8.0 Instruction Manual

This manual will be provided to the end-user with each unit sold/leased in the United States.

See attached users manual.

Glenayre®
WIRELESS INTERCONNECT

WESTERN MULTIPLEX
1196 Borregas Avenue, Sunnyvale, CA 94089-1302
(408) 542-5200 • Fax: (408) 542-5300

June 15, 1998

Federal Communications Commission
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD 21046

Attention: Reviewing Engineer

The Installation and Maintenance Manual supplied in this application is for LYNX.mini2 fractional radio. The product is a 2.4 GHz, 64-512kbps capacity fractional radio. When this manual is released, an appropriate statement will be made in the regulatory information cover sheet indicating the FCC and IC rule parts and its certification numbers.

Glenayre Western Multiplex confirms that there is no description of power adjustment in any operator's manual.

If you have any questions regarding this submission, please feel free to contact the undersigned.

Ken Ruppel

Director
Product Management &
Business Development

GLENAYRE™
Western Multiplex

INSTALLATION AND MAINTENANCE MANUAL

FRACTIONAL 64 to 512 Kbps
SPREAD SPRECTRUM RADIO
MODEM (2.4 GHz)

GLENAYRE™
Western Multiplex

Installation and Maintenance Manual

The information contained in this manual is subject to change without notice. Glenayre Western Multiplex shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this manual or equipment supplied with this manual. Glenayre Western Multiplex makes no warranty of any kind with regard to this manual or any equipment supplied with this manual, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

Heliax™ is a registered product of Andrews Corporation.

Fireberd is a registered product of Telecommunications Techniques Corporation.

Printed in the United States of America

Notice: Y2K (Year 2000 Issue)

All software supplied by and for Glenayre Western Multiplex products adheres to the four-(4) digit year nomenclature as required for Year 2000 compliance.

Glenayre Western Multiplex Corporation
1196 Borregas Avenue
Sunnyvale, CA 94089-1302
TEL : (408) 542-5200
FAX : (408) 542-5300

Issue: June 1998

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GLENAYRE™
Western Multiplex

Regulatory Notice

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

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

Shielded cables and I/O cords must be used for this equipment to comply with the relevant FCC regulations.

Changes or modifications not expressly approved in writing by Glenayre Western Multiplex may void the user's authority to operate this equipment.

This device complies with RSS-210 and/or RSS-139 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

This device must be professionally installed.

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GLENAYRE™
Western Multiplex

WARRANTY

GENERAL TERMS

1.1 All Definitions contained in Western's Conditions of Sale (Western document number CS96-8), apply to the Warranty.

1.2 Subject to the provisions of the Warranty, Western warrants that the equipment described in Paragraph 1.3 shall conform to their specifications described in Paragraph 1.4 in all material respects and that the equipment shall be free from material defects in materials and workmanship.

1.3 This Warranty applies to all original purchases of Western manufactured equipment and accessories (collectively the "Equipment").

1.4 This Warranty applies to the specifications contained in the most recent version of the manual for the model of the Equipment purchased (the "Specifications").

1.5 This Warranty does not apply to the following items of Equipment which are covered by the Original Equipment Manufacturer's warranty:

(a) antenna systems, including coax cable, waveguide, connectors flex-sections, mounts, other parts of the antenna system and installation materials;

(b) non-Western manufactured rack mounted equipment that is assembled wired and tested at Western's factory or supplied as part of a system, including orderwire items, channel banks, multiplexers, fuse/alarm panels, remote alarm items; and

(c) equipment which is not listed in Western's price book.

1.6 The effective period of this Warranty shall start on the date of shipment of the Equipment and shall end:

(a) for all spread spectrum unlicensed radio products and for all licensed digital microwave radio products, two (2) years later;

(b) for all analog microwave radio products, three (3) years later; or

(c) for all baseband products, five (5) years later (in each case the "Warranty Period").

1.7 The Customer acknowledges that Western does not represent or warrant that the services provided by Western under this Warranty will ensure uninterrupted or error-free operation of the Equipment.

