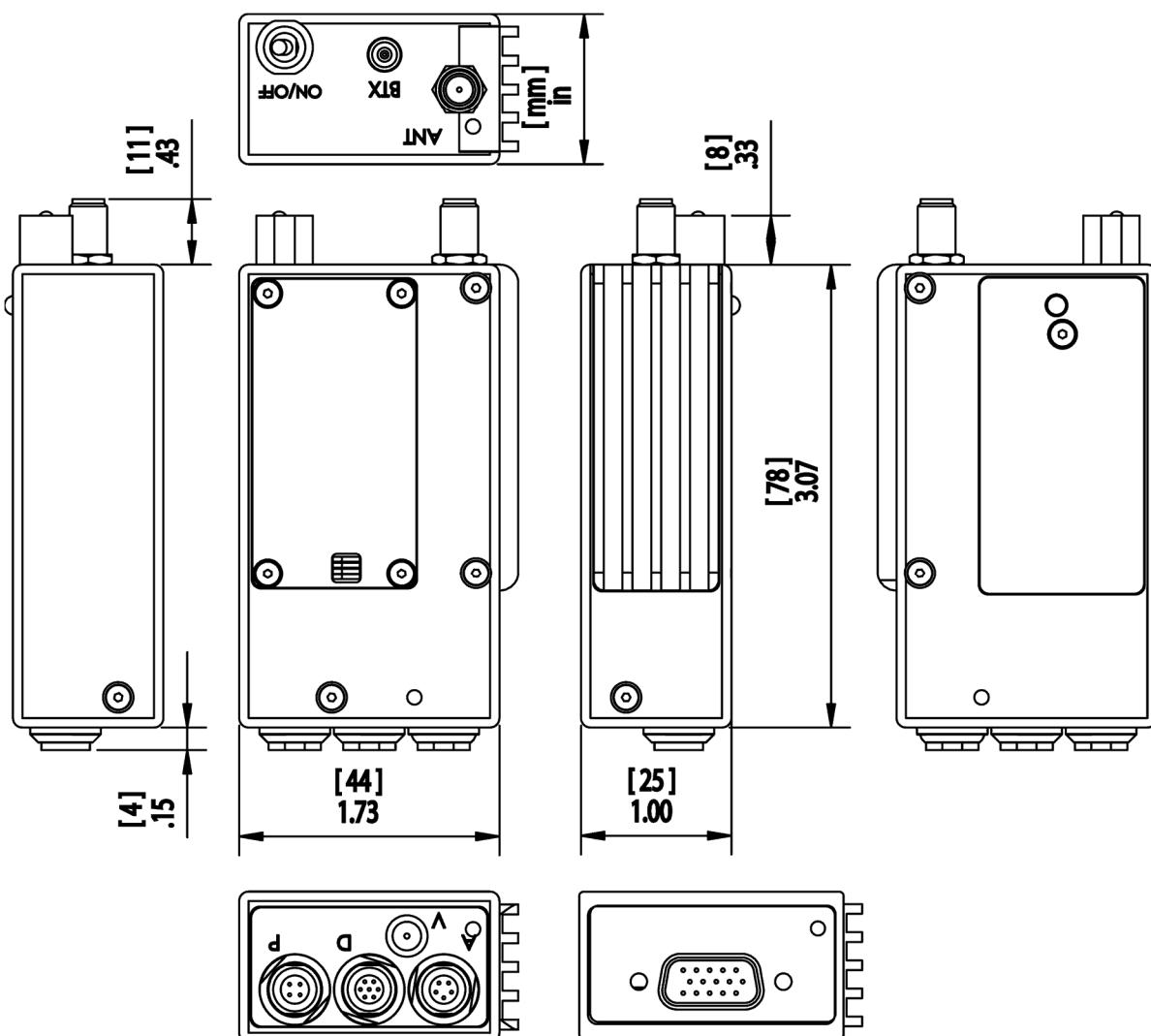


Figure G – TX600 Series Mechanical Outline

2.6 Environmental Conditions.

The TX600 Series is designed to meet the following environmental conditions:

2.6.1	Operating temperature	-4° to 122° F -20° to 50° C
2.6.2	Storage temperature	-13° to 150° F -25° to 65° C
2.6.3	Vibration	1.5G, from 10Hz to 2KHz, sine wave, 3 axis
2.6.4	Shock	15G, 25msec, half sine wave, three axis
2.6.5	Humidity	5 to 95%, non-condensing
2.6.6	Inclination	Any
2.6.7	Altitude	-1500 feet to 15,000 feet -450 meter to 4,500 meters

3. Operating the transmitter.

Before applying power, make sure all connectors and all antennas are hooked up.

