Installation and Operation Manual for the Tower Top Amplifier System Models 434B-94D-01-T and 434B-94D-01-M-110/48

Manual Part Number
7-9597-1

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1	05/19/16
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Symbols Commonly Used


WARNING !!!


CAUTION or ATTENTION

Important Information

Training Video Available


Heavy Lifting


High Voltage


Hot Surface


ESD Electrostatic Discharge


Electrial Shock Hazard


Safety Glasses Required

Changes to this Manual

We have made every effort to ensure this manual is accurate. If you discover any errors, or if you have suggestions for improving this manual, please send your comments to our Angola, New York facility to the attention of the Technical Publications Department. This manual may be periodically updated. When inquiring about updates to this manual refer to the manual part number and revision number on the revision page following the front cover.

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Table of Contents

General Description **7**
Tower Top Box 8
Base Control Unit 9
Functional Block Diagram **9**
Unpacking. **9**
Pre-Installation Checkout **9**
Mechanical Inspection 10
Initial Power-up Test 10
Bench Testing 13
Amplifier Bypass 15
Amplifier Termination 16
Installation **16**
Installing the System 16
Installing the Tower-Top Unit 16
In-building Lightning Arresters 16
Installing the Base Control Unit 20
Interference and IM Considerations 20
Feedline Data **21**
Optimizing the System **21**

Attenuation Settings **21**
TTA NET Gain 21
Setting the Attenuators 22
Spectrum Analysis **22**
Procedure for Spectral Analysis 23
Operational Tests (Sensitivity and Degradation) **24**
Front Panel Test Port 24
Tower Top Amplifier Inputs 24
Static System Sensitivity 25
Measuring Static Sensitivity (Load Connected) 25
Effective System Sensitivity 26
Measuring Effective Sensitivity (Antenna Connected) 26
Degradation 27
Routine Operation **27**
Amplifier Monitoring 27
LCD Display 27
Current Draw 27
TTA Temperature 27
Software Version 28
Front Panel LED's 28
Form-C Contacts 28
Alarms **28**
System Troubleshooting **28**
Performance Degradation 29
Hardware Problems 29
Lightning and Lightning Arresters 29
Vandalism 29
AC line Fuse (110 VAC model) 30
Periodic Maintenance **30**
Recommended Spare Parts **30**
Optional Equipment **30**
Multicoupler Expansion Deck 30
Ethernet Connectivity **30**
Dashboard Submenu 31
Bypass Amplifiers 31
Recommended Attenuation 32
Site Setup Submenu 33
Change Admin Password 33
Network Settings 33
Alarm Submenu 34
Raw Readings Submenu 35

Figures and Tables

Figure 1: Front view of the tower-top box 7
Figure 2: Front view of the Base Control Unit... 9
Figure 3: Top view of the Base Control Unit 11
Figure 4: Rear view of the Base Control Unit 11
Figure 5: Functional block diagram of the system 12
Figure 6: Initial power-up test 13
Figure 7: Default display 13
Figure 8: Software Menu Selections 14
Figure 9: Test equipment interconnection for “bench testing” the system 15
Figure 10: System installation guidelines 18
Figure 11: System installation guideline notes 23
Figure 12: Tower-top box mechanical details 19
Figure 13: Application of rubber splicing tape 19
Figure 14: Alarm terminals 20
Figure 15: Testing the output spectrum of the system 23
Figure 16: Maximum signal level mask 24
Figure 17: Using the test port to measure sensitivity of the system 25
Figure 18: Schematic of Form-C contacts 28
Figure 19: Expansion deck 75-83K-01 30
Figure 20: Login Screen. 31
Figure 21: Dashboard Submenu 32
Figure 22: Site Setup Submenu 33
Figure 23: Change Network Settings……………………………………………..33
Figure 24: Alarm History Submenu 34
Figure 25: Raw Readings Submenu 35

Table 1: System Specifications 7
Table 2: Tower Box Specifications 8
Table 3: Base Control Unit Specifications 10
Table 4: Base Control Unit Attenuator Settings 22
Table 5: Typical Current Readings 27
Table 6: Troubleshooting Guide 29

Appendixes

Appendix A: Ethernet Connectivity 36

GENERAL DESCRIPTION

Your TX RX brand Tower Top Amplifier System provides the highest degree of reliability available in a Tower Top Amplifier (TTA). The system uses quadrature-coupled amplifiers to create a redundant amplifier configuration. Each quadamplifier provides two simultaneously used, essentially parallel paths of amplification. Failure of one of these paths of amplification results in an overall gain reduction of only 6 dB.

The system is composed of two components including a tower top box (TTA) which incorporates filtering and a pair of low noise amplifiers. These amplifiers establish superior noise figure prior to feedline losses. The tower top box is mounted on the tower close to the antenna. The second component of the system is the base control unit which is located in the control room. Specifications for the system are listed in **Table 1**.

The system also supplies automatic backup-amplifier switching in the tower top box. Fault detection circuitry continuously monitors the DC power operation of the primary quad-amplifier and automatically switches to the identical secondary quadamplifier if conditions indicate a primary malfunction. Fault detection circuitry also provides at-a- glance status reporting, with front-panel LED's and an LCD display.

Parameter	Specification
Frequency Band	896 - 902 MHz
Reserve Gain	15.0 +1/-0.25 dB
Rejection	70 dB @ 894 MHz 110 dB @ 928 MHz
AC Current (434B-94D-01-M-110)	262 mA @ 120 VAC typ.
DC Current (434B-94D-01-M-48)	636 mA @ -48 VDC typ.

Table 1: System specifications.
15 dB reserve gain and maximum 6 dB transmission line loss assumed.

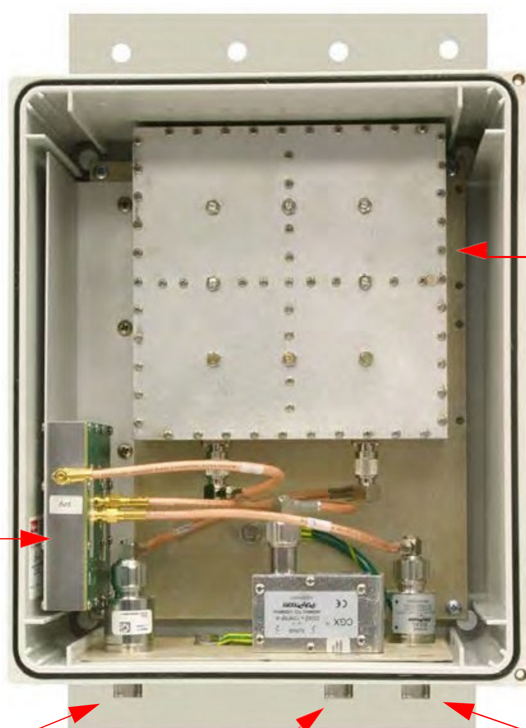

Figure 1: The tower top box.

Tower Top Box

The quad-amplifier in the tower top box amplifies the weak received signal before the signal enters a long and lossy transmission line, thus preventing the line loss from degrading the signal-to-noise ratio. The quadrature amplifiers have a separate power circuit for each half of the amplifier which provides component redundancy as well as unsurpassed IM performance. Microprocessor controlled fault detection circuitry in the tower top box provides continuous monitoring and switching of each quad amplifier while sending operational data to the base unit front panel for at-a-glance status reporting and form-C contact switching for alarm integration. Included in the tower top box is a preselector filter, amplifier “A” and amplifier “B,” switching circuitry, control board and lightning arresters (see **Figure 1**). The specifications for the tower box are listed in **Table 2**.

Base Control Unit

The ground-mounted Base Control Unit is intended for 19-inch rack mounting. It houses alarm indicators, a power supply or DC to DC converter, and a display panel to provide visual feedback on the system’s operating status. There is also a front-

Parameter	Specification
Frequency Band	896 - 902 MHz
Preselector Included	Yes
Preselector Frequency Range	896 - 902 MHz
Type of Amplifier	Quadrature Coupled (Redundant)
Amplifier Switching	Automatic
Type of Amplifier Switching	Solid State RF Switch
TTA Gain (Input to Output of TTA)	22.5 +/- 0.5 dB
Noise Figure: TTA	< 2.7 dB
Amplifier Input 3rd order IP	> +15 dBm
Return Loss of all RF Ports	> 14 dB
Power Requirements	Power derived from RX Cable
Operating Temperature Range	-30 °C to +60 °C
Amplifier Redundancy	Automatic change-over
Lightning Protection	Impulse Suppressor on all external ports
Test Port Included	Yes
Coupling Test Port (Test In / Amp In)	30 dB +/- 2 dB
50 Ohm Termination Test	Controlled by base unit
Type of RF Test Switching	Solid State RF Switch
Bypass Test Mode	Controlled by base unit
Enclosure	Weather resistant housing designed to NEMA standards
Dimensions	9.25” x 5.125” x 6”
Net Weight	8.9 lbs.

Table 2: Tower Top Box Specifications.

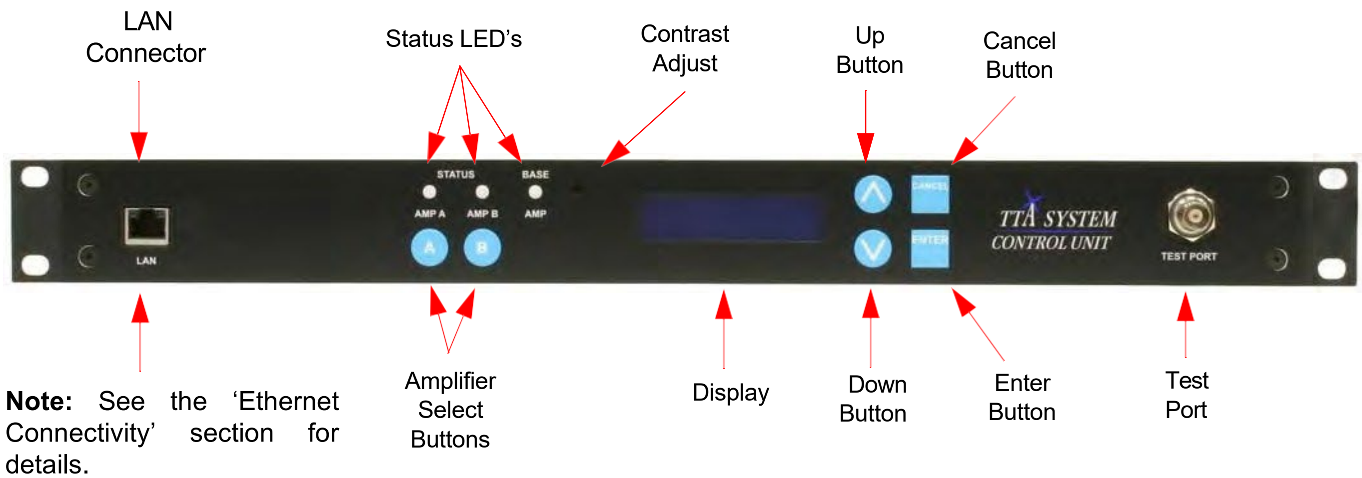

Figure 2: Base unit front panel.

panel test port input for providing an RF signal path for loopback tests. The front panel display shows status information such as amplifier current draw and temperature. In addition the display is used to provide a user interface for adjustments such as setting TTA Net Gain attenuation. The current draw values of each amplifier in the system is displayed by the base control unit. The front panel of the base control unit is shown in **Figure 2**.

The base control unit includes a receiver multicoupler function in addition to the base controlling functions. The deck has the built-in capability to split the received RF signal from the tower top box to 16 individual receivers. In addition, there is an expansion port available which allows expansion of the system up to 32 ports. The specifications for the base control deck are listed in **Table 3**. **Figure 3 and 4** are the top and rear views while **Figure 5** is a functional block diagram of the system.

FUNCTIONAL BLOCK DIAGRAM

Figure 5 is a functional block diagram of the entire TTA system which includes the tower top box and the control deck. RF signals enter the tower top box through the antenna port and are applied to either the A or B tower top LNA. When the system is in the bypass mode signal flow is around the amplifiers. Signals are output from the tower top box at the main port and travel down the main transmission line to the main port of the base control unit. As noted on the block diagram, the main transmission cable also carries DC operating voltage up to the tower box and provides a conduit for serial communications between the processors in the tower box and the base deck.

RF signals enter the main port of the base control unit deck and are routed to the filter port on the rear of the unit. Signals then pass through the bandpass filter located on the deck. After passing through the bandpass filter the RF signals are input to the base amplifier assembly. The amplifier assembly provides attenuation, amplification, and signal splitting. The signal splitter feeds a 16-way splitter for distribution to station receivers and an expansion port connector. The expansion port allows an optional 16-way to be added to the system.

UNPACKING

Each major component of the TTA system is individually packaged and shipped via motor freight or UPS. It is important to report any visible damage to the carrier immediately. It is the customer's responsibility to file damage claims with the carrier within a short period of time after delivery (1 to 5 days).

PRE-INSTALLATION CHECKOUT

The following pre-installation tests should be performed after unpacking the system to verify nothing has loosened during transit. Additionally, the system should be made operational on the bench with

Parameter	Specification
Frequency Range	896 - 902 MHz
Net Gain or Loss (Base Unit in to RX out)	- 7.0 dB (+/- 0.5 dB)*
Amplifier Type	Quadrature Coupled
Amplifier Output 3rd Order IP	> +45 dBm
Number of Output Ports	16 expandable to 32
RF Port Return Loss (min)	> 14 dB
TTA Connector	N - Female
Receive Connector	BNC - Female
Rx - Rx Port Isolation (min)	> 20 dB
Test Port Input (front of base unit)	BNC - Female
Test Port Output (rear of base unit)	N - Female
Reserve Gain Attenuator	15 dB in 0.5 dB steps
Distribution Gain Attenuator	4 dB in 1 dB steps
Alarm Contacts	Form-C contacts
Ethernet RJ45	Access from front panel
Power Requirements	90 - 240 VAC @ 50/60 Hz, or -48 VDC
Operating Temperature Range	0°C to +50°C
Enclosure	Standard EIA 19” Rack Mounting
Dimensions (HWD)	1 RU x 19” x 14” (38 x 483 x 356 mm)
Net Weight	7 lbs.