RETURN OF EQUIPMENT UNDER WARRANTY

2.1 If an item of Equipment malfunctions or fails in normal intended usage and maintenance within the applicable Warranty Period:

(a) the Customer shall promptly notify Western of the problem and the serial number of the defective item;

(b) Western shall, at its sole option, either resolve the problem over the telephone or provide the Customer with a Returned Materials Authorization number (RMA #) and the address of the location to which the Customer may ship the defective item;

(c) if the problem is not resolved over the telephone, the Customer shall attach a label to each Returned item describing the fault and the Customer's Return address. The Customer shall, at its cost, properly pack the item to be Returned. prepay the insurance and shipping charges, and ship the item to the specified location;

(d) if the Western product shall prove to be defective in material or workmanship upon examination by Western, Western shall either repair or replace the Returned item at its sole option. The replacement item may be new or refurbished; if refurbished, it shall be equivalent in operation to new Equipment. If a Returned item is replaced by Western, the Customer agrees that the Returned item shall become the property of Western.

(e) Western shall at its cost, ship the repaired item or replacement to any destination within the United States of America by carrier and method of delivery chosen by Western. If the Customer has requested some other form of conveyance, such as express shipping, or is located beyond the USA borders, then the Customer shall pay to the cost of return shipment.

2.2 Equipment which is repaired or replaced by Western under this Warranty shall be covered under all of the provisions of this Warranty for the remainder of the applicable Warranty Period or ninety (90) days from the date of shipment of the repaired item or replacement, whichever period is longer.

DEFAULT AND TERMINATION

3.1 Western may immediately terminate this Warranty and all of its performance under this Warranty, upon notification to the Customer, if the Customer:

(a) makes any unauthorized modifications to the Equipment;

(b) assigns or transfers the Customer's rights or obligations under this Warranty without the written consent of Western;

(c) becomes bankrupt or insolvent, or is put into receivership; or

(d) has not paid Western all amounts for the Equipment, services, or other additional charges within thirty (30) days of receipt of written notice from Western.

3.2 If this Warranty is terminated by Western, the Customer shall remain liable for all amounts due to Western.

FORCE MAJEURE

4.1 "Force Majeure" has the same meaning as defined in Western's Conditions of Sale (Western document number CS96-8).

4.2 Western shall not be responsible for failure to discharge its obligations under this Warranty due to Force Majeure.

LIMITATIONS AND QUALIFICATIONS OF WARRANTY

5.1 This Warranty does not apply to any damage, defect or failure caused by:

(a) any part of the Equipment having been modified, adapted, repaired, or improperly installed, operated, maintained, transported or relocated by any person other than Western personnel or a Western authorized service agent, without Western's prior written consent;

(b) storage or environmental conditions which do not conform to the applicable sections of the appropriate Western Equipment Manual;

(c) failure to conform with the Equipment Installation, Operating and Maintenance Instructions of the appropriate Western Equipment Manual;

(d) external causes, including external electrical stress or lightning, or use in conjunction with incompatible equipment, unless such use was with Western's prior written consent;

(e) cosmetic damage;

(f) accidental damage, negligence, neglect, mishandling, abuse or misuse, other than by Western personnel or a Western authorized service agent; or

(g) Force Majeure.

Please see reverse side for additional limitations on damages.

LIMITATIONS ON DAMAGES (North America)

6.1 THE WARRANTY STATED IN THIS DOCUMENT IS THE CUSTOMER'S EXCLUSIVE WARRANTY FOR THE EQUIPMENT; WESTERN SPECIFICALLY DISCLAIMS ALL OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND OF MERCHANTABILITY.

6.2 WESTERN SHALL NOT BE LIABLE IN TORT, INCLUDING LIABILITY IN NEGLIGENCE OR STRICT LIABILITY, AND SHALL HAVE NO LIABILITY AT ALL FOR INJURY TO PERSONS OR PROPERTY. WESTERN'S LIABILITY FOR FAILURE TO FULFIL ITS OBLIGATIONS UNDER THIS WARRANTY OR ANY OTHER LIABILITY UNDER OR IN CONNECTION WITH THE EQUIPMENT SHALL BE LIMITED TO THE AMOUNT OF THE PURCHASE PRICE OF THE EQUIPMENT. THE REMEDIES STATED IN THIS WARRANTY ARE THE CUSTOMER'S EXCLUSIVE REMEDIES AGAINST WESTERN REGARDING THE EQUIPMENT.

