3.7 Antenna Installation & Alignment

INSTALLER CAUTION: Antenna(s) used for this transmitter must be fixed-mounted on outdoor permanent structures with a separation distance of at least 1.5 meters from all persons during normal operation. Users and installers must be provided with antenna installation instructions and transmitter operating conditions, including antenna co-location requirements of 1.1307(b)(3), for satisfying RF exposure compliance.

The antenna installation consists of permanently mounting the antenna to the mast/pole/tower and then attaching the ODU mounting plate and then the ODU itself to the mount. The antenna and ODU assembly must be mounted outdoors on a tower, building roof, or other location that provides line-of-sight path clearance to the far-end location. In general, antennas smaller than 2.0 feet diameter are not recommended.

Antennas should be ordered with the suitable mounting kit specific to the site requirements. The antenna must be very rigidly mounted, with adequate room for azimuth and elevation adjustment from the rear. The antenna polarization must be the same at both ends of the link, either vertical or horizontal. The mounting kit includes the details on how to mount and adjust azimuth and tilt. Here, the details on how to mount the adapter plate and ODU are described. Be sure to have all the necessary tools available (see section 3.4) before mounting the antenna and ODU.

In general, antenna mountings require a support pipe to which upper and lower support brackets are attached with "U" bolts. The antenna and optional elevation and azimuth adjustment rods are then mounted onto the support brackets. The whole structure must be adequately grounded for lightning protection. The antenna system must always be installed according to the manufacturer's instructions.

Unless special test equipment is available, two operating *Lynx* radios are required to align the antennas. The antenna is coarse aligned using visual sighting and then fine aligned using the receive signal level (RSL) voltage of the *Tsunami*. See figure 3-7.

The RSL voltage reading can still be used to peak antennas even if the radios have not synchronized, however far-end RSL cannot be measured from the near-end terminal until radios are synchronized.

3.7.1 Mounting plate to pole mounting assembly:

Refer to the diagrams below and figures 3.1, 3.2 and 3.6.
Note:
Be sure to mount the ODU with the antenna connector UP and the connection to the IDU DOWN.

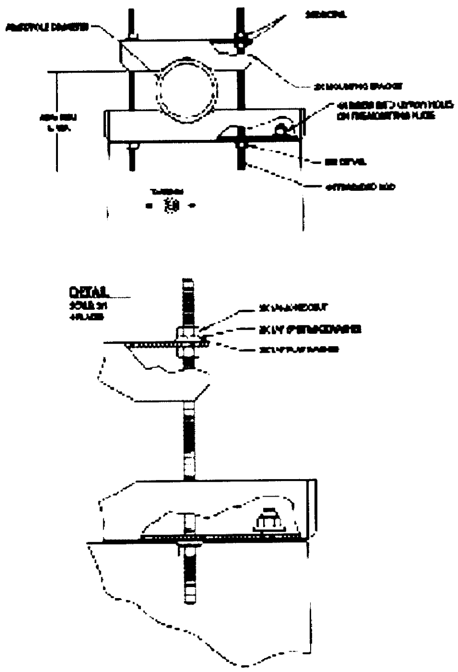
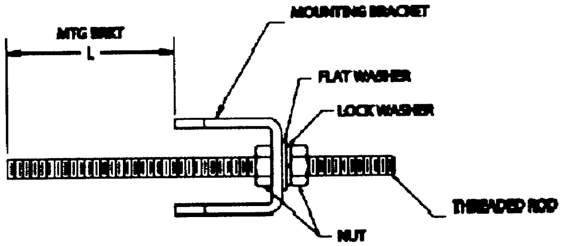


Figure 3-5: ODU Mounting Detail

After attaching the antenna assembly per their enclosed instructions, attach the ODU to the mounting plate as shown in Figure 3-2.

After mounting the antenna, attach the coax cable that connects the ODU with the IDU.

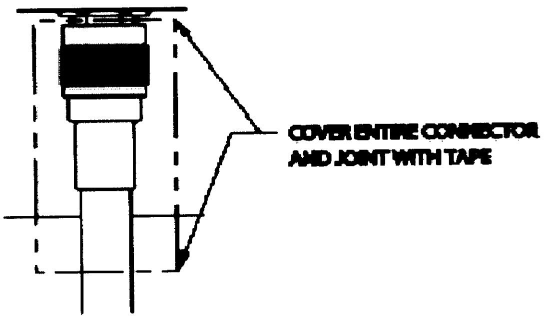


PRE ASSEMBLE CLAMP

2X ASSEMBLE MOUNTING BRACKET THREADED ROD AND HARDWARE PRIOR TO MOUNTING ODU TO MAST/POLE. REFER TO TABLE B FOR THREAD ROD ASSEMBLED LENGTHS.