NOTE

The transmitter will not transmit unless it has an antenna.

3.1 The transmitter has two operator controls and one indicator:

a) Channel select.

Units that have a manual synthesizer have a 4-position dip switch that selects a channel number (from 1 to 16). The preset channel numbers are defined by a label on the side wall of the transmitter.

The user is advised to select a channel within the permissible frequency range to begin with, and if any interference is observed, switch over to another channel.

b) On/Off switch.

3.2 The wireless data link is a secondary/utility link that is used to transfer data/voice in the reverse direction and some alarms/telemetry data in the forward direction. It is a narrow band UHF link operating at 473 MHz.

Following are the characteristics:

a) VOICE: Voice is transmitted from the receiver (DX side) to the Transmitter side (TX side). It is implemented as a VOX (voice operated transmit) and only the headset microphone is used on the DX side & only the earpiece is used on the TX side. The microphone is an electret mic.

b) DATA: The data rate is 9.6Kbaud fixed (other data rates supported) on a RS485 interface.

c) TELEMETRY/ALARMS: This data is sent about 5-6 times a second.

3.3 General Guidelines

The choice of a Transmitter and the Antenna to be used is dictated by power consumption, required distance of operation of the link, if it is a fixed or a mobile environment, the space constraints, the location itself (indoors or outdoors, presence of nearby objects like trees, bridges, etc.) and etc. Avalon RF will work with you to determine the right combination. Placement/positioning of the transmitter antenna is important for proper operation of the wireless video link. The antenna shipped with the unit is omni-directional, which means it will radiate in all directions and when upright (vertical) will be vertically polarized. The receiver side antenna's then, must also be mounted vertically. While the above method would be the usual / most common way, certain applications need a different placement. As an example, to transmit between floors in a high rise building, the transmit & receive antennas can be small, directional, high gain panel antennas, mounted horizontally, directly 'looking' at each other. Circular polarized antennas are more expensive, but give a far better performance, especially in mobile applications.

For proper operation of the wireless link, the transmitter antenna should be kept clear of metal objects, trees, buildings, etc. If the transmitter is mobile such as on a video camera, ensure the antenna is sufficiently clear of the operator's body, especially the head. A 2.4 GHz link is a line-of-sight communications, which means the receive antennas should 'see' the transmit antenna.

Another very important aspect relates to health hazards from RF energy absorption in the body. To minimize the risk, we ask that the user ENSURE the minimum distance of the transmitting antenna from the human body per Table 4. These values have been calculated per FCC Bulletin OET65, Supplement C & related documents.

Minimum Distance from Body (in Inches)						
Model ↓	Antenna Gain →	0 dBi	3 dBi	10 dBi	27 dBi	
TX600/TX618	Distance	2"	3"	4"	-	
TX623		3"	4"	8"	48"	
TX630 **		6"	9"	16"	84"	

Table 4 – Minimum Safe Distance

WARNING:

** An Antenna extender cable is shipped with the TX630, it is meant to hold the antenna at the minimum safe distance from the human body. This extender cable **MUST** be used whenever the TX630 is operated in a mobile environment (such as on a camera) and the user should mount the transmitter in a way that does not defeat the purpose of this cable. If the transmitter is mounted in a manner other than intended with the extender cable, it **SHALL** be the user's responsibility to ensure the above minimum distance from 'any' human being. Avalon RF will help/advise you if necessary. Failure to comply with these instructions will void the grant of the site license under part 74 or part 90 (as the case may be).

If the antenna you received is not one of the above, use the next higher distance or call/e-mail Avalon RF.

Operating range will depend on the transmit and receive antennas used - a wide choice of antennas is available from Avalon RF. Please visit the website (www.avalonrf.com) for more details.

For fixed installations, power saving can be achieved by turning off the video camera or the video source. A 'video presence' detection circuitry will turn off the power amp when no video is detected - power will be restored when the video signal is restored. Besides power conservation, it also eliminates high power RF transmission by reducing the output by about 30 dB (1000 times less) when no video is present.

4. Ordering information

4.1 Base Models

TX600	2.4GHz-2.483GHz, FM modulated, O/P of 1mW
TX618	2.4GHz-2.483GHz, FM modulated, O/P of 70mW
TX623	2.4GHz-2.483GHz, FM modulated, O/P of 200mW
TX630	2.4GHz-2.483GHz, FM modulated, O/P of 900mW

NOTE

Models with 200mW and up are licensed to customers per FCC Part 74 and Part 90 or for export only.

While ordering, please specify the desired connector style with the proper suffix e.g. TX630B for LEMO connectors.