6.3 EVEN IF WESTERN HAS BEEN ADVISED OF THE POSSIBILITY OF THEM, WESTERN SHALL NOT BE LIABLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING THE COST OF LABOR BY THE CUSTOMER'S OWN EMPLOYEES, AGENTS OR CONTRACTORS IN IDENTIFYING, REMOVING OR REPLACING THE DEFECTIVE ITEM; LOST PROFITS, AND REVENUES; FAILURE TO REALIZE EXPECTED SAVINGS; ANY CLAIM AGAINST A CUSTOMER BY A THIRD PARTY; OR ANY OTHER COMMERCIAL OR ECONOMIC LOSSES OF ANY KIND.

6.4 THESE LIMITATIONS AND DISCLAIMERS ARE NOT MADE BY WESTERN WHERE PROHIBITED BY LAW.

LIMITATIONS ON DAMAGES (International)

6.1 THE WARRANTY STATED IN THIS DOCUMENT IS THE CUSTOMER'S EXCLUSIVE WARRANTY FOR THE EQUIPMENT; ALL OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND OF MERCHANTABILITY ARE EXCLUDED TO THE FULLEST EXTENT PERMITTED BY LAW.

6.2 WESTERN'S LIABILITY FOR FAILURE TO FULFIL ITS OBLIGATIONS UNDER THIS WARRANTY OR IN TORT OR AS A RESULT OF STRICT LIABILITY OR ANY OTHER LIABILITY UNDER OR IN CONNECTION WITH THE EQUIPMENT OR ITS SUPPLY SHALL BE LIMITED, EXCEPT IN RESPECT OF DEATH AND PERSONAL INJURY CAUSED BY WESTERN'S NEGLIGENCE, TO THE AMOUNT OF THE PURCHASE PRICE OF THE EQUIPMENT. THE REMEDIES STATED IN THIS WARRANTY ARE THE CUSTOMER'S EXCLUSIVE REMEDIES AGAINST WESTERN REGARDING THE EQUIPMENT.

6.3 EVEN IF WESTERN HAS BEEN ADVISED OF THE POSSIBILITY OF THEM, WESTERN SHALL NOT BE LIABLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING THE COST OF LABOR BY THE CUSTOMER'S OWN EMPLOYEES, AGENTS OR CONTRACTORS IN IDENTIFYING, REMOVING OR REPLACING THE DEFECTIVE ITEM; LOST PROFITS, AND REVENUES; FAILURE TO REALIZE EXPECTED SAVINGS; ANY CLAIM AGAINST A CUSTOMER BY A THIRD PARTY; OR ANY OTHER COMMERCIAL OR ECONOMIC LOSSES OF ANY KIND.

GLENAYRE™ Western Multiplex

CONDITIONS OF SALE

DEFINITIONS

1.1 In these Conditions, unless there is something in the subject matter or context necessarily inconsistent:
- (a) "Western" means Western Multiplex Corporation (d.b.a. Glenayre Western Multiplex), Sunnyvale, CA;
- (b) "Equipment" means the equipment itemized on the Quotation/Order Acknowledgment;
- (c) "International" means any location other than United States of America and Canada, including their territories and possessions;
- (d) "North America" means any location in the United States of America and Canada, including their territories and possessions;
- (e) "Order Acknowledgment" means the sales order acknowledgment provided by Western to the Customer;
- (f) "Payment Instructions" means Western's payment instructions, (Western document P197-1);
- (g) "Quotation" means the quotation signed by an authorized representative of Western and provided to the Customer;
- (h) "Shipping Date" means the actual date on which the Equipment left Western's factory at Sunnyvale, CA, U.S.A.;
- (i) "Warranty" means Western's warranty, document W97-1;
- (j) "Invoice" means the bill of goods prepared by Western for the equipment with the shipping and any insurance costs.