Table 3: Base Control Unit Specifications.
* **Note**: The Net Gain or Loss is measured with 6 dB of Reserve attenuation and 3 dB of Distribution attenuation.

all components at ground level to verify proper electrical performance.

NOTE The tower top box should NOT be installed on the tower until all of the pre-installation tests are successfully completed.

Mechanical Inspection

It is advisable to check the tightness of the hold-down screws for the base unit assemblies to insure nothing loosened during shipment. Likewise, check all of the cable connections on the base control unit to insure that they are all properly mated to their associated plugs.

CAUTION: The wide band filter in the tower top box is factory tuned and must not be field adjusted. Field tuning of this filter is not required. Do not adjust the tuning slugs of the amplifier/filter assembly.

Initial Power-Up Test

To perform the initial power-up test the system should be temporarily interconnected at ground level using short temporary cables. To temporarily interconnect the equipment connect a cable between the main port on the tower box and the main port on the base unit. Also connect a cable from test port connector on the tower box to the

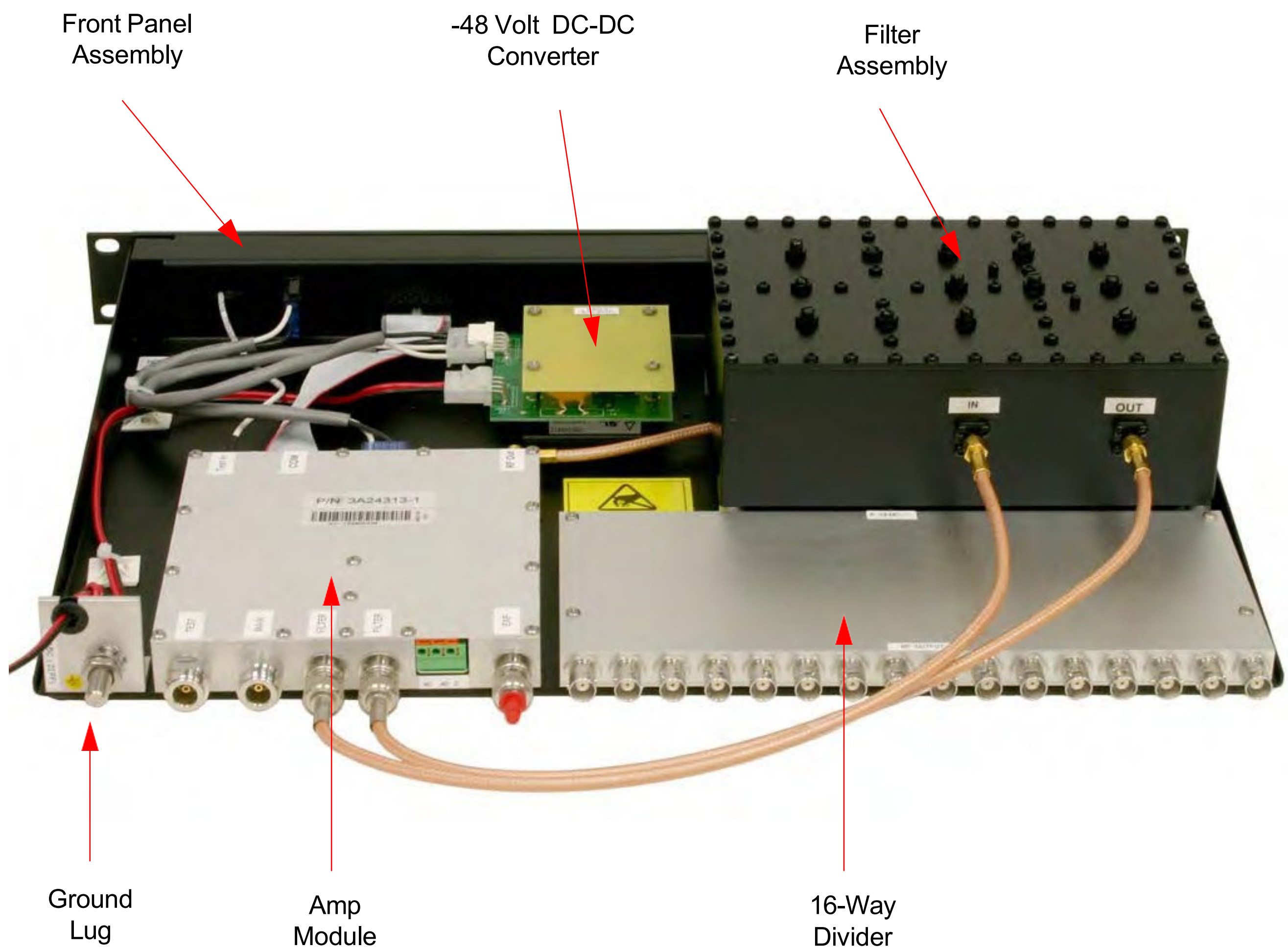

Figure 3: Top view of the Base Control Unit (-48 VDC model shown as example).

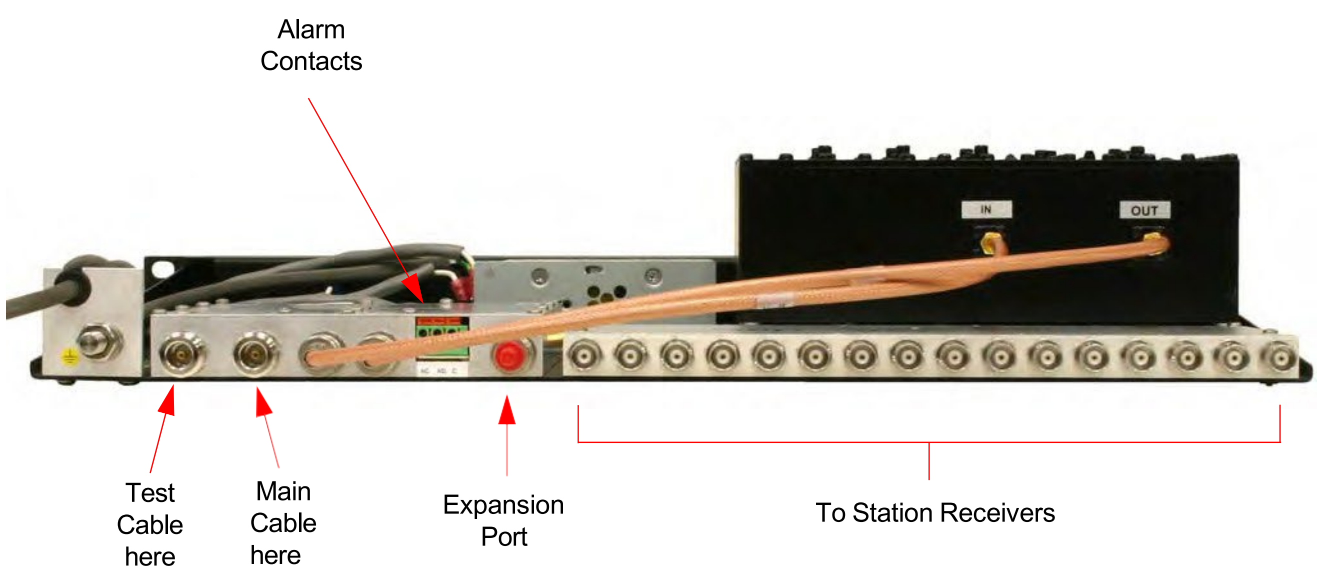

Figure 4: Back view of the Base Control Unit (110 VAC model shown as an example).

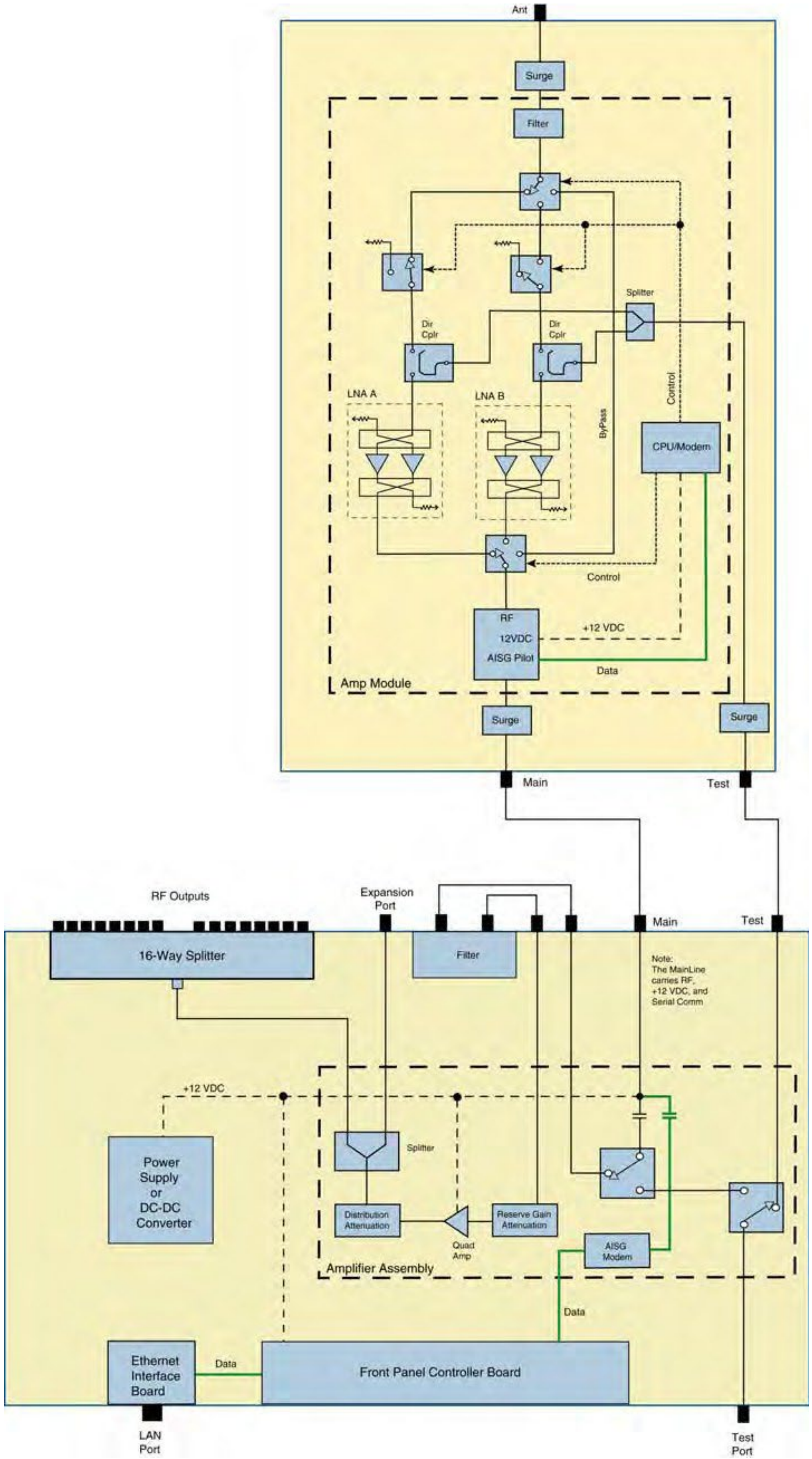

Figure 5: Functional block diagram of the system.

test port connector on the base unit. **Figure 6** shows the temporary equipment hookup for initial power-up testing of the system. Once the equipment is temporarily interconnected then power is applied to the system by plugging the control unit's AC cord into a suitable AC outlet or by connecting the DC power cable to a suitable -48 VDC supply. The following start-up sequence occurs.

1) At power on, the three front panel status LED's will all flash then dim. This will last for a few seconds while the system's microcontrollers boot.

2) During the next few seconds the base control unit will establish communications with the tower box. The display panel will present the message "Connecting to Tower Unit".

3) For a few seconds more the base control unit will establish communications with the ethernet controller. The display panel will present the message "Connecting to Ethernet Comms".

4) After the power-up sequencing is complete the screen should show the default display. See **Figure 7** below. The status LED for the active amplifier will glow a steady green and the status LED for the inactive (stand-by) LNA will be dark.

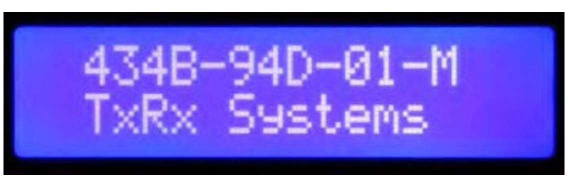

Figure 7: Default front panel screen display.

The tower top amplifier system is software directed so control of the system is accomplished via user interface with the front panel using the display screen and the four menu selection buttons. A flow chart showing all of the possible user menu selections is shown in **Figure 8.**

Bench Testing

The purpose of the bench test is to verify that all of the system components are working correctly and to measure the systems sensitivity before climbing the tower to mount the tower top box. One station receiver is selected and the test is performed at this frequency. Short temporary cables are used to interconnect all components. A SINAD meter (or a bit error rate meter if required) is used for the test along with a signal generator.

1) The stand-alone receiver sensitivity is measured and recorded first.

2) To interconnect the equipment connect a cable between the main port on the tower box and the main port on the base unit. Also connect a cable from test port connector to the test port connector. **Figure 9** shows all of the equipment interconnections for bench testing the system. Be sure that the signal generator is setup for a 3 KHz deviation with a 1000 Hz tone (analog) or proper pattern for BER testing. Connect the SINAD/Bit Error Rate meter to a receiver and connect the receiver to one of the RF output ports on the back of the base unit.