TABLE

MAST/POLE DIA. In.	MTG BRKT L Inches
1.90	2.7
2.38	3.3
2.88	4.0
3.50	4.7
4.00	5.3
4.50	5.9



4 PLACES

REMOVE BACKING LINER FROM SEALING TAPE FOUND IN INSTALLATION KIT. STRETCH TAPE ABOUT 30%. WRAP TAPE AROUND CONNECTORS LABLED "TO IDU", AND "TO ANTENNA", AND BOTH CONNECTORS ATTACHED TO ANTENNA.

Figure 3-6: Bracket Assy. and Coaxial Connections

3.7.2 Course Antenna Alignment

To coarse-align the antenna, first set it for flat elevation (no up or down tilt) using a spirit level. Then point it at a heading marker obtained using a compass/GPS (magnetic corrected) back-bearing from an adjacent location, (ideally, 100 feet or more away from the antenna).

If a heading marker cannot be set sufficiently far away (for example when on a city building roof or looking through a window) then a rough azimuth setting can be obtained by sighting along the antenna feed.

It should be verified that both antennas are on the same polarization by using the manufacturer's instructions. Otherwise the RSL will be approximately 25 to 30 dB below the calculated level.

Most antennas will also need fine alignment obtained using an operating link because it is very important to maximize the receive RF signal level at each end of the radio link.

Read Section 3.7 before applying DC power to the Lynx radio.

Once the coarse alignment has been set-up at both ends, then the link can be powered and some level of reliable communication established. The voltage at the *Lynx* ODU RSL test point (BNC connector) should be measured with a DVM to determine the relative receive RF signal level.

For the fine alignment, adjusting first the azimuth and then the elevation of the local antenna will maximize the RSL voltage. Then, the far antenna is aligned in the same way, using the RSL voltage of its local *Lynx* radio ODU.

When aligning antennas it may be convenient to allow direct visibility to the technicians aligning the antenna.

An orderwire telephone will provide end-to-end voice communications once radios are synchronized. Synchronization usually can be accomplished by coarse alignment only. After synchronization, the orderwire phones can be used to communicate between radio sites for antenna fine alignment. The phone interconnect cable can be extended to the antenna when desired.

The larger the antenna size, the more critical alignment becomes: for example, with a 2 foot dish, the antenna can be moved ±3 degrees off the correct heading before the receive signal level drops by 3 dB. This compares with a 6-foot dish which may only be moved ±1 degree for the same degradation.

The graph shown in Figure 3-7 shows the typical variation of RSL voltage as the receive signal level is increased from threshold to a higher level. There is some variation between *Lynx* receivers, but an approximate estimate of the potential RSL value may be made using this figure.

Use the Factory Test Data Sheet shipped with your Lynx terminal to obtain the best estimate of your RSL.

Above 0 dBm RSL, the receiver may produce errors: however this level is rarely likely to be exceeded. A link budget calculation should be made to calculate the anticipated RSL as described in Section 3.3.3. During anomalous propagation conditions, the RSL may fade but will not increase up more than 10 dB (except in unusual very long paths which may fade up by 15 dB).

Antenna alignment should enable the RSL to be peaked to the level calculated in the link budget. If the RSL is peaked but is approximately 20 dB below the calculated level, then it is likely that the antennas are aligned on a sidelobe of the antenna's radiated signal. In this case, the antennas should be rotated in a wide arc until the main lobe is located. (Other possible causes of low RSL are path obstructions, loss in connectors, adapters and pigtail jumper cables or different antenna polarization at each end of the link.)

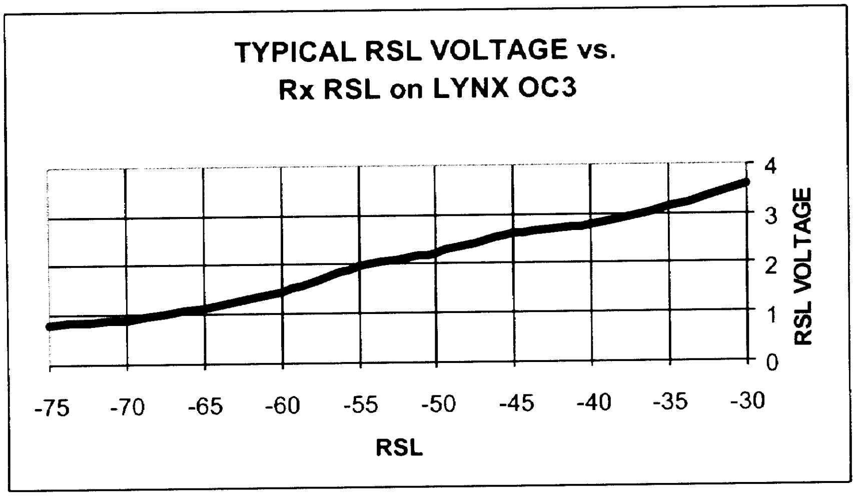


Figure 3-7: Typical RSL Voltage versus Received Signal Level (RSL)

3.8 OC-3 Interface Connection

The radio link's SONET/SDH interface connection to the *Lynx* radio is on the front panel.