1.2 Headings have been inserted in these Conditions for convenience of reference only and will not effect their construction.

ENTIRE AGREEMENT

2.1 The Quotation, these Conditions of Sale, the Order Acknowledgment, the Payment Instructions and the Warranty shall apply to all sales made by Western and shall constitute the entire agreement by Western and the Customer (the "Agreement ").

2.2 Any terms and/or conditions of sale, which may be included on the Customer's purchase order form or any communication from the Customer, that are not identical with the terms and conditions steed in this document shall NOT become a part of the agreement of sale unless expressly agreed to in writing in the Quotation.

2.3 Western's failure to object to any terms and/or conditions of sale contained in any communication from the Customer shall not be considered as acceptance of such terms and/or conditions or as a waiver of the terms and conditions of sale contained herein.

2.4 Western shall sell to the Customer, and the Customer shall purchase from Western, the Equipment in accordance with the Agreement. Western accepts the Customer's purchase orders for Equipment and agrees to deliver the Equipment to the Customer only on the terms of the Agreement.

2.5 No variation of the Agreement shall be binding unless agreed to in writing by authorized representatives of Western and the Customer.

PRICING

3.1 All prices in the Quotation are exclusive of all shipping charges and all applicable taxes including but not limited to, federal, state, local, excise, sales and use taxes.

3.2 All prices in the Quotation unless otherwise stated:
- (a) for North American customers are FOB Sunnyvale, CA, USA. (New York Uniform Commercial Code); or
- (b) for international customers are Ex-Works, Sunnyvale, CA, U.S.A. (Incoterms 1990).

3.3 All prices in the Quotation include standard domestic packing, unless a separate line item is provided detailing export or special packing charges.

SHIPPING AND INSURANCE

4.1 Western shall arrange shipping and insurance when requested by the Customer, and shall bill the Customer for the Equipment with the shipping and any insurance costs as separate items, on an invoice (the "Invoice").

4.2 Delivery dates quoted by Western are to be considered estimates only. In no event will Western be liable for any loss or damage resulting from its failure to deliver products within a specified time.

TERMS OF PAYMENT

5.1 The Customer shall pay for all Equipment, including shipping and insurance in accordance with the terms of the Invoice.

5.2 All Invoices for North American Customers are due and payable in thirty (30) days from the date of the Invoice.

5.3 International Customers shall make payments in accordance with Western's Payment Instructions by either:
- (a) providing a wire transfer (telegraphic transfer) for the full amount of the Equipment, shipping and insurance charges contained in the Quotation or the pro-forma Invoice sent to the Customer, prior to the Shipping Date; or
- (b) establishing an acceptable Letter of Credit (LC) for the full amount of the Equipment, shipping and insurance charges contained in the Quotation prior to the order being booked and accepted by Western.

5.4 If a Customer fails to pay an Invoice when due, Western may, without prejudice to am other remedy, postpone shipments, alter payment terms, terminate the Agreement and charge interest on all overdue amounts the rate of 1.5% per month compounded monthly (or if less, the maximum allowed by law). Upon demand, the Customer shall pay all such interest charges and all reasonable collection fees, including reasonable legal expenses.

SECURITY FOR PAYMENT

6.1 If the Customer is located in North America, the Customer grants to Western a purchase money security interest in the Equipment to secure the payment of the purchase price of the Equipment and all other amounts due from the Customer.

6.2 If the Customer is not located in North America:
- (a) despite delivery and passing of risk in the Equipment and any other provision of these Conditions, the title in the Equipment shall not pass to the Customer until Western has received payment in full of the purchase price of the Equipment and all other amounts then due from the Customer, and
- (b) until the title in the Equipment passes to the Customer:
  - (i) the Customer shall hold the equipment as Western 's fiduciary agent and bailee, and shall properly store, protect and insure the Equipment and shall identify the Equipment as Western property;
  - (ii) if the Customer fails to pay Western in accordance with the agreed payment terms, Western may require the Customer to deliver up the Equipment to Western, and, if the Customer does not, Western may enter on the premises where the Equipment is stored and repossess the Equipment; and
  - (iii) the Customer shall not pledge the Equipment by way of security for any, indebtedness of the Customer, but if the Customer does so all moneys owed by the Customer to Western shall, without prejudice to any other remedy of Western, immediately become due.