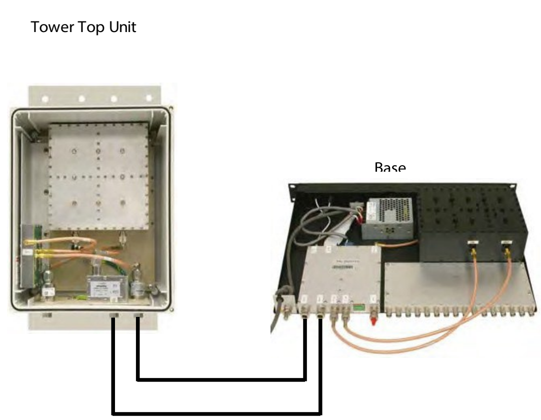

Figure 6: Initial power up test.

434B-94D-01-M Menu System

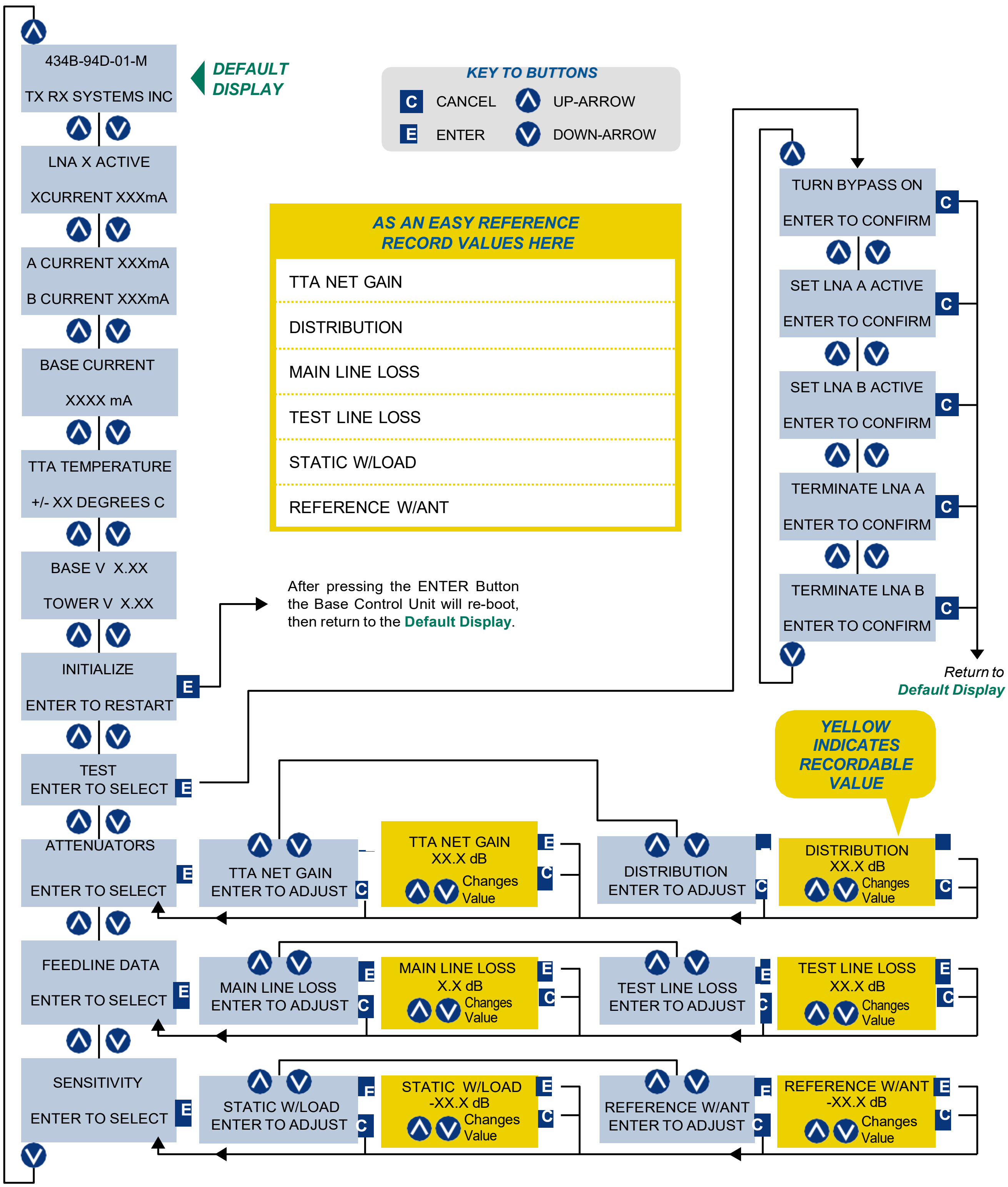

Figure 8: 434B-94D-01-M menu selections

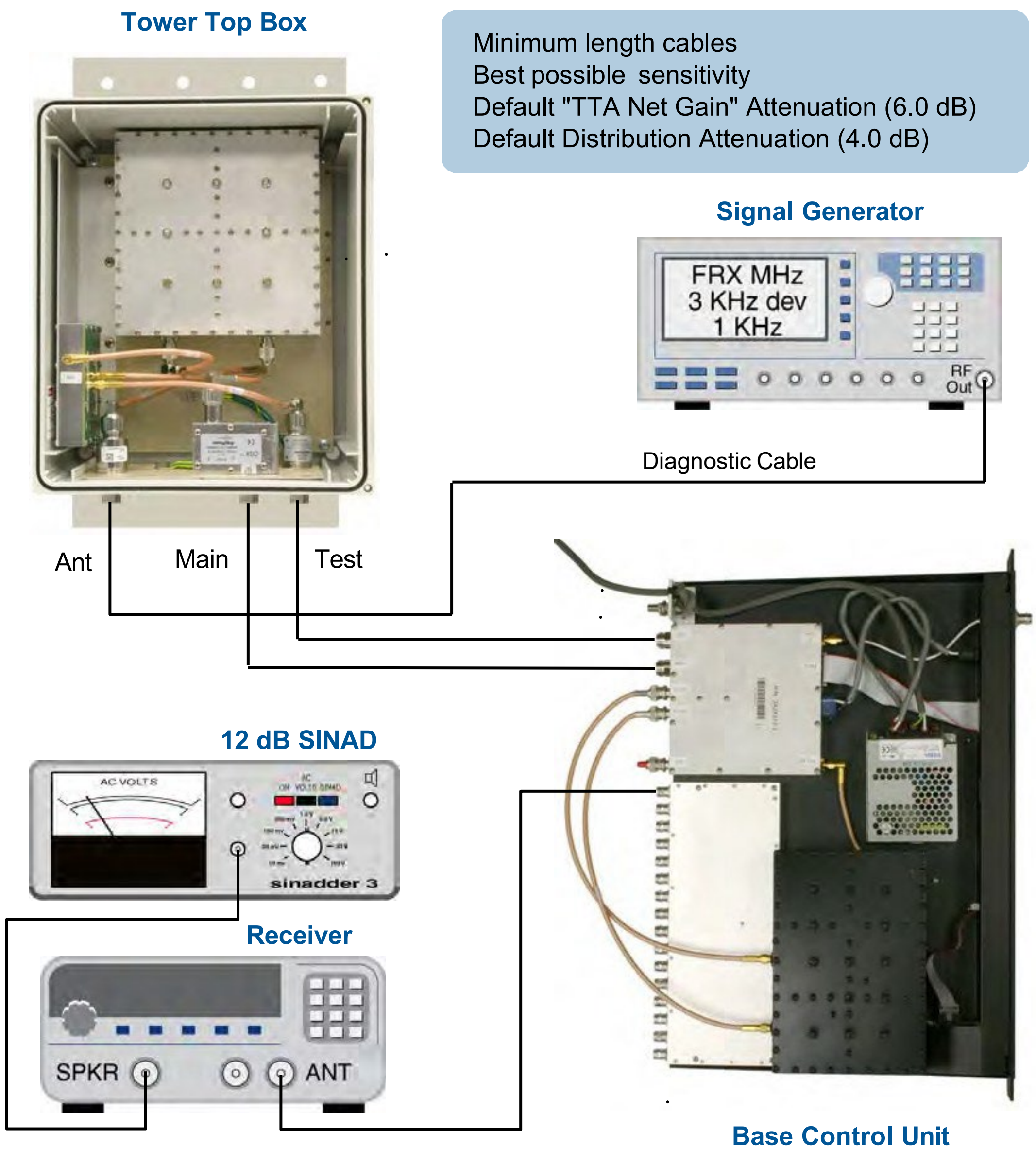

Figure 9: Test equipment interconnection for "bench testing" of system components.

3) Measure and record the systems bench test static sensitivity. The sensitivity value will vary depending on the amount of internal programmable attenuation selected via software interface. The bench test measurement should be taken with the default attenuation values. As shipped from the factory the default TTA Net Gain attenuation for the system is 6.0 dB and the default Distribution attenuation is 4.0 dB.

4) Select the other tower top amplifier and check that the bench test static sensitivity value remains nearly the same. This will insure that both amplifiers in the tower top box are functioning properly. To select an alternate tower-top amplifier press the associated amplifier select button on the front panel, the status LED will begin to flash, then press the front panel ENTER button to finalize the selection.

AMPLIFIER BYPASS

The system is designed with a bypass function which allows the antenna to be connected directly to the test port. In this mode of operation the front panel test port is electronically re-routed to the main transmission line and the amplifier circuit in the TTA is bypassed. This will allow for sweeping the antenna from the front panel test port. As part of bench testing the system this function needs to be tested. To temporarily interconnect the equipment connect a cable between the main port on the tower box and the main port on the base unit. Also connect a cable from test port connector to the test port connector**.** Using the front panel display interface place the unit in the bypass mode. When the system enters the bypass mode there should be an RF signal path between the front panel test port on the base unit and the antenna port on the tower top box. Note that after 1 minute of being in the bypass mode the system will automatically switch back to normal operation.

AMPLIFIER TERMINATION

The input of the tower top amplifier can be switched to an internal 50 Ohm load for diagnostic purposes. As part of bench testing the system this function needs to be tested. To temporarily interconnect the equipment, connect a cable between the main port on the tower box and the main port on the base unit. Also connect a cable from test port connector to the test port connector**.** Using the front panel display interface place the unit in the terminate mode. The system will switch the input of the tower top amplifier to the internal load. Note that after 1 minute of being in the terminate mode the system will automatically switch back to normal operation. Signals applied to the antenna port of the TTA will be greatly attenuated in this mode.

INSTALLATION

The following sub-sections of the manual discuss general considerations for installing the system. All work should be performed by qualified personal. TX RX provides the base control unit and tower top amplifier box. All additional parts required for installation must be supplied by the customer. Before mounting the tower top box we recommend that you record the model number and serial number of the unit for future reference in the event you need to call the factory for customer service support.

NOTE

Proper installation of this system requires the installation of a test transmission line in addition to the main transmission line for system testing and diagnostics.

Installing the System

Installation of the TTA system should follow the installation standards listed in **Figure 10 and 11**. Installation and grounding of the system should follow the R56 standards. Lightning surge suppressors are incorporated throughout the system. In addition, surge suppression is also provided for all cable connections within the tower top box. Proper grounding techniques MUST BE observed for these devices to perform properly.

Installing the Tower Top Unit

The tower top box has a mounting plate on the back of the unit to allow for fastening to the tower, refer to **Figure 12**. *Because of the varied tower types, the customer must fabricate the interface brackets between the tower frame and the unit*. To install the tower top unit perform the following steps.

1) Mount a receiving antenna on the tower.

2) Run the main transmission cable and test cable up the tower.

3) Mount the tower top unit on the tower at a location near the antenna and connect the antenna feedline, main transmission line, and test line to the unit.

4) Connect the tower top box ground lug to a good solid ground on the tower.

NOTE

To insure stability, it is important to securely fasten the box to the tower. The box must be mounted with the connectors and moisture openings facing **downward** to prevent water entry. After connecting the main transmission line, test line, and the antenna feedline, we recommend that the connections be tightly wrapped with rubber splicing tape (see **Figure 13**). This will help prevent water entry into the cables. Start the wraps on the cable several inches away from the connector and wrap **towards** the connector, this will prevent water from seeping in between the wraps of tape. Cover the connectors completely with tape.

In-building Lightning Arresters

Lightning arresters must be installed in the equipment room one each for the main and test transmission lines. The following steps are required for proper installation.