Important notes:

It is very important to make sure that the OC3 input signal to the radio does not cause saturation!

Input level should NOT EXCEED –14 dB (be sure by first attenuating the connection with 15dB and then 10dB with optical attenuators.

If the OC3 equipment has a single mode interface, its output level can be as high as –8 dB.

If your signal level is too high (measure before making the connection), an in-line attenuator can be used in series with the interfaced signal (use 15dB first).

3.9 System Turn-up to Service

1. Prior to installing the system, it may be desirable to perform a back-to-back test of the *Lynx* radio pair. Consult Section 4.9 for further details. Back-to-back testing is a simple way to verify that the *Lynx* radios are fully operational before they are installed. Installation adds several variables (such as antenna alignment) which can lead to system turn-up delays. Also, during back-to-back testing, the DIP switch settings and some connections can be tested. This step can eliminate a majority of troubleshooting once the radios are installed.

A cellular phone or two-way radio system (walkie talkie, CB, mobile radio) can be very useful during installation. These can be used for temporary near-end and far-end communications between the installation personnel at one site and installation personnel at the other site while installing the system. These can also be helpful for communication between a person at the top of a very tall tower and ground personnel.

The Lynx radio incorporates an internal Orderwire feature that provides end-to-end "telephone" style communications. However, the link must be partially operational to use this feature. In lieu of, or in addition to the use of cellular phones or two-way radio, this Orderwire feature can also be very useful for installation, but typically cannot be put into service until step 8 or 9 of this procedure is completed. See Section 3.14.1 for more details.

2. Perform a general alignment of the antennas on both ends of the path using binoculars, compass or other related tools. It is important to have the antennas aligned as accurately as possible before putting radio traffic over the link. This will help in getting the system running more rapidly.

3. Connect the short coax cable (minimum 16" included in the Antenna mounting accessory kit) from the ODU to the antenna feed horn (see Section 3.9). Connect the thicker coax cable to the bottom Type-N connector of the ODU. This coax cable should already be in place between the antenna mounting area, and the location of the indoor unit (IDU).

4. Connect the thicker coax cable to the IDU front panel. The ODU must be connected to the IDU before applying power to the IDU.

5. With the DC power source active, but not plugged into the *Lynx* radio, using a voltmeter, confirm that the DC mating connector has the proper power connections in accordance with Section 3.7. Verify the polarity and the absolute voltage on all pins. Verify ground connection for power.

6. Connect power to the *Lynx* radio.

Ensure that the ODU Antenna port connection is properly terminated to the antenna feed before applying power to the Lynx terminal.

When the Lynx radio is initially powered-on, after all flashing LED startup mode, some alarm conditions may be present. This is normal *and alarms can be ignored at this time.*

The Lynx radio requires professional installation. With some Lynx models, in certain countries, there may be Effective Isotropic Radiated Power (EIRP) limits which dictate the maximum output power that the Lynx radio can transmit given the transmission line loss and the gain of the antenna. Consult with appropriate government agencies or Western Multiplex if there is any question regarding maximum output power allowed. ***Do not adjust output power above factory settings.***

7. Connect a voltmeter to the ODU's test point (BNC connection). This voltage reading corresponds to the Received Signal Level (RSL) of the near-end radio. In other words, RSL is the "amount" of signal the near-end radio is receiving from the far-end radio. Since the antennas have not been finely aligned, it is not expected at this time that the RSL will read very high. However, at this point it can be verified that some communication is taking place between the two *Lynx* terminals. Use the RSL voltage reading to align the antennas. Align one antenna at a time in accordance with Section 3.8.2. Complete alignment of both ends of the radio link before going further.

   RSL of both ends should be verified to be within approximately 2 dB of predicted value (see Section 3.3.3). There are several factors that can contribute to low RSL:

- Incorrect antenna alignment (aligned on a lobe and not on the main signal)
- Improper polarization alignment of antennas (horizontal vs. vertical)
- Incorrect installation of the ODU to antenna cable
- Transmission line problems (loose connections, bent or damaged cables, lossy adapters)
    - Path obstructions (trees, buildings, hills, etc.)
    - Path clearance (line-of-sight, earth curvature, Fresnel zone, diffraction and partial obstruction)
    - Weather (inversion layers, ducting and multipath)
    - Antenna feed (coaxial/connector) problem

The Lynx radio requires professional installation. Don't forget that the transmitter output power adjustment on the Lynx radio effects the RSL. Depending on EIRP limits (if any), path distance, and antenna gain, you may need to adjust the output transmit power to the proper level before putting the radios in service.