CHANGES TO PRODUCT SPECIFICATIONS

7.1 Western may, without notice to the Customer, make changes to the specifications of Equipment which do not materially affect the quality or performance of the Equipment.

EQUIPMENT CONFIGURATION AND EXPEDITING CHARGES

8.1 At the Customer's request, Western may, for a fee agreed in advance:
- (a) reconfigure the Equipment; or
- (b) expedite the Customer's order.

SHORTAGES

9.1 The customer shall not make any claim for shortages (which are items that the Invoice does not show are on back-order) after twenty-one (21) days after the date of the Invoice.

RETURNS AND EXCHANGES

10.1 The return of defective Equipment is covered by the Warranty .

10.2 The Customer may only return Equipment that is not defective if:

(a) the Equipment does not correspond with the Customer's purchase order; or

(b) the Equipment has been ordered in error by the Customer and Western has permitted the Customer to remedy the mistake by ordering the correct equipment and resuming the Equipment and the Customer obtains a Returned Materials Authorization number ("RMA #") from Western prior to returning any Equipment.

10.3 Western reserves the right to charge a fee for returned equipment under Subparagraph 10.2(b) with the amount of the fee being determined prior to an RMA # being given by Western.

10.4 Authorized returns of equipment under Paragraph 10.2 must be in an undamaged condition, in the original configuration, in the original packing materials and within a time period agreed to when the RMA # was issued.

10.5 If the Customer does not comply with the provisions of Paragraphs 10.2, 10.3, and 10.4, the Customer shall pay the full amount of the Invoice.

10.6 The party liable for all shipping, insurance and any other expenses incurred by the Customer in returning the Equipment under Paragraph 10.2 and for all loss or damage to the Equipment until received by Western, shall be: (a) for all items returned under Subparagraph 10.2(a), Western and (b) for all items resumed under Subparagraph 10.2(b), the Customer.

CANCELLATION

11.1 If the Customer cancels an order before the Shipping Date, Western reserves the right to charge the Customer a cancellation charge up to 100% of the amount of the order.

11.2 The Customer shall pay all cancellation charges within thirty (30) days from date of the Invoice.

FORCE MAJEURE

12.1 Western shall not be liable if its performance of the Agreement becomes commercially impractical due to any contingency beyond Western's reasonable control, including acts of God, fires, floods, wars, sabotage, civil unrest, accidents, labor disputes or shortages, government laws, rules and regulations, whether valid or invalid, inability to obtain material, equipment or transportation, incorrect, delayed or incomplete specifications, drawings or data supplied by the Customer or others (collectively "Force Majeure"). In no event of Force Majeure shall Western be required to purchase goods from others to enable it to deliver the Equipment under the Agreement.

ENGINEERING AND SYSTEM DESIGN

13.1 The Customer is solely responsible for the engineering, design, integration and normal preventative and remedial maintenance of the Customer's system for which Western supplies Equipment.

13.2 Western is not responsible for the satisfactory operation of the Equipment in conjunction with other manufacturer's equipment, nor for any losses which may occur as a result of a failure of the Equipment to coerate in conjunction with other manufacturer's equipment.

WARRANTY

14.1 All Equipment is covered by the Warranty.

14.2 THE WARRANTY CONTAINS LIMITATIONS ON THE CUSTOMER'S RIGHTS AND REMEDIES AGAINST WESTERN UNDER THE AGREEMENT. THE CUSTOMER ACKNOWLEDGES HAVING READ, UNDERSTOOD AND AGREED TO THOSE LIMITATIONS.