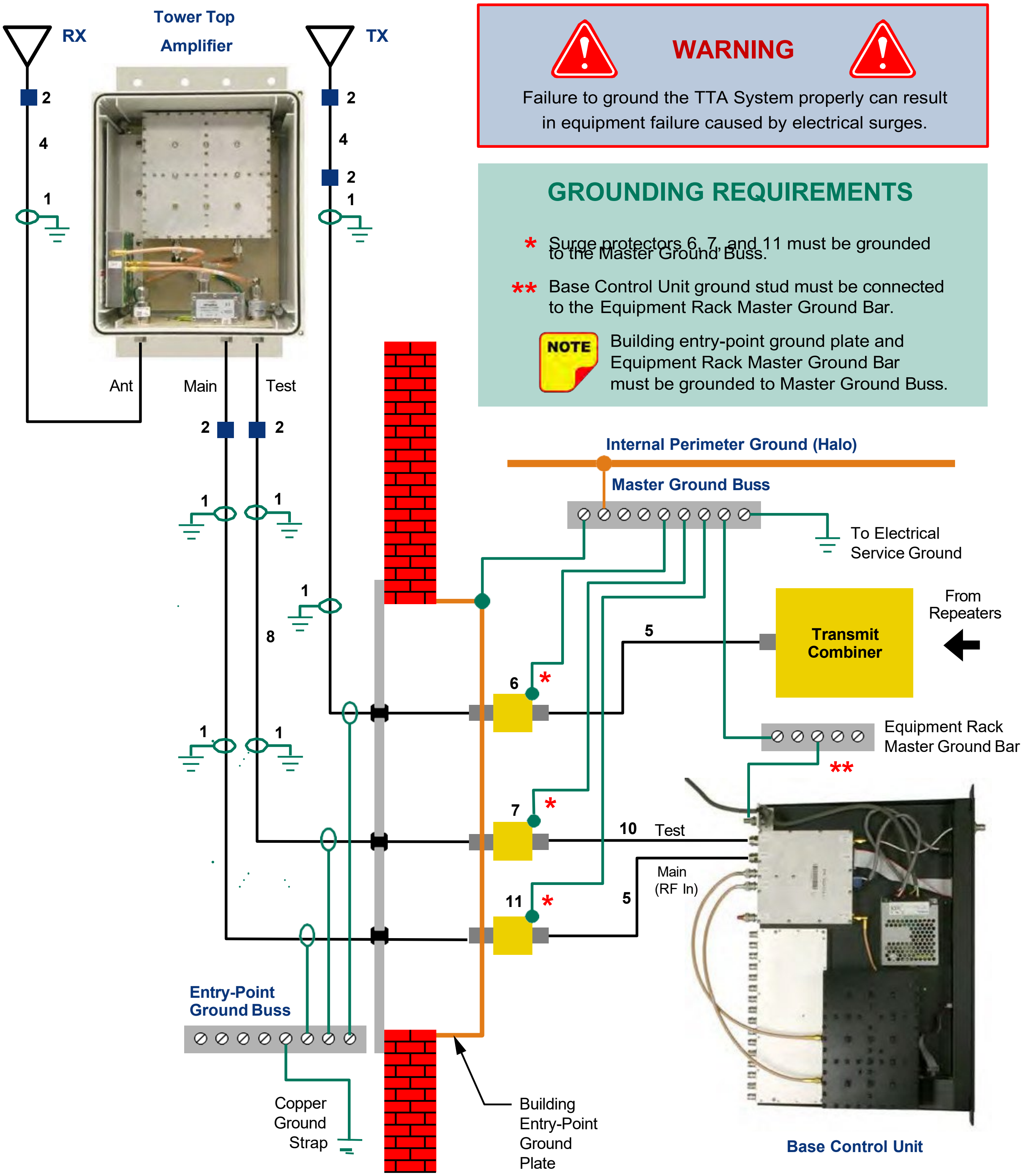

Figure 10: System installation guidelines.

INSTALLATION STANDARDS

1. Main transmission, test transmission, and antenna lines grounded at top, base, shelter entrance and every 75 feet.
2. All external cable connections weatherproofed.
3. Hoisting grips used every 200 feet per mainline.
4. 1/2" LDF cable from each antenna to its mainline or tower top amplifier.
5. 1/2" Superflex for all internal RF runs.
6. Lightning Arrester on TX Line. (Customer Supplied)
   PolyPhaser part number TSXDFMBF (Female/Male)
   PolyPhaser part number TSXDFFBF (Female/Female)
7. Lightning Arrester on Test Port line. (customer supplied)
   PolyPhaser part number 1090501WA (Male/Female)
   PolyPhaser part number 1090501WD (Female/Female)
8. 1/2 " LDF test port transmission line.
9. Installation and grounding must conform to R56 Standards.
10. 1/4" Superflex, N male to N male.
11. Lightning Arrester with DC and 2.176 MHz Subcarrier pass through. (customer supplied)
    PolyPhaser part number 1090501WA (Male/Female)
    PolyPhaser part number 1090501WD (Female/Female)

GROUNDING REQUIREMENTS

* Lightning Arresters 6, 7 and 11 must be grounded to the Master Ground Buss.

** Base Control Unit ground stud must be connected to the Equipment Rack Master Ground Bar.

NOTE Building entry-point ground plate and Equipment Rack Master Ground Bar must be grounded to Master Ground Buss.

SYSTEM ENGINEER RESPONSIBLE FOR

All mounting hardware

Wall feed-through hardware

Figure 11: System installation guideline notes.

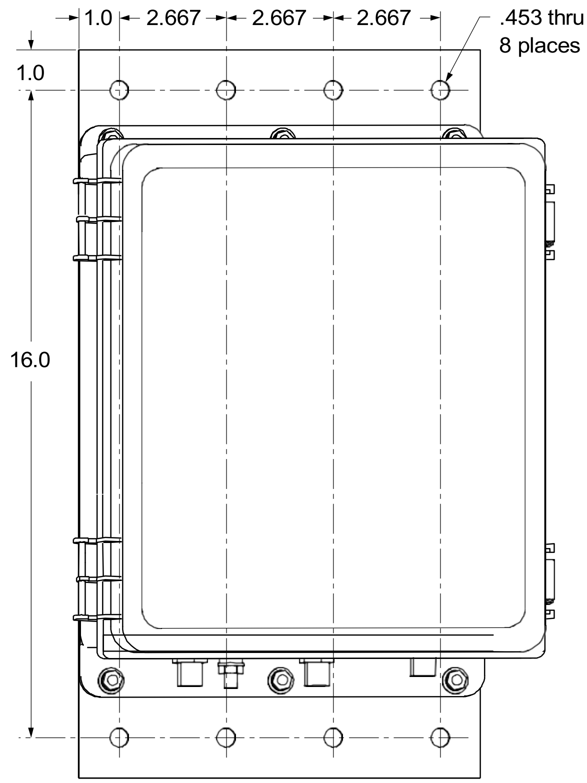

Figure 12: Tower top box mechanical details.

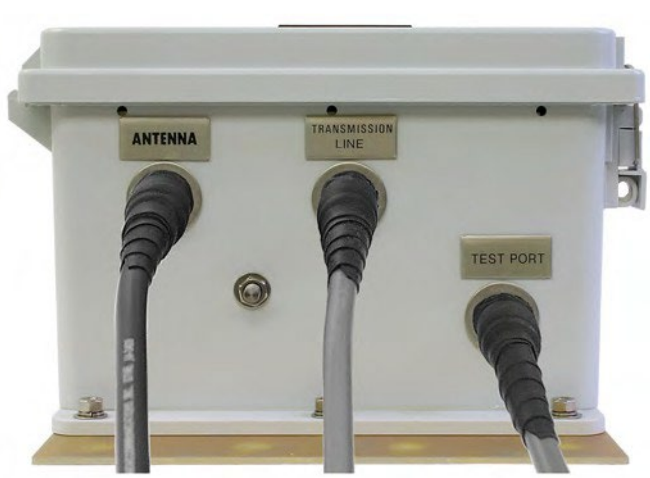

Figure 13: Application of rubber splicing tape. NOTE: Additional waterproofing protection can be realized by covering the rubber tape with either “Scotch Kote” or vinyl plastic electrical tape (“Scotch” brand 33+).

1) For the test line install a lightning arrester. Polyphaser part# 1090501WA (male/female) or 1090501WD (female/female). The chassis of the arrester should be connected to the master ground buss with a pigtail.

2) For the main transmission line install a lightning arrester. PolyPhaser part# 1090501WA (male/ female) or 1090501WD (female/female). The chassis of the arrester should be connected to the master ground buss with a pigtail.

Installing the Base Control Unit

The base control unit is designed for indoor mounting in a common 19-inch relay rack or cabinet. The following steps are required for proper installation.

1) Install the base control unit into the rack or cabinet with four mounting screws found in the hardware kit (part # 3-16509) which is included with your shipment. Make sure you use a nylon washer under the head of the screws in order to protect the front panel. Torque the mounting screws to no more than 15 in/lbs. Overtightening the mounting screws may damage the front panel. For aesthetics a blank panel is included for use above the decks front panel.

2) Connect the base control unit ground lug to the Equipment Rack Master Ground Bar with a pigtail.

3) Connect the main and test transmission cables to the appropriate connectors at the back of the deck.

4) If you have a supervisory alarm system, connect its wiring harness to the alarm terminals at the back of the control unit. Refer to **Figure 14**.

5) Connect the station receivers and optional 16port receiver multicoupler expansion deck to the output ports on the back of the base control unit with high-quality 50-ohm coaxial cable such as 1/4-inch super flexible transmission line. Some flexibility in the jumper cables will prevent strain and possible damage to the connections. We also recommend the use of quality BNC connectors. Unused receiver outputs need not be terminated. However an unused expansion port should be terminated with 50 ohms until connected to an expansion deck.

Interference and IM Considerations

Although TX RX TTA systems are designed for maximum interference immunity, there are many factors that can lead to harmful interference when using a tower-mounted amplifier. It is highly recommended that the receiving and transmitting antennas be vertically separated to maximize antenna isolation.

Although most transmitters are connected to their antenna through a combiner, it is quite likely that the combiner does not have enough transmitter noise filtering to prevent desensitization of the receivers unless there is significant antenna space isolation. Large values of antenna isolation are most easily realized when the antennas are separated vertically. This antenna isolation also helps reduce the possibility of intermodulation interference in the receiving system.

Figure 14: Alarm terminals. Normally open and normally closed terminals are available.

One other important factor that can strongly contribute to interference problems is excessive gain, ahead of the receiver. Excessive gain can cause overdrive to the station receivers when strong signals are present, making them more prone to intermodulation or carrier desensitization problems. Receiver preamplifiers should not be used.

FEEDLINE DATA

As part of the installation process you will need to determine the cable losses for your main and test transmission lines. These loss values can be determined by sweeping the cables or they can be looked up from the cable manufactures specifications. For your system these values will be fixed once the cable type is chosen and cut to length.

Once you have determined the main and test line cable loss for your system this information can be recorded in system memory for future reference in the Feedline Data menu selection. To save the cable loss values in memory perform the following steps.

1) From the default display press the DOWN ARROW button on the front panel to scroll through the menu choices until you reach the FEEDLINE DATA menu.

2) With the FEEDLINE DATA menu displayed press the ENTER button to step down to the MAIN LINE LOSS sub-menu.

3) Use the UP and DOWN ARROW buttons to set the main line loss to the desired value. This storage register works in a forward loop fashion, starting at 0.0 and increasing to 9.9. A button press after 9.9 returns the setting back to 0.

4) After setting the main line loss value press the ENTER button to return back to the FEEDLINE DATA menu. This will save your setting choice.

5) With the FEEDLINE DATA menu displayed press the ENTER button to step down to the MAIN LINE LOSS sub-menu. Press the UP ARROW button to move to the TEST LINE LOSS sub-menu.

6) Use the UP and DOWN ARROW buttons to set the test line loss to the desired value. This storage register works in a forward loop fashion, starting at 0.0 and increasing to 9.9. A button press after 9.9 returns the setting back to 0.

7) After setting the test line loss value press the ENTER button to return back to the FEEDLINE DATA menu. This will save your setting choice. Then pressing the CANCEL button while at the FEEDLINE DATA menu will return you to the default display.

OPTIMIZING THE SYSTEM

In the TTA system the first stage of amplification is in the tower top box which is used to overcome the main line loss, develop the noise figure, and the TTA Net Gain. The second amplifier, located on the base control unit is used to overcome the losses associated with distribution. When the tower top amplifier system is installed there are detailed adjustments and test procedures which must be followed in order to insure optimum performance of the system. The process includes:

Attenuation Settings
Spectrum Analysis
Operational Tests
  Sensitivity with Load Connected
  Sensitivity with Antenna Connected

Operational testing must be performed in a methodical manner to provide the correct performance evaluation and ensure that the information obtained is correct. For each procedure it is important that the data be recorded accurately and is available anytime assistance is required or when performance is in question. Before a receive system problem is suspected, the appropriate operational tests must be performed. Before operational tests for sensitivity can be verified, the programmable attenuation settings and spectrum analysis must be performed. If these are not correct, the sensitivity and degradation may appear out of tolerance.

ATTENUATION SETTINGS

The system contains programmable attenuators for optimizing the TTA Net Gain and for adjusting the systems receiver multicoupler distribution. Both of these attenuators must be adjusted as part of the system installation. The attenuation adjustments allow the system to maintain maximum protection of the receivers, while obtaining the best sensitivity possible.

TTA Net Gain

TTA Net Gain is defined as the net gain between the input of the tower top LNA and the input of the station receiver. The amount of programmable attenuation that your system requires in order to reach an ideal amount of TTA Net Gain will vary depending on the length of your main transmission line and the loss of the short (pig-tail) cable between the base control unit and the radio.

Setting the Attenuators

The base control unit has two programmable attenuators including the TTA Net Gain Attenuator and the Distribution Attenuator. These attenuators need to be adjusted such that the gain from the input of the tower top LNA to the input of the station receiver equates to **15 dB**.

The TTA Net Gain Attenuator is preset at the factory for 6.0 dB and the Distribution Attenuator is factory preset to 4.0 dB. These settings are appropriate for 0 dB of Main Line Loss and 0 dB of Pigtail loss.

Main Line Loss	TTA Net Gain Attenuator Setting
0	6.0
0.5	5.5
1.0	5.0
1.5	4.5
2.0	4.0
2.5	3.5
3.0	3.0
3.5	2.5
4.0	2.0
4.5	1.5
5.0	1.0
5.5	0.5
6.0	0
Pig-tail Loss	**Distribution Attenuator Setting**
0	4.0
1.0	3.0
2.0	2.0

Note: Values marked in red are the factory preset values.
Note: A TTA system is not required for main line losses of less than 1.5 dB

Table 4: Base Control Unit attenuator settings.

Table 4 indicates how to set the attenuators for any other case.

Attenuator changes are done through software interface via the menu select keys. Your setting will be stored in system memory until you change it again even if the equipment is powered down. To adjust the value perform the following steps.