If radio synchronization has been established, the radio link may be able to provide some limited communications over the link. It can be helpful to establish voice communications from one end of the radio link to the other using the Orderwire feature of the Lynx radio. See Section 3.14.1 for details.

If RSL is lower than anticipated, recheck the path clearance and transmission line as these are the typical causes of low RSL. Radio operations can be verified by connecting radios back-to-back with attenuators (40-60 dB), (see Section 4.9). If the problem remains, consult Section 4 of this manual for troubleshooting techniques which will help determine the source of the problem.

8. Once radio performance is verified and acceptable (ODU, CABLE, IDU, and RF LINK LEDs are green), the *Lynx* radios can now be put into service with the intended traffic.

9. Verify configuration states of the connected switches, routers or computers connected to the IDU(s).

10. Connect to the site equipment by using the SC (fiber) SONET/SDH connector, the OC-3 input LED should then be green.

11. Now that the link is operational, other services can be connected including T1 (DSX-1), Orderwire, Diagnostics, Alarms and Aux Data (Service Channel). Consult Section 3.14 for details on these connections.

3.10 Additional Connections

There are additional customer connections which are optional and are **not required** to make the *Lynx* operational but may prove useful.

3.10.1 Orderwire Connection

Orderwire is a "telephone" type wayside service which allows users of the *Lynx* radio to establish voice communications from one radio to another, either directly to the companion far-end, or through a repeater configuration, or several repeater configurations.

Telephone connection specifications:

REN (Ringer Equivalency Number)	1.0 B
DTMF tones	within ±1.5% of nominal freq.
Ringing Voltage	48 VDC, typical

(Ringing voltage is adequate for modern solid state ringers, NOT for the older mechanical type ringers)

This Orderwire service does not affect the normal radio transmission of traffic. Refer to Section 2.3.5 for the telephone specifications. For simple near-end to far-end communications, follow the steps below:

1. Using a standard RJ-11 telephone cable, connect a standard electronic telephone (a touch tone phone, complete with dialer; a handset by itself will not work) to the Orderwire connector on the *Lynx* front panel. This connector is wired identically to a standard two-wire telephone jack, see Figure 3-8 for details.

2. With a telephone connected to each *Lynx* terminal on opposite ends of the link, either telephone can be used to "dial-up" the far-end location. The far-end terminal's internal ringer and the connected telephone will ring, and if answered, two-way full-duplex voice communication is established.

If using the Orderwire or Network management functions, each Lynx radio connected must have unique address settings (telephone numbers). The address of each radio can be changed from its factory setting, via the NMS or config port.

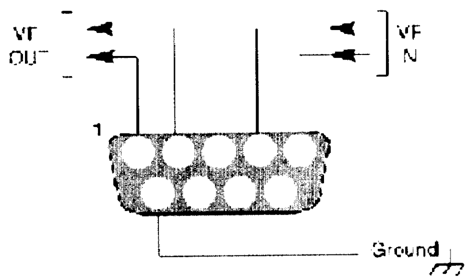
4. If the *Lynx* radios are connected in a repeater configuration, Orderwire services can be established to all *Lynx* terminals in the network by implementing a connection of their rear-panel connectors between repeater terminals. At the repeater site, a cable can be connected to the two *Lynx* terminals between their rear panel VF 9-pin connectors as shown in Figure 3-6. With this cable in place, the Orderwire function will operate at terminals at each end of the repeater and at the repeater site. This function can be continued through several repeater sites if desired. For hub connections of 3 or more *Lynx* radios at the same site, an external 4-wire bridge is required to connect all radios to the orderwire.

The orderwire system can be integrated with orderwire equipment supported by many other vendors. If your existing orderwire network *uses 2 digit addressing, and 0 dBm VF interface, it can be connected to a Lynx as shown in Figure 3-9.*

Dialing a (star key) on the orderwire telephone implements an "all call" feature which rings all connected radios. Also, if a phone anywhere in the connected network has accidentally been left off-hook, the # (pound key) key can be used to mute all off-hook handsets until they are placed on and off hook again.

The orderwire operates like a "party line". All telephones provide communication to all other telephones in the connected network. Even if a particular telephone does not ring, it can still be used to talk and listen to any ongoing orderwire activity if the orderwire is in use at other terminal locations.

Orderwire Connection



VF Port Connection

Figure 3-8: Orderwire & VF Port Connection

3.10.2 Alarm Connections

External alarm outputs are provided at the 9-pin, D-type subminiature ALARM connector. There are two Form C summary alarm relays capable of switching 30 VDC at 1 A. See Table 3-E and Figure 3-9 for Alarm Connections.