DAMAGES FOR BREACH OF AGREEMENT

15.1 If either party is successful in any litigation between the parties based on the Agreement, the successful party shall recover from the other, in addition to direct damages, the successful party's reasonable attorney's fees and other costs of litigation.

INSOLVENCY OF CUSTOMER, ETC.

16.1 Western may cancel the Agreement and suspend any further deliveries under the Agreement without any liability to the Customer, and, if Equipment has been delivered but not paid for, the price shall become immediately due and payable despite any other agreement to the contrary if:

(a) any proceedings in bankruptcy, insolvency, receivership or liquidation are taken against the Customer;

(b) the Customer makes an assignment for the benefit of creditors or commits an act of bankruptcy or insolvency;

(c) the Customer ceases, or threatens to cease, to carry on the ordinary course of its business, or transfers all or substantially all of its property;

(d) the Equipment is seized under any legal process or confiscated; or

(e) Western in good faith believes that the ability of the Customer to pay or perform any provision of the Agreement is impaired, or that any of the events mentioned above is about to occur.

NOTICE

17.1 All requests, instructions and notices from one party to the other must be in writing and may be given via registered post or facsimile transmission to the address of the parties shown on the Quotation or Order Acknowledgment.

EXPORT PROVISIONS

18.1 The Customer shall not, whether directly or indirectly (including facilitating a third party) export or re-export the Equipment outside the country in which the Customer has stated these items are to be used without obtaining the licenses required under all applicable rules. The Customer shall indemnify Western against any liability incurred by Western due to any violation by the Customer of any of the provisions of this Section, but this indemnity shall not apply if the Customer reasonably relies on information supplied to it by Western with respect to export licenses. Upon receipt of a governmental consent to export the receiving party shall immediately notify the other in writing.

MISCELLANEOUS

19.1 No waiver by Western of any breach of this Agreement shall be considered as a waiver of any subsequent breach of the same or any other provision.

19.2 Any provision of the Agreement which is, or is deemed to be, unenforceable in any jurisdiction shall be severable from the Agreement in that jurisdiction without in any way invalidating the remaining portions of the Agreement, and that unenforceability shall not make that provision unenforceable in any other jurisdiction.

19.3 The rights which accrue to Western by virtue of the Agreement shall inure for the benefit of and be binding upon the successors and assigns of Western.

19.4 The agreement shall be governed by the laws of the State of California including the California Uniform Commercial Code. However Western may enforce the provisions of the Agreement in accordance with the laws of the jurisdiction in which the Equipment is situated. The United Nations Convention on the Sale of Goods (The Vienna Convention) shall not apply to the Agreement.

19.5 Les parties ont exigés que cette entente soit rédigée en anglais.

GLENAYRE™ Western Multiplex

Lynx mini2

Table of Contents

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Tables

GLENAYRE™
Western Multiplex

1. How to Use This Manual

1.1 Manual Organization

The Installation and Maintenance Manual provides information required to install and maintain the *LYNX mini2* and to use its many features to the fullest advantage. This manual is divided into the following sections:

Section 1 Provides instructions on how to most effectively utilize the information in this manual.

Section 2 Provides a brief description and specifications of the *LYNX mini2*.

Section 3 Explains the *LYNX mini2* installation and adjustments in detail.

Section 4 Provides maintenance, repair and troubleshooting information for the *LYN mini2*.

Appendices Charts and diagrams are provided for radio connections and DIP switch settings along with other general information.

This device must be professionally installed. Instructions on setting the transmitter RF output power are contained in Section 3 of this Manual.

This device is to be used exclusively for fixed point-to-point operation that employs directional antennas.

1.2 Product Guide

The *LYNX mini2* Product Guide is a separate publication from this manual. The Product Guide is used for all the activity typically performed prior to the installation of the radios. The Product Guide contains the following information:

General Features Description

Ordering Information

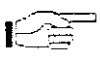
Path Planning

Installation Planning

The Path Planning portion of the product guide is critical to the success of the installation and use of the *LYNX.sc* radios. If you have not performed path planning, consult the *LYNX.sc* Product Guide to determine the anticipated performance of your radio system link. This information will be very helpful during installation, troubleshooting and maintenance. General information on path planning is also available in Section 3 of this manual.