1) Press the DOWN ARROW button on the front panel to scroll through the menu choices until you reach the ATTENUATORS menu.

2) With the ATTENUATORS menu displayed press the ENTER button to step down to the TTA NET GAIN or DISTRIBUTION sub-menu.

3) Press the ENTER button again to advance to the TTA NET GAIN or DISTRIBUTION adjustment screen. The current value will now be displayed. Use the UP and DOWN ARROW buttons to set it to the desired value. The attenuation setting works in a forward loop fashion.

4) After setting the correct value press the ENTER button to return back to the ATTENUATORS menu. This will save your setting choice. Then pressing the CANCEL button while at the ATTENUATORS menu will return you to the default display.

NOTE

Additional attenuation may be required in cases where carriers are encountered above -35 dBm as measured at the receiver. In such cases 1 dB of additional attenuation is recommended for each 2 dB of signal over 35 dBm. Good sensitivity will never be obtained if the signals entering the system are above -25 dBm.

SPECTRUM ANALYSIS

Obtaining good sensitivity requires an understanding of the levels applied to the receiver. A receiver, like any electronic device, has a dynamic range of operation. As long as this dynamic range is maintained, the specifications of the receiver are maintained. When the levels applied to the receiver exceed this range, the sensitivity, intermodulation rejection, as well as the adjacent channel selectivity will deteriorate. To properly perform a Spectrum

Analysis, a spectrum analyzer must be connected to the output of the multicoupler as if it were a receiver, essentially monitoring what the receiver sees.

Figure 15 shows the equipment interconnections for this measurement while **Figure 16** is a graph which indicates the maximum desired measured signal levels both inside and outside of the transmit and receive bands. TTA filter selectivity and antenna space isolation are the dominant factors that determine the signal levels observed. Excessively strong receive signals indicate the need for additional attenuation in the control unit. There are three areas of the spectrum that must be evaluated:

1) **Receive Band** - The spectrum where the receive frequencies reside must not have carri ers above 35 dBm. These are the carriers that are intended to enter the receiver. If subscribers or control stations are near the infrastructure the levels can be very high. If the levels are above 35 dBM, the gain of the system must be reduced or the source of the high level carrier must be reduced.

2) **Transmit Band** - The highest carrier that the receive system will consistently see is its own transmitter. The preselector of the receive sys tem must adequately remove these carriers to prevent over-drive. The goal of the preselector is to reduce all transmit carriers below -55 dBm. If the level of a transmitter is above -55 dBm the preselector is not adequately performing its job and must be changed.

3) **All Other Frequencies** - The receiver is designed to monitor very low signals and there must be a minimum amount of undesired energy exposure. The preselector has very sharp selectivity and must reduce all carriers outside the bandwidth below -75 dBm except as indicated above.

Procedure for Spectral Analysis

Spectral analysis will verify the signals arriving at the receiver as well as validate the TTA Net Gain adjustment. To perform a spectral analysis of the site follow the steps listed below.

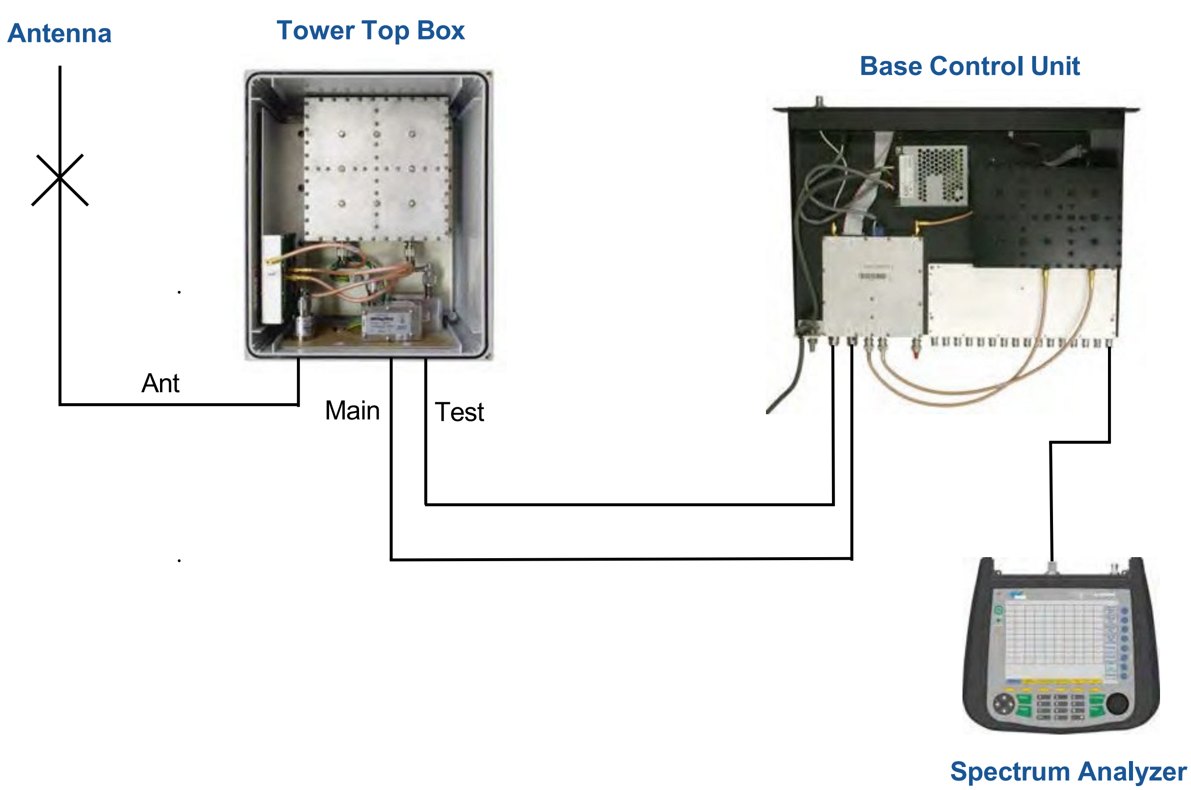

Figure 15: Testing the output spectrum of the system.

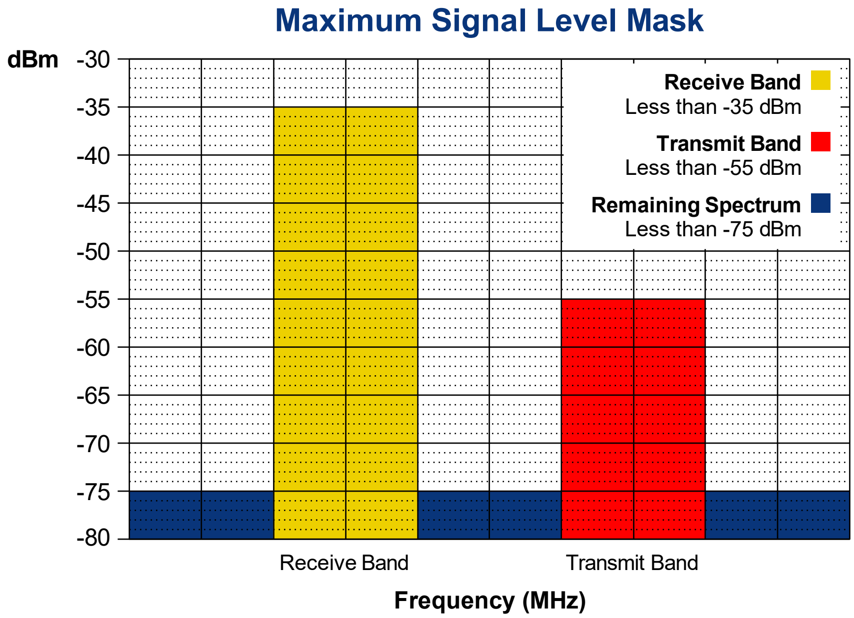

Figure 16: Maximum permissible signal levels of receiver outputs of the base unit.

1) Make sure programmable attenuators are properly adjusted.

2) Connect the spectrum analyzer to one of the output ports of the multicoupler.

3) Setup the spectrum analyzer as follows;

   Span = 700 - 800 MHz
   Resolution = 50 KHz
   RF Attenuation = 0 dBm
   Reference Level = - 20 dBm
   Peak (Max) Hold = ON

4) Monitor the spectrum for 5 minutes (during peak hours).

OPERATIONAL TESTS (SENSITIVITY AND DEGRADATION)

Before sensitivity and degradation can be verified, attenuation adjustments and spectrum analysis must be performed. If these are not correct, the sensitivity and degradation may appear out of tolerance.

The sensitivity tests will measure the full range of performance from the maximum achievable to realworld performance in the presence of RF noise.

These tests are absolutely necessary, not only to insure proper performance, but also to serve as a bench mark for future evaluations and troubleshooting.

Two types of sensitivity measurements will need to be made, static and effective. Static sensitivity is measured without the presence of site noise while the Effective sensitivity measurement includes site noise. The difference between the two is the system degradation.

Front Panel Test Port

The front panel BNC test port is connected to the tower box through the test line allowing signals generated at ground level to be injected into an isolated 30 dB port at the input of each tower top amplifier circuit board. The test port feature provides a convenient means of performing static sensitivity tests of the system.

Tower Top Amplifier Inputs

Under normal operating conditions RF signals pass from the antenna to the inputs of the tower top amplifier. In addition, the input of each tower top amplifier can also be switched to an internal 50 Ohm load for testing purposes. The front panel test port remains connected (through its isolated 30 dB input plus test cable loss) to the tower top amplifiers regardless of whether the amplifiers input is connected to the antenna or the internal load. This allows system sensitivity testing to be done with and without site noise being coupled into the system through the antenna.

Static System Sensitivity

Static sensitivity is the maximum sensitivity achievable because any possible interfering signals are blocked from entering the LNA while static sensitivity is measured. To determine the Static system sensitivity the signal level into the first amplifier must be known. The easiest way to achieve this is to inject a test signal into the Test Port (located on the front panel of the base unit) and measure the BER or SINAD of the test receiver. The static system sensitivity can only be measured while the active tower-top LNA is connected to the internal load. Once you have made the measurement the actual static system sensitivity can be calculated.

Measuring Static Sensitivity (Load Connected)

To test the static system sensitivity through the test port with the internal load connected to the amplifier perform the following steps;

Caution: During this test on-air signals will NOT pass through to the station receivers.

1) The signal generator should be connected to the front panel test port.

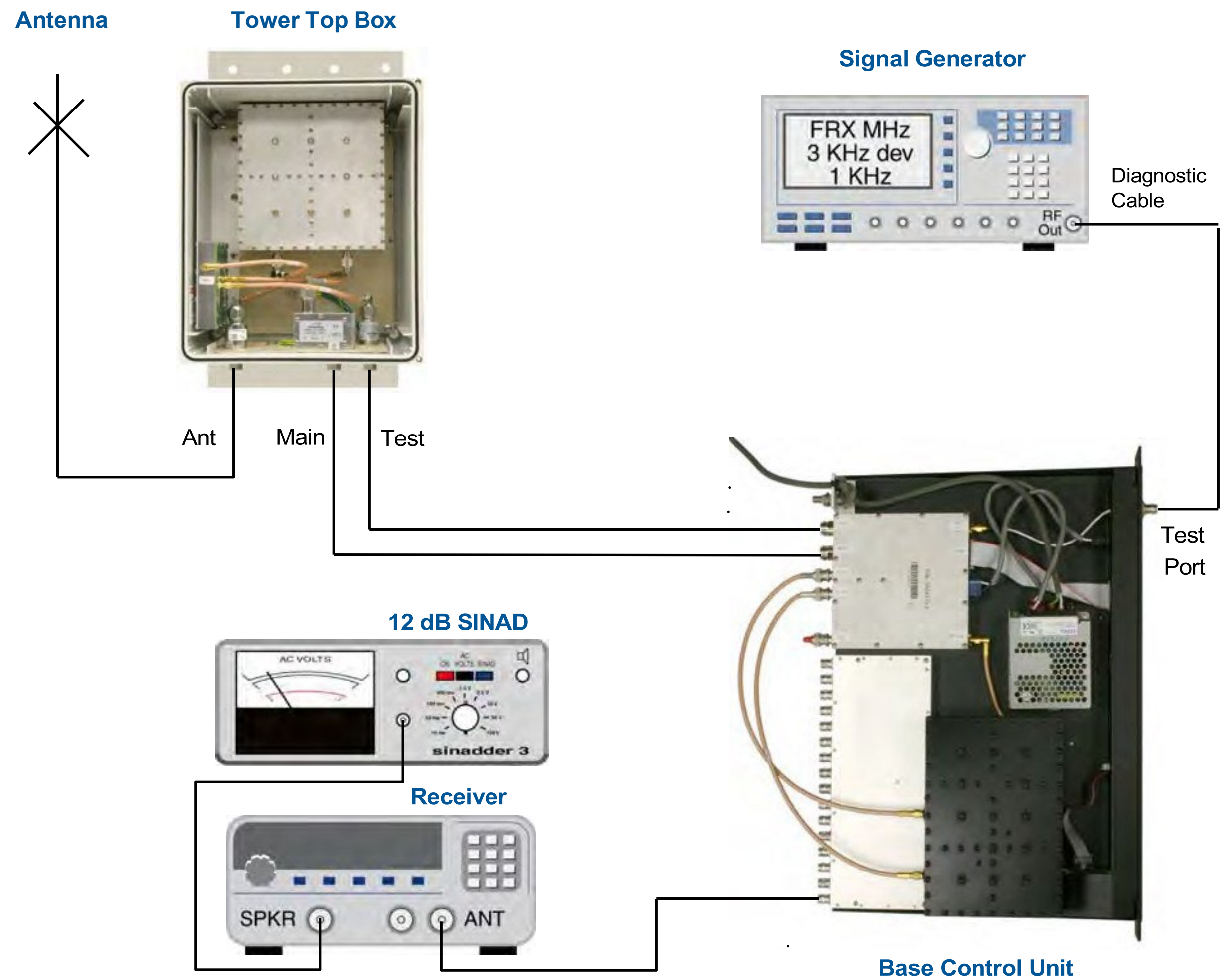

Figure 17: Using the test port to measure sensitivity of the system.