The "summary" alarm (Form C relay) is activated by any near-end front panel LED alarm condition, including if the internal test mode is enabled.

The "out-of-service summary" alarm (Form C relay) is activated by any of the following alarm conditions:

- RF LINK (alarm for loss of RF signal)
- Radio Fail (alarm for hardware failure)
- Internal Test (alarm for miscellaneous failure)

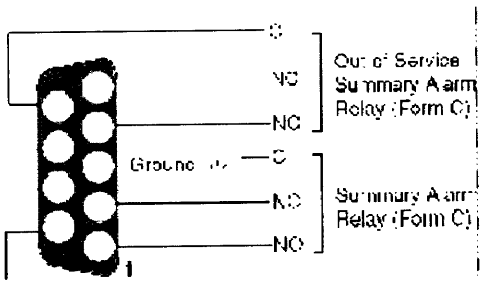


Figure 3-9: Pin Connections, ALARM Interface

PIN 1	**NO, SUMMARY ALARM, FORM C** - normally open connection on summary alarm relay. Closed when in alarm.	**PIN 4**	**NO, OUT OF SERVICE SUMMARY ALARM, FORM C** - normally open connection on out-of-service summary alarm relay. Closed when in alarm.
PIN 6	**C, SUMMARY ALARM, FORM C** - common connection on the summary alarm relay.	**PIN 9**	**C, OUT OF SERVICE SUMMARY ALARM, FORM C** - common connection for the out-of-service summary alarm relay.
PIN 2	**NC, SUMMARY ALARM, FORM C** - normally closed connection on summary alarm relay.	**PIN 5**	**NC, OUT OF SERVICE SUMMARY ALARM, FORM C** - normally closed connection on out-of-service summary alarm relay. Open when in alarm.
PIN 7	Not connected	**PIN 8**	Not connected

Table 3-E: Alarm Interface Connections

All alarms are active for a minimum of one second, or as long as the alarm condition persists, which ever is longer.

3.10.3 Configuration (Diagnostic) Port Operation

The "Config" Port is used to retrieve diagnostic information and to configure additional features within the *Lynx* radios by means of a computer connection via SERIAL interface. Also can be used as an RS-232 port to download the latest revision radio operation software.

The config port allows connection of RS-232 devices to receive status of the *Lynx* radio and provide configuration.

Initially, set your COM port to 9600 baud (8N1) and use an interconnect cable with ONLY pins 2, 3 and 5 connected (pins 2 to 3 and pins 5 to 5)

For RS-232 diagnostics connection (Section 4.11) to the *Lynx* radio, connect the serial device (modem, computer, terminal) to the male 9-pin subminiature connector in accordance with Figure 3-10.

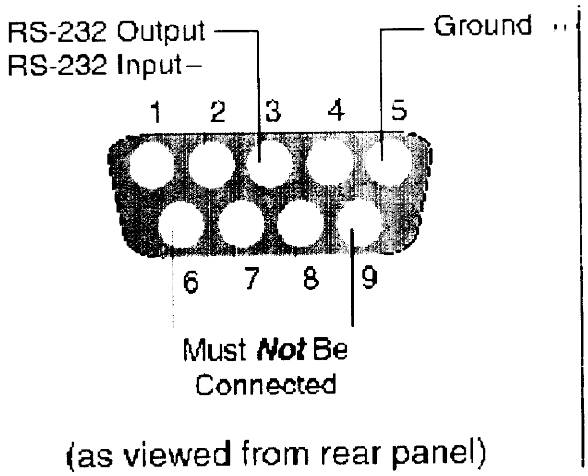


Figure 3-10: RS-232 Config Port Connections

Pins 6 through 9 must not be connected for RS-232 communications to operate properly.

3.10.4 AUX DATA (Digital Service Channel) Connection

The AUX DATA port is a separate wayside serial port which can be configured to allow the connection of any user serial data (to 9600 baud and 8N1) through the radio network. Connection to the AUX DATA port is an RS-232 serial interface, identical to the config(uration) port (see Section 3.14.3).

3.10.5 T1 (DSX-1) Interface Connection

The Lynx radio also provides four wayside T1 connections. These connections allows for standard DSX-1 connect of voice circuits without affecting the main traffic. A standard RJ-48c connector is provided for this connection.

3.10.6 NMS Interface Connection

The NMS connection provides connection for the network management system. This allows an HTML interface to the Lynx radio for purposes of monitoring, configuration and security settings. This connection is either the RJ-45 modular connection or the SC fiber connection, both of which comply to the standard 100BaseTx or Fx interface, respectively. One connection is selected automatically when a cable is connected and data is transferred. Typically, the installer or manager will connect to the NMS with a stand-alone computer to initially configure the radio prior to installation.