1.3 Icons

Throughout this manual, the following icons are used to highlight areas of special interest and importance.



Note

Practical Tip

Caution

2. Product Description

2.1 General Description

The *LYNX mini2* provides a new level of control and convenience in a digital communications network.

The *LYN mini2* carries one 64 - 512 Kbps synchronous signal and one 300 - 38400 bps signal between two locations without the delay and expense of installing cable or traditional microwave.

Because each owner controls the operation of the link there is no reliance on any outside services. *LYNX mini2* operators are able to operate instant links whenever needed, and to be in control of their own network.

The *LYNX mini2* offers two primary benefits:

- **CONVENIENCE**

  Easy to install and operate with **no user license requirements** or frequency coordination in the USA. (Other countries may require a user license and/or frequency coordination).

- **CAPABILITY**

  Full transparent fractional 64 - 512 Kbps signal over any line-of-sight distance (typically up to 50 miles, depending on terrain and governmental regulations).

2.1.1 LYNX Evolution: 4 Generations

In 1992, Western Multiplex Corporation introduced the original first generation ***LYNX*** radios. These radios were the first spread spectrum radios to provide T1 and E1 point-to-point communications in the world.

In 1994, Western Multiplex Corporation added a significant feature to the LYNX product line. The second generation ***LYNX.cp*** product family provided controlled power, which allowed users to adjust the radio transmitter output power in order to meet EIRP limits. Also, Western Multiplex Corporation introduced the first double-capacity radios, the LYNX 2T6 and LYNX 2E6 in this family series.

The third generation ***LYNX.sc*** now continues this product evolution by adding many additional user features, most notably a service channel. The service channel allows radios to carry additional traffic over the radio link, such as alarms or network management. In addition, orderwire and remote/far-end monitoring features have been added along with some improved performance features, such as forward error correction and extended temperature operation.

A fourth generation *LYNX mini2* is now available in Fractional Capacities (64 to 512 kbps). It occupies a smaller single rack unit of space in a 19" rack.

2.2 Specifications

All specifications are subject to change without notice.

2.2.1 Transmitter

Frequency Selection	Rear Panel DIP switches; 7-cavity RF filter assembly
Modulation	QPSK
Coding	Direct Sequence
Number of Codes	4 (Rear Panel DIP switch selectable)
	2.4 GHz T1
Output Power (typ.)	+27 dBm
Output Power (min.)	+25 dBm
Control Range	30 dB min.
Frequency Range	2409-2473 MHz (occupies 2400 - 2483.5 MHz)

2.2.2 Antenna / Antenna Coupling Unit

Mechanics	External antenna
Antenna Connection	N-type female
Impedance	50 ohms
	2.4 GHz
Recommended Antenna (not included)	4, 6, or 8 foot parabolic or flat panel (narrow beam)
Gain & Beamwidth (3 dB)	
2 ft Antenna	N/A
4 ft Antenna	27 dB / 7°
6 ft Antenna	31 dB / 5°
8 ft Antenna	33.5 dB / 3.5°

2.2.3 Receiver

Nominal Receive Level	-30 to -60 dBm	
Maximum Receive Level	0 dBm error free, +10 dBm no damage	
Frequency Selection	Rear Panel DIP switches, 7-cavity RF filter assembly	
Processing Gain	10 dB minimum	
Threshold Rx Level ($BER = 10^{-6}$)	**2.4 GHz Fractioanl**	Data Rate
	-98 dBm	64 kbps
	-96 dBm	128 kbps
	-94 dBm	256 kbps
	-92 dBm	384 kbps
	-91 dBm	512 kbps
Frequency Range	2400 - 2483.5 MHz	

2.2.4 System (Single Hop Performance)

Error Floor	10^{-11}
Dispersive Fade Margin	58 dB, typical
Transmission delay	
(radio only)	250 usec, maximum
(10 mile path)	300 usec, maximum

Transmit (Receive) Frequencies (MHz)