2) Be sure the signal generator is setup for a 3 KHz deviation with a 1000 Hz tone (analog) or proper pattern for BER testing.

3) The test receiver and SINAD meter (or bit error rate meter if appropriate) should be connected to one of the RF outputs at the rear of the base unit. Refer to **Figure 17**.

4) From the default display, use the ARROW buttons to scroll to the TEST menu choice then select the terminate function. The RF signal path through the tower top box will be interrupted and on-air signals will not be passed to the station receivers.

5) Adjust the signal strength from the signal generator until the 12 dB SINAD or 5% BER point is acquired. This determines the systems static sensitivity without the presence of site noise. This value should be recorded in the control unit's memory for future use.

NOTE It is very important that sensitivity always be measured to a recognized benchmark such as bit rate error (BER) or SINAD. Do not use your ear or other subjective techniques.

NOTE If left unattended, after about 1 minute the input of the active amplifier will automatically switch back to the antenna and on-air signals will again pass through to the station receivers.

6) From the default display, use the ARROW buttons to scroll to the SENSITIVITY menu choice then press the ENTER button.

7) Use the ARROW buttons to scroll over to the STATIC W/LOAD menu choice and press the ENTER button.

8) Use the ARROW buttons to dial in the static sensitivity value (from the signal generator) and press the ENTER button to save the information in memory. By storing the sensitivity value at the time of installation it can be compared with future tests and used as an indication of system degradation or failure. In general, the sensitivity measured with the antenna will be less than that measured with the load unless site noise is at a minimum.

NOTE The sensitivity value measured in step 5 is less (30 dB plus Test Line loss) than the actual sensitivity value.

Effective System Sensitivity

The Effective System Sensitivity is the sensitivity as seen by the subscriber. This represents the talk-in coverage component of the infrastructure. To determine the Effective System Sensitivity the signal level into the first amplifier must be known. The easiest way to achieve this is to inject a test signal into the Test Port (located on the front panel of the base unit) and measure the BER or SINAD of the test receiver. The effective system sensitivity can only be measured while the active tower-top LNA is connected to the antenna. Once you have made the measurement the actual effective system sensitivity can be calculated.

Measuring Effective Sensitivity (Antenna Connected)

The Effective system sensitivity should be taken under normal conditions as well as with all transmitters producing full power. All transmitters keyed will show the worst case situation. To test the systems effective sensitivity through the test port with the antenna connected to the amplifiers perform the following steps;

1) The signal generator should be connected to the front panel test port.

2) The test receiver and SINAD meter (or bit error rate meter if appropriate) should be connected to one of the RF outputs at the rear of the base unit.

3) Under normal conditions the antenna is connected to the amplifiers so no software interactions are required. Be sure the signal generator is setup for a 3 KHz deviation with a 1000 Hz tone (analog) or proper pattern for BER testing.

4) Adjust the signal strength from the signal generator until the 12 dB SINAD or 5% BER point is acquired. This determines the systems sensitivity in the presence of site noise. Record this value in the control unit's memory for future use.

5) From the default display, use the ARROW buttons to scroll to the SENSITIVITY menu choice then press the ENTER button.

6) Use the ARROW buttons to scroll over to the REFERENCE W/ANT menu choice and press the ENTER button.

7) Use the ARROW buttons to dial in the effective sensitivity value and press the ENTER button to save the information in memory. By storing the sensitivity value at the time of installation it can be compared with future tests and used as an indication of system degradation or failure.

NOTE

The sensitivity value measured in step 4 is less (30 dB plus the Test Line loss) than the actual sensitivity value.

Degradation

The difference between the static sensitivity (load-connected) and the effective sensitivity (antenna-connected) is the system degradation which can be caused by noise or interference (such as a user on an active channel). At 900 MHz it is unusual to have degradation greater than 2 dB (and even this is rare). The degradation value should be recorded for future reference. Degradation levels in excess of 1 to 2 dB should be investigated, as this will decrease the range and performance of the system.

ROUTINE OPERATION

During normal operation only one of the two tower top amplifiers ("A" or "B"), and the base control unit amplifier ("BASE"), are used to amplify the received RF signals. The LED's for the active amplifiers will illuminate green. The remaining tower-top amplifier will be in stand-by mode, which is indicated by its LED being off. The system software also provides an indication of which tower top amplifier is active. From the default display use the ARROW button to scroll down to the LNA X ACTIVE menu which will display the currently active tower top amplifier.

Upon power-up, the system defaults to operation on the "A" tower top amplifier and the "BASE" amplifier in the base control unit is always on. Operation can be manually switched to the "B" tower top amplifier by pressing the "B-SELECT" switch, which is located below the "B-Status LED" on the control unit front panel. The "B-Status LED" will begin to flash, then press the ENTER button to finalize the selection.

NOTE

If necessary the system can be re-initialized via software interaction. From the default display use the ARROW button to scroll to the INITIALIZE menu then press the ENTER button.

Amplifier Monitoring

The system continuously monitors the current being drawn by the amplifiers and reveals the status of the amplifiers in three ways: LCD Display, front panel LED's and Form-C contacts ("screw terminals").

LCD Display

The LCD display provides extensive status information through the menu system including the current draw of all amplifiers, connection of the test transmission line, the tower top box temperature, and installed software version level.

CURRENT DRAW

Typical displayed values for each of the system amplifiers are listed in **Table 5**. The current value for any amplifier can be read from the display by using the ARROW buttons to scroll down from the default display. The A and B tower top amplifiers current draw are shown on one menu display and the BASE amplifier current draw on another.

Amplifier	Displayed Value
TTA Amp A	~440 mA
TTA Amp B	~440 mA
Base Amp	~980 mA

Table 5: Typical current readings.
Note: An inactive amp will show about 0 mA.

TTA TEMPERATURE

The temperature of the tower top box can be read from the display by using the ARROW buttons to scroll down from the default display to the TEMPERATURE sub-menu. The recommended normal operating temperature range for the tower top box is -30 to +60 degrees Celsius. The tower top amplifier will function up to +70°C without shutting down. However, the specifications are not guaranteed.

SOFTWARE VERSION

There are micro-controllers located in both the tower top box as well as the base unit so there are two software versions in the system. Both the BASE and TOWER software version can be read from the display by using the ARROW buttons to scroll down from the default display to the SOFTWARE VERSION sub-menu.

Front Panel LEDs

Status indicator LED's for all the amplifiers illuminate in one of two colors; green for normal operation and red for alarm condition. During normal operation, the LED's for amplifier A and the BASE amplifier will glow green, indicating normal current draw. The LED for amplifier B will be off indicating this amplifier is in stand-by.

Form-C Contacts

The ALARM Form-C relay contacts are located at the back of the control unit. These terminals are intended for connection to the customer's supervisory and data acquisition system. Both normally open and normally closed contacts are available. When power is applied to the control unit the CPU will energize the relay and the common terminal will then be connected to the normally closed terminal. This is the normal mode of operation. When an alarm condition occurs the CPU will de-energize the relay and the contacts will change state indicating the alarm condition. **Figure 18** is a schematic representation of the Form-C contacts functionality. The contacts are shown in the drawing in the de- energized state.

Specifications for the Form-C contacts are: Nominal switching capacity (resistive load) of 2 Amps @ 30 VDC or 0.5 Amps @ 125 VAC, and Maximum switching power (resistive load) of 60 Watts.

ALARMS

The system will alarm when an abnormal current flows in any of the systems three amplifier assemblies. The specific devices front panel LED will glow a solid red. The alarm Form-C contacts located at the back of the unit will also change state. In addition, a loss of serial communications between the base unit and the tower top box will cause both the A & B LED indicators to flash red.

Fault detection circuitry continuously monitors the DC power operation of the primary tower top quad-amplifier and automatically switches to the identical secondary quad-amplifier if conditions indicate a primary malfunction. When the current to any of the three amplifiers deviates from normal amplifier switching will take place in the tower top box if the fault lies with one of the tower top amplifiers. There is no switching provision for the amplifier in the base control unit because there is only one quad amplifier on the deck.

SYSTEM TROUBLESHOOTING

System problems fall under these main categories:

1) Performance problems characterized by poor receiver sensitivity and possibly accompanied by activation of the alarm system. RF interference or component problems can be the cause.

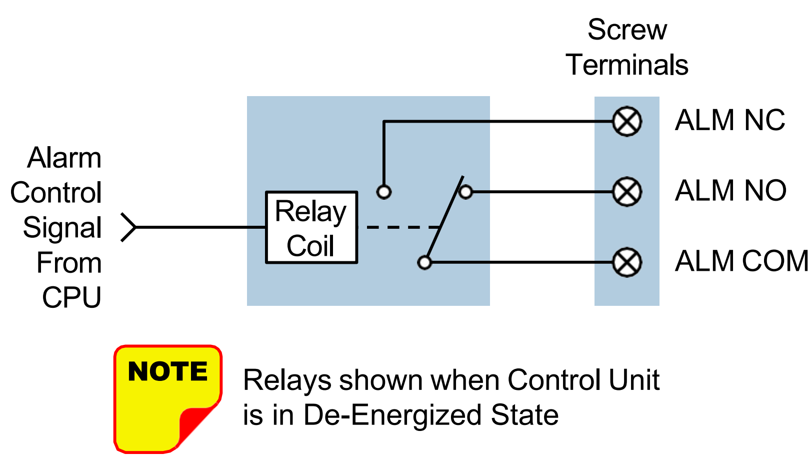

Figure 18: Schematic representation of the Form-C contact functions.

2) Hardware problems.

3) Power Supply.

Performance Degradation

Most performance difficulties manifest as an intermittent or continuous loss of effective receive channel sensitivity sometimes accompanied by audible interference in FM systems or dropouts in digital radios. Sensitivity loss on a continuous basis is more likely to indicate a hardware problem which may produce an alarm condition. **Table 6** is a troubleshooting guide that is read from top to bottom to narrow down the possible causes. The guide contains both symptoms and suggested tests as outlined earlier in this manual. Both the measurement of sensitivity and observation of the output spectrum are key tests along with the presence of any alarm condition.

Hardware Problems

Two of the most common reasons for TTA alarms are direct lightning strikes and vandalism. Even though the system is designed with redundancy so that likely-to-fail components have backups, it is possible to shut the system down, especially if a common component such as a transmission line or antenna is damaged.

LIGHTNING & LIGHTNING ARRESTERS

The tower box uses three lightning arresters: one on the antenna port, one for the main transmission line and one for the test line. Although no practical amount of protection can prevent catastrophic failure as the result of a direct hit, the lightning arresters are very effective in preventing damage from nearby strikes and smaller direct hits. Lightning arresters do not last forever and can eventually fail, especially after a strong hit. A damaged arrester can cause low gain with known-good A & B amplifiers. An arrester with lightning damage will exhibit increased insertion loss, poor return loss, and may appear as a DC short on the main or test lines.

VANDALISM

Damage to the TTA caused by hunters or target-shooters in remote locations is not uncommon. Penetrating bullets may open or short transmission lines. Operating voltages are applied to the tower top box by the main transmission line. In addition, the main transmission line carries RF, tower box operating voltage, and serial communications, so

Loss of Sensitivity (Intermittent / Continuous)

Individual Receive Channel(s) affected		All Receive Channels affected	
Intermittent	Continuous	Intermittent	Continuous
Measure Sensitivity	Measure Sensitivity	Measure Sensitivity	Measure Sensitivity
Small to moderate loss of sensitivity	Small to severe loss of sensitivity	Small to moderate loss of sensitivity	Small to severe loss of sensitivity
Do spectrum analysis	Do spectrum analysis	Do spectrum analysis	Do spectrum analysis
Two or more carriers > 35 dBm when desense occurs	On-channel TX stuck on and visible in spectrum.	One carrier > 35 dBm when desense occurs then Carrier Desense Interference likely.	Possible Alarm condition
Other-channel modulation heard in FM system or dropouts in digital system	Defective cable / connector / Receiver	Carrier(s) < 35 dBm when desense occurs then Transmitter Noise Interference likely.	Check operation with amplifier A and B. Failed amplifier gives low sensitivity on 1 amplifier only.
Intermodulation Interference likely			If operation is the same on amplifier A or B, Defective common component is likely

Table 6: Troubleshooting Guide for TTA systems with degraded performance. Shaded blocks indicate common possible cause.

serious damage to this cable can prevent system operation. The system will operate normally if the test transmission line becomes damaged but there will be a loss of system testing and an alarm will be continuously set.

AC Line Fuse (110 VAC model)

A failure of the power supply will obviously shut the tower amplifier down because of high signal loss through the tower box and control unit. The power supply is located on the control unit chassis and has a replaceable 250 volt, 2 amp fuse for the AC line. The supply has a green status LED located next to the connectors which illuminates when the supply is turned on. The 48 VDC model uses a DC-DC converter instead of a power supply assembly.

PERIODIC MAINTENANCE

The following procedures can be followed as part of a periodic maintenance program.

1) TX RX recommends that tests for establishing the performance level of the system, as outlined in this manual, be performed every six months.

2) Because it is possible that the current alarms *may not* detect a fault affecting RF gain, we recommend measuring system sensitivity every six months and comparing this value against the recorded value.

3) A yearly inspection of the tower box is also recommended. Inspect and tighten any loose connectors or other hardware.

4) All feedline connections should be inspected for tightness and waterproofing integrity. Water seeping into the transmission lines will cause system degradation.