The factory default IP address is set to 10.0.0.1. To reset the radio back to the factory default, Hold down the far-end test button while powering up the radio. Release the switch after 6 seconds.

This radio provides in-band management through an internal PPP/HDLC link. SNMP, HTTP, FTP and TELNET sessions are all allowed through the in-band management into a radio network. The in-band manager provides RIP I dynamic routing. The user must configure the IP and in-band management IP address correctly for valid network operation.

Ethernet Cable: Straight version to hub/switch, crossed version direct to PC.
(Pins:1=Tx+, 2=Tx-, 3=Rx+ & 6=Rx-)

4. Troubleshooting

4.1 Regular Maintenance

The *Lynx* radios do not require any regular maintenance, however, it is prudent to monitor the radio link at regular intervals to assure that the link conditions are not changing. When visiting a radio site for maintenance, the following items may be checked and their results recorded:

- RSL, via HTML interface
- Far-end RSL, via HTMP/SNMP/TELNET interface
- Alarm conditions (via the Alarm Log)
- Verify radio has adequate ventilation
- Verify security ID is set the same at each radio through NMS

If any alarm conditions exist, they should be recorded, and troubleshooting procedures from this Section of the manual should be followed.

4.2 Technical Support

4.3 Repair Policy

4.4 Front Panel Status LEDs

There are several front panel status LEDs on the *Lynx* radio. These LEDs indicate conditions where either a hardware failure has occurred or the radio link is not optimum. In many cases, a combination of LEDs may be illuminated. The following sections describe the necessary troubleshooting procedures should any LED(s) indicate a problem during or after installation.

IDU	Green = Indoor Unit OK Yellow = warning condition in IDU (over-temp and/or both fans failed) Red = Indoor Unit detected hardware or NMU/IDU communication failure
Cable	Green = ODU Cable OK Red = ODU Cable shorted
ODU	Green = Outdoor Unit OK Red = IDU to ODU communication failure, DC power loss, or Outdoor Unit detected hardware failure Yellow = Over temperature alarm
RF Link	Green = Link established with BER <10E-6 Yellow = BER 10E-6 Red = BER >10E-3 or Loss of Sync Blinking = Security ID mismatched
OC-3 Input	Red = loss of input signal Green = Input OK
Loopback	Yellow = Any T1 or OC port has loopback enabled Off = no OC or T1 in loopback
Far End	Red = Alarm(s) present on the far-end radio** Green = No far end alarm(s) detected
NMS (10/100BaseT)	Green = Tx or Rx data present on the NMS interface Off = No NMS interface connection detected
T1 INPUT	Green = T1 connection detected on enabled channels (any/all of 4 T1s) or channel(s) disabled Red = Alarm(s) enabled (any/all of 4 T1s) and no T1 connection detected

	Note: consider above as all OK (green), or something wrong (red)

*** Radio Fail, RF Link (yellow or red), T1/OC Input (yellow or red)*

Upon startup, all front panel lights will flash through a sequence – this may take up to 2 minutes before the radio is operational.

4.4.1 RF LINK Alarm

Function:

This LED indicates that the demodulator function is not synchronizing with the intended received signal.

Possible Causes:

- Severe path fading due to atmospheric conditions, usually accompanied by low RSL reading
- Poor transmission line connections usually accompanied by low RSL reading
- Antenna problems, misalignment, or path clearance usually accompanied by low RSL voltage reading
- Improper radio settings (e.g. frequency channel)
- Received signal level (RSL) is too strong
- Interference (other 5.3/5.8 GHz transmitters nearby)
- Far-End radio transmitter circuitry is faulty
- Near-End radio receiver circuitry is faulty
- Link security ID not the same for each radio

Recommended Actions:

Check the following at each end of the link:

- Verify that all connections between radios and antennas are secure and all devices between radios and antennas are rated for the radio frequency band (5.3/5.8 GHz).

On the ODU: Measure RSL by placing a voltmeter across RSL and GND test points. Compare this voltage to the Factory Test Data Sheet and estimate the RSL in dBm. Compare this to the RSL that was expected using path calculations (see Section 3.3.3).

From the IDU, through the HTML interface: Pull up the Performance sub menu to look at the near and far end radios' RSL. Compare this voltage to the Factory Test Data Sheet and estimate the RSL in dBm. Compare this to the RSL that was expected using path calculations (see Section

3.3.3).

If RSL from both ends of the radio are approximately the same as each other, but lower than anticipated for this installation, then the likely cause of the BER alarm(s) is excessive losses between the radios. Excessive loss problems could include the transmission line at either end, all adapters, connectors, the antennas, the antenna alignment as well as the path itself (any obstructions or clearance problems). Antenna alignment, line-of-sight and path clearance should be verified; if this does not improve RSL, all devices between the radios and their antennas at both ends should be checked. Make sure all transmission line, connectors and any other devices are properly rated for operation at the radio's frequency (5.3/5.8 GHz).