Suffix 'B' is Broadcast style and comes with LEMO connectors.
Suffix 'S' is Security style and has only a DB15 connector.
Refer to Figure 'A' for connector style.

All units come with the following standard accessories:

4.1.1 Omni directional whip antenna

4.1.2 A 3-foot power cord with flying leads, to be connected to a customer specific battery pack.

4.1.3 User guide and operating manual (this manual).

4.1.4 A heavy-duty reusable carton.

4.2 Options.

- 4.2.1 Option 01 – Remote programming. Requires option 11
- 4.2.2 Option 04 – Extended tuning range
TX600 series – 2.150GHz to 2.5GHz
This is ONLY the available range. User should indicate specific frequencies licensed to them in this band at the time of ordering.
- 4.2.3 Option 11 – Wireless Data Link (WDL)
Includes an AX402 omni-directional whip antenna with MCX connector.
- 4.2.4 Option 31 – Talk back audio channel. Requires option 11.
- 4.2.5 Option 41 – Alarm/Motion Sensor input. Requires option 11.
- 4.2.6 Option 51 – Telemetry inputs (3 on Security Type, 1 on Broadcast Type). Requires option 11.
- 4.2.7 Option NM – Basic unit installed in an outdoor NEMA 4 box with an internal power and signal distribution panel.
- 4.2.8 Option SP – Basic unit installed in an outdoor NEMA 4 box with solar panel, charger and internal lead-acid battery

4.3 Recommended accessories.

4.3.1 Antennas

The following is a list of antennas available from Avalon RF. Only certain antennas can be used with high power models like TX623 & TX630 to comply with FCC's EIRP restrictions. Overseas customers must check local regulations for compliance before ordering. The choice of a particular antenna is dictated by transmitter power consumption, the application environment, physical size constraints, governing local regulations, etc. As a rule, the higher the antenna gain, the larger it's size and narrower the beam width (the more directional the antenna).

Omni-directional antennas for mobile application:

Gain	2.4GHz	Comments
0dbi	AX600	1/4 wave whip (needs ground plane)
3dbi	AX603CP	Circular polarized whip
3dbi	AX603	Linear polarized
4dbi	AX604	Linear polarized
6dbi	AX606	Linear polarized
8dbi	AX608	Linear polarized
10dbi	AX610	Linear polarized

Directional antennas for fixed point-to-point applications:

Gain	2.4GHz	Comments
10dbi	AX610CP	Circular polarized panel
13dbi	AX613CP	Circular polarized panel
16dbi	AX616CP	Circular polarized panel
24dbi	AX624PD	Parabolic Dish
27dbi	AX627PD	Parabolic Dish

The following table shows permissible Antennas that can be used with the different transmitters:

Antenna	Permissible for use with Model			
	FCC Part 15 (License Free)	RSS210 (Canada)	FCC Part 90 (Licensed)	FCC Part 74 (Licensed)
AX600	TX600	Any TX6XX	Any TX6XX	Any TX6XX
AX603 AX603CP	-	TX600 TX618 TX623	Any TX6XX	Any TX6XX
AX604	-	TX600 TX618 TX623	Any TX6XX	Any TX6XX
AX606	-	TX600 TX618 TX623	Any TX6XX	Any TX6XX
AX608	-	TX600 TX618	TX600 TX618 TX623	Any TX6XX
AX610 AX610CP	-	TX600 TX618	TX600 TX618 TX623	Any TX6XX
AX613CP	-	TX600	TX600 TX618 TX623	TX600 TX618 TX623
AX616CP	-	TX600	TX600 TX618	TX600 TX618 TX623
AX624PD* AX627PD*	-	TX600	TX600	TX600

* These antennas must be mounted on a roof or mast.

Table 5 - Permissible Antenna/Transmitter Model Combinations

4.3.2 Cables

The length of the cable between the transmitter and the antenna will have a bearing on the output power transmitted. It is not recommended to have more than 30 feet of cable, as the cable loss will become appreciable, even with a low loss cable. If a cable must be used, we recommend a low loss cable like the LMR240 or LMR400 or equivalent.

4.3.3 Battery packs

- a) BAT80 – 14.4V/80WH Li-Ion battery pack with charger and power cable to transmitter - will run a TX630 transmitter for approximately 9 hours.
- b) BAT92 – 14.4V/92WH Li-Ion battery pack with charger and power cable to transmitter - will run a TX630 transmitter for approximately 12 hours.
- c) BAT103 – 14.4V/103WH Li-Ion battery pack with charger and power cable to transmitter - will run a TX630 transmitter for approximately 15 hours.