RECOMMENDED SPARE PARTS

There are no recommended spare parts for the TTA system.

OPTIONAL EQUIPMENT

Optional equipment can be purchased from TX RX in order to increase the performance of your TTA system. This includes a multicoupler expansion deck. The multicoupler expansion deck will increase the total multicoupler outputs to 32.

Multicoupler Expansion Deck

The multi-coupler expansion deck (part number 75-83K-01) includes a 16-way divider mounted on a 19 inch deck as shown in **Figure 19**. The divider is designed to be connected to the expansion port output on the back of the base unit. With this option installed, a total of 32 system receivers can be connected, with the system gain remaining constant for all receivers. A cable is provided for connecting the expansion deck to the base unit. It is recommended that the multicoupler expansion deck be mounted in the same rack just beneath the base unit. The optional multicoupler expansion deck will require 1 “rack unit” of space.

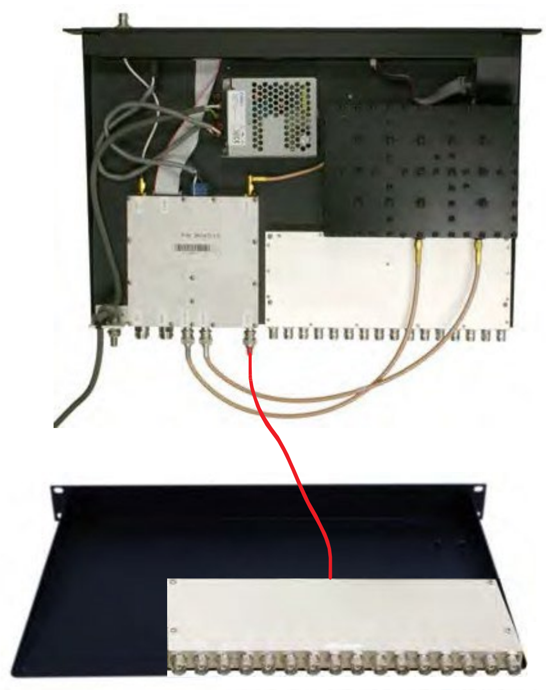

Figure 19: Multicoupler Expansion Deck model number 75-83K-01.

ETHERNET CONNECTIVITY

The TTA offers web-based Ethernet connectivity via the front panel LAN port. The LAN port will need to be connected to the internet by the customer using a standard CAT-5 cable. The IP address of the base control unit will need to be changed from the factory default setting to an address suitable for the customers network. The factory default IP address for the base control deck is **“192.168.1.1”** and the factory default subnet mask is **"255.255.255.0"**. The customer should consult with their IT department for recommendations on setting a new IP address. The initial customer interface to the deck should be done with a laptop computer at the time of installation. Specific instructions for initially direct connecting a laptop are given in **Appendix A** at the back of this manual. The remaining discussions in this manual assume the initial Ethernet connection to the front panel is completed and the base control deck has been set to a suitable IP address.

Dashboard Submenu

Once your laptop computer is properly connected to the base control deck the password prompt will appear as in figure 21. Type in the default username "admin" and password "admin" (no spaces and all lower case letters) and then click the Authorize button. The Dashboard display will appear.

On the left-hand side of the screen are a list of the major submenus available to the user including Dashboard, Site Setup, Alarm and Raw Readings. Place the cursor over a particular submenu heading and left click to make a selection. Each page contains a group of related functions.

The top heading of the dashboard shows the configured site name. Site name indicates the location of the TTA and can be modified via the 'Site Setup' submenu.

On the top right-hand side there is a down arrow 'heartbeat' indicator and an alarm bell showing the number of active alarms. 'Night mode' or 'daylight mode' can be selected by clicking the moon indicator. Any setting <u>underlined</u> in green can be changed. Non-underlined values are for informational purposes. Refer to Figure 22 during the following discussion of the dashboard page.

Amplifier Status

The amplifier status box indicates the current readings of the tower top low noise amplifiers and the base unit and the alarm thresholds for each. Alarm thresholds are calibrated during assembly and cannot be changed. Amplifiers can be activated or placed in Bypass mode by selecting the control field and editing the value. Placing either amplifier in Bypass mode forces the other amplifier into Bypass. Exit bypass mode by setting either Amp A or Amp B 'Active'.

Status

The status box gives an indication of communications to the ethernet communications processor within the Base Control Unit, and communications to the tower amplifier. The rear-panel alarm relay output can be enabled or disabled by using the Alarm Relay setting.

Information

The information settings reflect the front-panel configuration settings as stored during setup. Firmware versions for tower, base, and ethernet comms are also displayed.

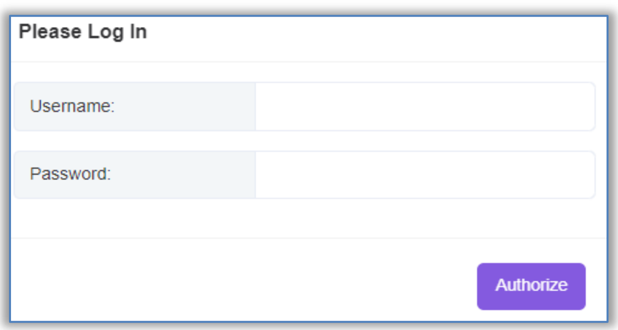

Figure 20 - Login screen

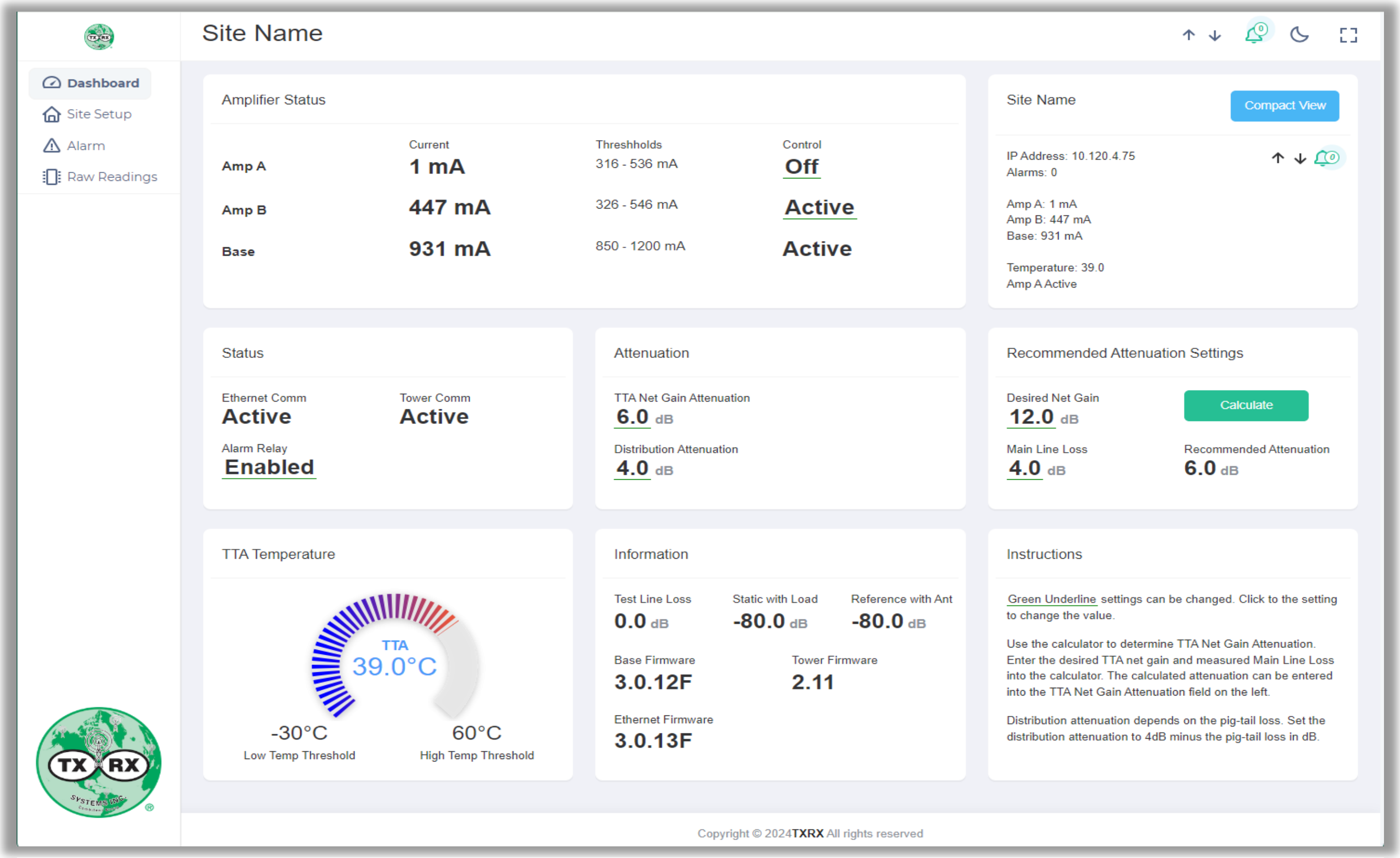

Figure 21 - Dashboard Submenu

Attenuation Area

The attenuation area allows the user to view the current settings of the attenuators and the mainline loss. This section of the web page interface also allows the user to adjust the settings. There are recommended values presented to help the user optimize the TTA system setup.

Main Line Loss (dB) - this is the user determined loss associated with the main line cable. The present value is shown which is taken from the Main Line Loss register found under the Feedline Data submenu on the front panel. Refer to the menu system flow chart (figure 8). Notice that the Main Line Loss register is one of the yellow highlighted boxes on the menu diagram.

Desired Net Gain (dB) – this is the net gain desired by the user. Entering a Desired Net Gain value and clicking 'Calculate' provides a recommended value to be entered in the TTA Net Gain Attenuation field.

Recommended Attenuation (dB) - This is the calculated recommendation for the correct TTA Net Gain setting in order to achieve an optimized TTA system. Optimization is achieved when there is 15 dB of system gain (called TTA Net Gain). The calculator does not change actual gain values – users should manually enter the Recommended Attenuation into the TTA Net Gain Attenuation field on the left.

Distribution Attenuation (dB) – The Distribution Attenuator is used to adjust for differing amounts of pigtail loss depending on site layout. The factory default setting for this attenuator is 4.0 which is optimal when your pigtail loss is close to zero (suitable for most installations). If the pigtail loss at your site is greater than about zero then decrease the Distribution Attenuator accordingly. Refer to the attenuator setting chart shown in table 4.

TTA Net Gain Attenuation (dB) - This is the current setting of the TTA Net Gain Attenuator in the base control deck. The present value shown is taken from the TTA Net Gain register found under the Attenuators submenu. Refer to the menu system flow chart (figure 8). Notice that the TTA Net Gain register is one of the yellow highlighted boxes on the menu diagram. Changes to the TTA Net Gain Attenuation on the web interface will be reflected on the front panel menu and vice-versa.

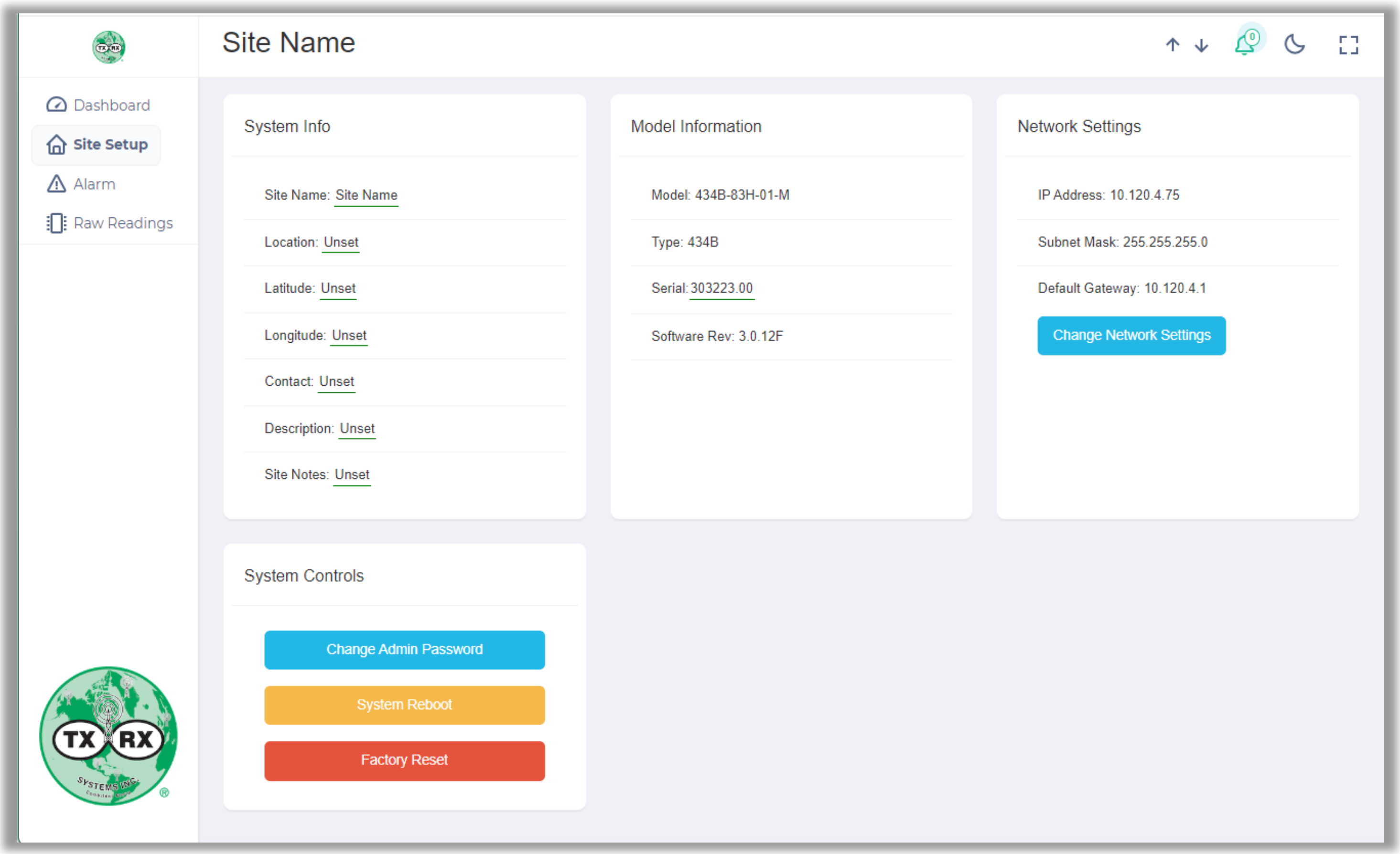

Figure 22 - Site Setup Submenu

Site Setup Submenu

The Site Setup submenu provides general information about the Base Control Unit

System Info/Model Information

The system info and model information sections contain notes about the site for reference.