If only one end has low RSL, this could be caused by low transmit output power from the opposite end radio. Verify that the transmitter output power of the radio opposite to the low RSL receiver has been set in accordance to path calculations, or EIRP restrictions (where applicable). Power adjustment must be performed by professional installation personnel only. The PWR test point can be used and compared with the Factory Test Data Sheet, the front panel recessed potentiometer can be turned clockwise to increase power. If an RF power meter is available, this can be connected to the RF output of the radio for precision measurement. This test will also verify that the radio transmitter is working properly.

If one terminal (or both) has high RSL, this could be caused by a very short path or interference. To verify the possible presence of interference, remove DC power to the radio which is opposite to the one that is reading high RSL. Once power is removed, measure RSL on the remaining radio. If the RSL is lower than that which is listed for "Threshold" in the Factory Test Data Sheet, then an interfering signal is present. If interference is suspected, the easiest potential remedy is to swap frequency channels on both sides of the link. See Section 4.2 for details. Swap terminals at both ends of the link so that they are the opposite from their original installation. After both ends are moved, reconnect the radios and determine if the BER alarm is still active. If the BER alarm is still active, other frequency channels can be installed, or other interference countermeasures can be tried, in accordance with Section 4.8.

If all path related and data input problems have been pursued and the BER alarm is still active, the problem could be related to a radio failure. While radio failure is typically indicated by more severe alarm conditions, it is possible that one of the radios may be out of specification, and this could be the cause of the BER alarm. A back-to-back test will verify proper radio operation. See Section 4.9 for details. A threshold test on both radios along with a test to verify proper RF output power would be beneficial.

Perform a back-to-back test before returning any radio terminal to the factory for repair. A back-to-back test verifies radio operation. (See Section 4.7).

If the radios successfully pass their back-to-back testing, the problem is likely with the path or the connections between the radio and the antenna or interference. Before reinstalling the radios, be sure to set the output power to the appropriate level for the installation.

4.4.2 FAR END Alarm

Function:

This LED indicates that there is an alarm condition present on the far-end radio. When the DISPLAY FAR END button is pressed (and held), the status LEDs indicate the alarm conditions of the far-end radio. If all the LEDs flash red, the telemetry channel is not in operation, probably due to the RF link down.

Possible Cause:

- One or more alarm condition(s) exist on the far-end radio
- Telemetry channel is down

Recommended Actions:

1. Press and hold the DISPLAY FAR END button and observe the LED status.
2. Follow instructions for troubleshooting the far-end radio in accordance to the appropriate LEDs which are in alarm, as described in Section 4.6.1.

4.5 Errors in the Data Stream

When the radio is in service, errors in the data stream may occur. This is usually known to the operator by either faulty data indications of downstream equipment or external bit error rate testing.

It is possible that no alarms appear on the front panel during normal operations, but there are errors present in the data stream. Some errors will not result in no alarm (such as bipolar violations, slow "dribbling" errors, improperly terminated connections or incorrect settings), but will be exhibited on downstream data processing equipment or during a BER test. In other cases, there may be data errors due to atmospheric conditions (fading), interference or other reasons, but not at a high enough error level to be indicated with the BER alarm LED. In the case of these types of errors, the following information can be helpful to troubleshoot the radio link.

Indications:

- During external BER test, test equipment indicates errors
- Downstream equipment (mux, channel bank, CODEC, router, etc.) indicates errors

Possible Causes:

- Path fading due to atmospheric conditions
- Poor transmission line connections
- Antenna problems, misalignment or path clearance
- Received signal level (RSL) is too strong
- Far-End radio transmitter circuitry is faulty
- Near-End radio receiver circuitry is faulty
- Interference

Recommended Actions:

1. Verify SONET/SDH connection and cable.
2. Follow the instructions described in Section 4.4.1

4.6 Back-to-Back Testing

Back-to-back testing, as shown in Figure 4-1, is an ideal method of testing the *Lynx* radios. This testing eliminates link problems caused by auxiliary equipment, installation, or the radio path and isolates potential radio hardware problems. Back-to-back testing must be performed with both radios at the same location. The following test equipment is required:

- DC power source capable of supplying approximately 250 Watts (total) to the radios.
- Coax coupled with 60dB loss attenuation.
- BER tester

☞ *Back-to-back testing must be performed to verify a radio problem before returning any radio to the factory for repair.*

☞ *Use a coax cable with approximately 60dB attenuation*

When the equipment is connected as shown in Figure 4-1, both *Lynx* radios should have no alarm conditions. If these conditions have been met, then it is likely that the *Lynx* radio is operating in accordance to specifications. If errors or alarms occur during this test, verify that all configuration settings are properly set. If alarms or errors are still present, the radio is likely to be faulty.