Network Settings

Use the 'Change Network Settings' button to configure the IP network addresses. The 434B does not use DHCP (Dynamic Host Control Protocol) for automatic IP address assignment, instead a static IP address must be assigned.

NOTE

The Change Network Settings button may be inactive if the web browser window is too small. If the button does not open a sub-window, try manually growing or shrinking the browser window.

System Controls

Use the 'Change Admin Password' button to update the login password from the factory default. 'System Reboot' will reboot the Base Control Unit, which can affect radio performance. (Attenuator settings will be briefly reset during the boot cycle.) 'Factory Reset' forces all parameters to factory defaults.

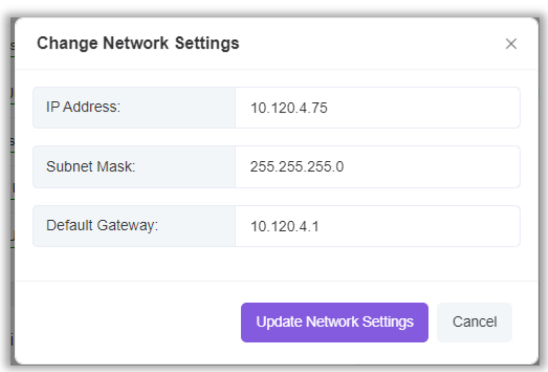

Figure 23 - Change Network Settings

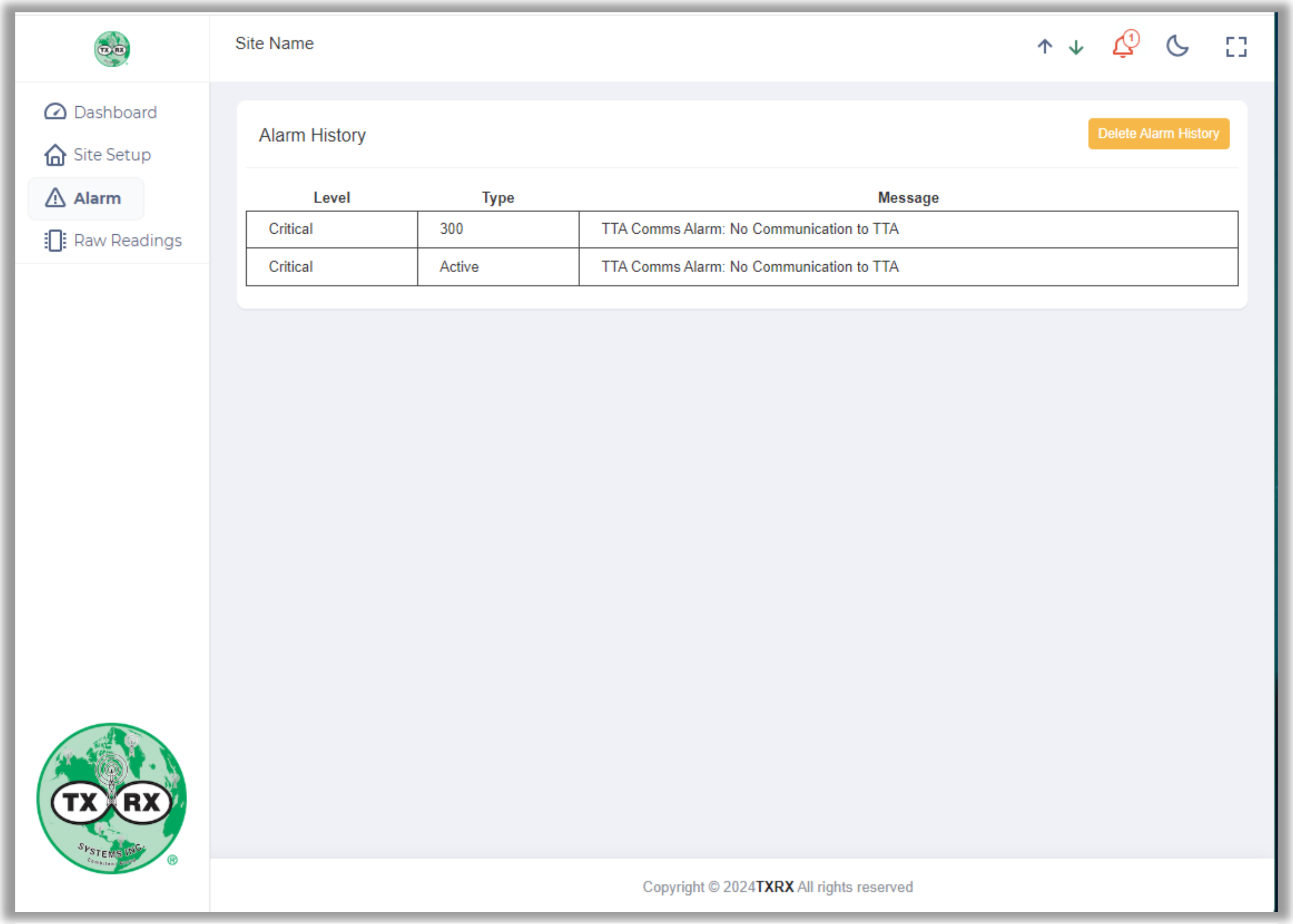

Figure 23 - Alarm History Submenu

Alarm History

The Alarm history submenu shows detailed information regarding alarms requiring user action. 'Active' alarms are alarms which have not yet been resolved by the customer. A button is available to permanently delete historical alarms.

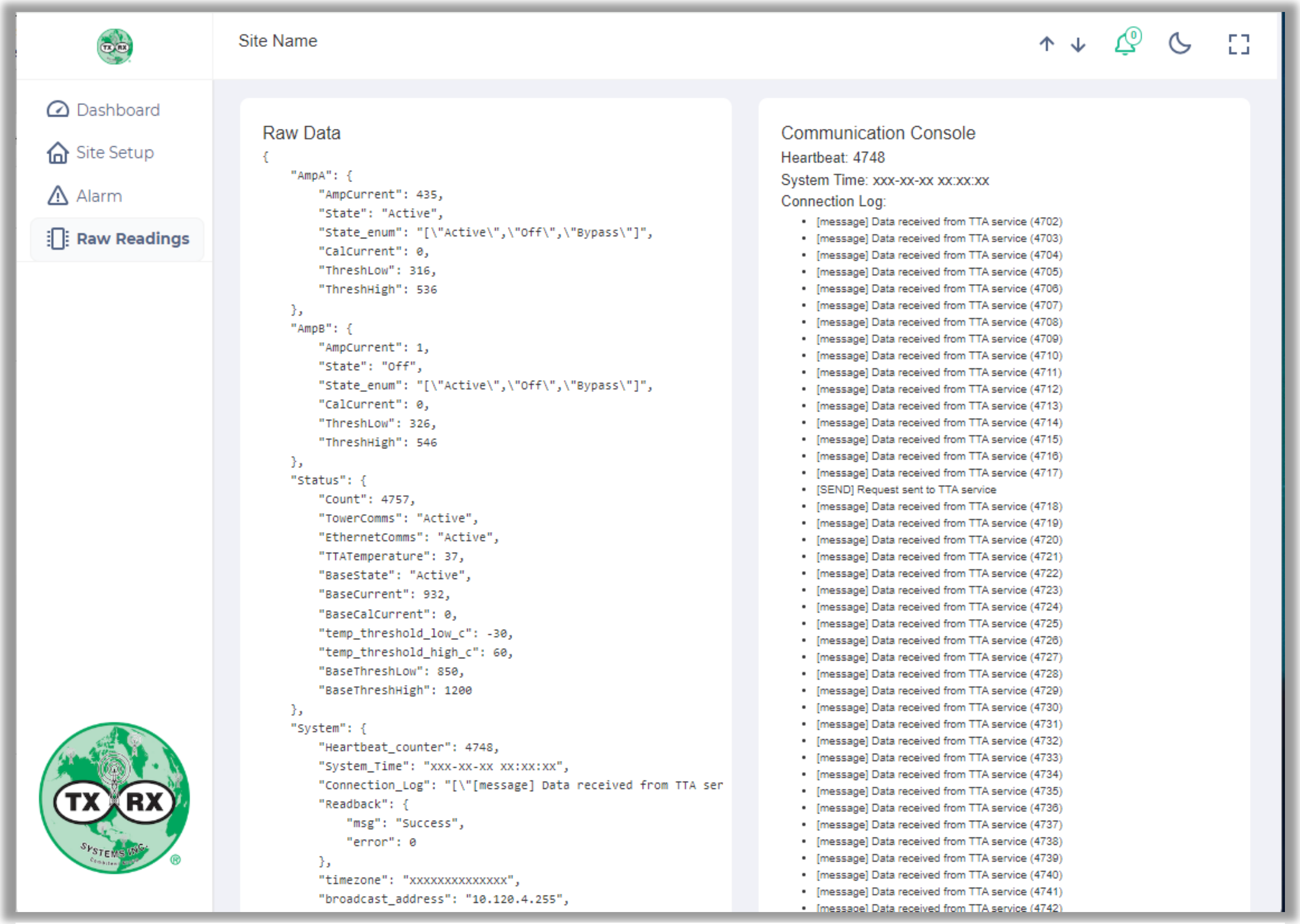

Figure 24 - Raw Readings Submenu

Raw Readings

The Raw Readings submenu provides diagnostic data regarding the state of the system. These raw readings may be useful when contacting TX RX support.

NOTE Some raw readings have nonsensical or unused values due to differences in features between various TX RX TTA products.

APPENDIX A
Ethernet Connectivity

The LAN connector on the front panel of the deck provides for 10/100 BASE-T Ethernet connection using the TCP-IP or DNS protocol. The control unit deck is shipped from the factory with a default TCP/IP address of "**192.168.1.1**". A direct connection (at the installation site) should be established the first time you interface to the web interface using the fixed IP mentioned above. Once the initial communications are established the IP address in the deck can be changed to permit a connection to the internet. The initial direct connection should be made with an Ethernet crossover cable. **Figure A1** shows the pinout for a CAT-5 crossover cable.

LINK LED (left side)		**ACTIVITY LED** (right side)	
Color	Meaning	Color	Meaning
Off	No Link	Off	No Activity
Amber	10 Mbps	Amber	Half-Duplex
Green	100 Mbps	Green	Full-Duplex

Table A1: LAN port status LED's

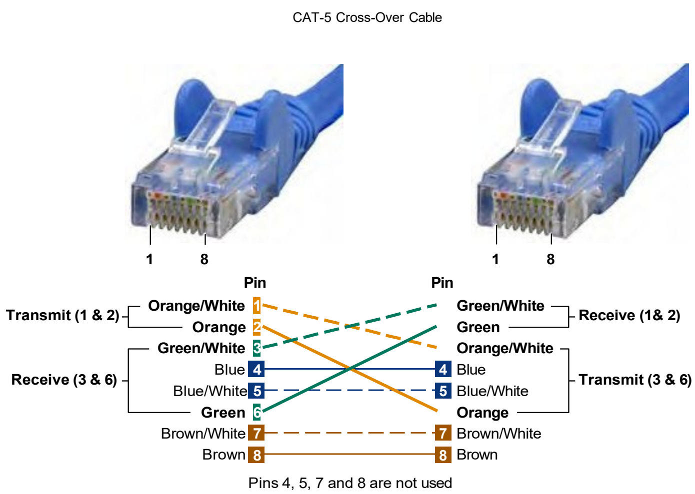

Figure A1: CAT-5 Crossover cable pinout.

Procedure

To direct connect your laptop computer to the LAN port on the deck perform the following steps;

1) Connect your laptop network port to the LAN connector on the deck using a standard CAT-5 Crossover cable.

NOTE The front panel LAN connector has two built-in bi-color status LED's which will aid you in establishing communications. The meaning of each LED is shown in **Table A1**.

2) The left-most (LINK) status LED built-in to the LAN port connector should illuminate amber or green indicating that a good physical connection is established between your computer and the TTA. After a few moments of initialization the right-most LED should flash occasionally.

3) Insure that your laptop's IP address is compatible with the default address of the deck. This may require changes be made to the Ethernet adaptor address on your laptop (refer to **Appendix B**). Your laptop's IP address will need to be set to **"192.168.1.2"** along with a subnet mask of **"255.255.255.0"**. The right-most (ACTIVITY) status LED built-in to the LAN port connector will turn amber or green and flash occasionally indicating good TCP-IP communications are established between the laptop and the control unit.

4) Launch your web browser software on the laptop.

5) In your web browsers address box type-in the IP address of the deck "http://192.168.1.1" and press the ENTER button. The home screen (System Summary) of the SNMP feature should appear in your laptop's browser window.

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