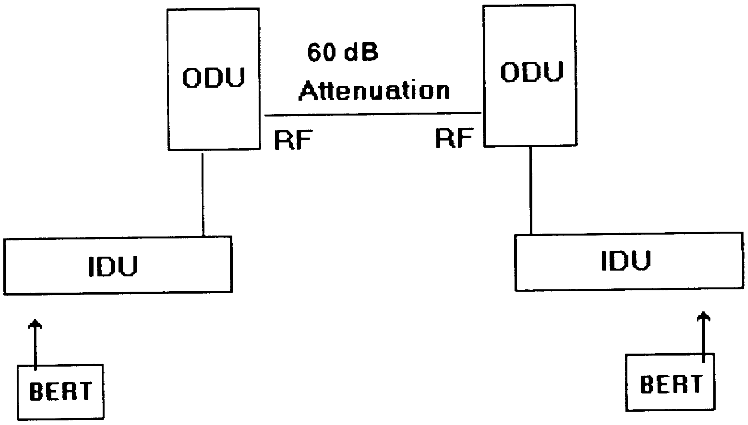


Figure 4-1: Back-to-Back Test Configuration

The Lynx radios will be damaged if appropriate RF attenuation is not supplied between radios. You must provide a minimum of 50 dB and no more than 70 dB attenuation between the two radios. Use this attenuation in the coax connection cable!

Also, be sure to use enough optical attenuation on short OC-3 BERT testers as these devices may output as much as +2dB! If the BERT has a high output and the test cables are short, at least 15dB of optical attenuation is necessary for proper operation.

4.7 LINK Testing

Link testing is the preferred way to evaluate a radio link's performance. It can be performed from end-to-end or in link test mode (which tests both directions of the radio path). Figure 4-2 illustrates a typical test configuration (which may include the radio's path instead of in-line attenuators). Figure 4-2 illustrates a typical test configuration for end-to-end testing.

When performing testing, make sure of the following:

- Disconnect all SONET/SDH inputs and outputs to both radios.
- Verify all configuration settings.

Link testing may be performed on the bench, with two terminals back to back, or over the radio path. Also, it may be performed from end-to-end (which requires two SONET/SDH test sets over a link, the far-end unit slaved to the near-end unit's clock or in loopback mode)

If link testing indicates an unacceptable level of errors, follow the instructions in Section 4.4.1. or perform a back-to-back test.

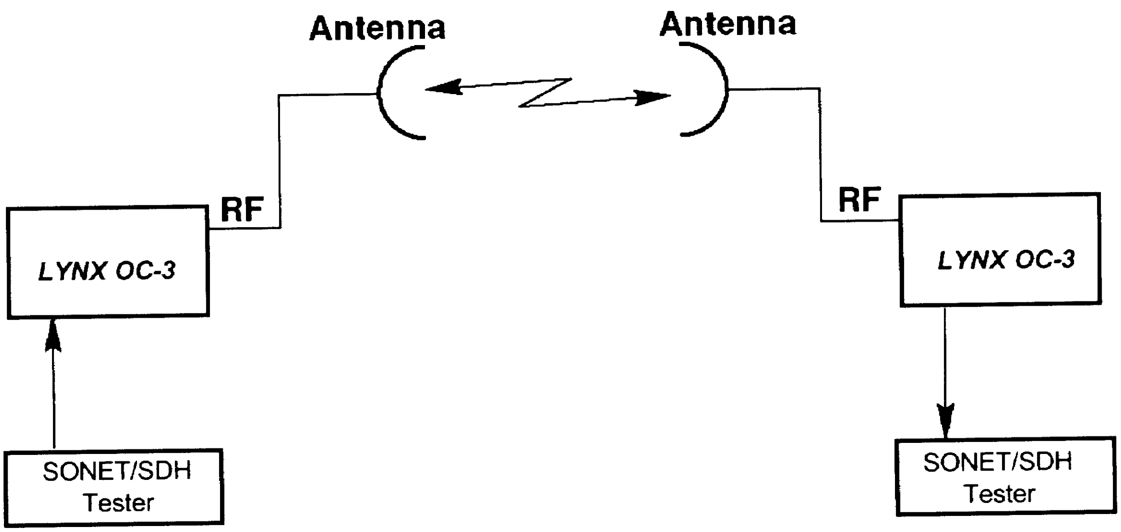


Figure 4-2: End-to-End Test Configuration

Be sure to use enough optical attenuation on short OC-3 BERT testers as these devices may output as much as +2dB! If the BERT has a high output and the test cables are short, at least 15dB of optical attenuation is necessary for proper operation.