Channel	64 kbps	128 kbps	256 kbps	384 kbps	512 kbps
0	2409.472*	2409.472*	**	**	**
1	2410.472	2410.472	2410.472*	**	**
2	2411.520*	2411.520*	2411.520	2411.520*	2411.520*
3	2412.544	2412.544	2412.544	2412.544	2412.544
4	2413.568*	2413.568*	2413.568	2413.568	2413.568
5	2414.592	2414.592	2414.592*	2414.592	2414.592
6	2415.616*	2415.616*	2415.616	2415.616	2415.616
7	2416.640	2416.640	2416.640	2416.640	2416.640
8	2417.664*	2417.664*	2417.664	2417.664*	2417.664*
9	2418.688	2418.688	2418.688*	2418.688	2418.688
10	2419.712*	2419.712*	2419.712	2419.712	2419.712
11	2420.736	2420.736	2420.736	2420.736	2420.736
12	2421.760*	2421.760*	2421.760	2421.760	2421.760
13	2422.784	2422.784	2422.784*	2422.784	2422.784
14	2423.808*	2423.808*	2423.808	2423.808*	2423.808*
15	2424.832	2424.832	2424.832	2424.832	2424.832
16	2425.856*	2425.856*	2425.856	2425.856	2425.856
17	2426.880	2426.880	2426.880*	2426.880	2426.880
18	2427.904*	2427.904*	2427.904	2427.904	2427.904
19	2428.928	2428.928	2428.928	2428.928	2428.928
20	2429.952*	2429.952*	2429.952	2429.952*	2429.952*
21	2430.976	2430.976	2430.976*	**	**
22	2432.000*	2432.000*	**	**	**

* These are non-overlapping channels

** These channels may not be used for 256, 384, or 512 kbps to prevent against out of band emissions. Selection of channel 0 or 1, will force the selection of channel 2 and selection of channel 21 or 22, will force the selection of channel 20 at these data rates

2.2.4 System (Single Hop Performance) Continued

Receive (Transmit) Frequencies (MHz)

Channel	64 kbps	128 kbps	256 kbps	384 kbps	512 kbps
0	2449.408*	2449.408*	**	**	**
1	2450.432	2450.432	2450.432*	**	**
2	2451.456*	2451.456*	2451.456	2451.456*	2451.456*
3	2452.480	2452.480	2452.480	2452.480	2452.480
4	2453.504*	2453.504*	2453.504	2453.504	2453.504
5	2454.528	2454.528	2454.528*	2454.528	2454.528
6	2455.552*	2455.552*	2455.552	2455.552	2455.552
7	2456.576	2456.576	2456.576	2456.576	2456.576
8	2457.600*	2457.600*	2457.600	2457.600*	2457.600*
9	2458.624	2458.624	2458.624*	2458.624	2458.624
10	2459.648*	2459.648*	2459.648	2459.648	2459.648
11	2460.672	2460.672	2460.672	2460.672	2460.672
12	2461.696*	2461.696*	2461.696	2461.696	2461.696
13	2462.720	2462.720	2462.720*	2462.720	2462.720
14	2463.744*	2463.744*	2463.744	2463.744*	2463.744*
15	2464.768	2464.768	2464.768	2464.768	2464.768
16	2465.792*	2465.792*	2465.792	2465.792	2465.792
17	2466.816	2466.816	2466.816*	2466.816	2466.816
18	2467.840*	2467.840*	2467.840	2467.840	2467.840
19	2468.864	2468.864	2468.864	2468.864	2468.864
20	2469.888*	2469.888*	2469.888	2469.888*	2469.888*
21	2470.912	2470.912	2470.912*	**	**
22	2471.936*	2471.936*	**	**	**

* These are non-overlapping channels
** These channels may not be used for 256, 384, or 512 kbps to prevent against out of band emissions. Selection of channel 0 or 1, will force the selection of channel 2 and selection of channel 21 or 22, will force the selection of channel 20 at these data rates

2.2.5 Digital Line Interface

Data Capacity, Primary Input	64, 128, 256, 384, or 512 kbps, synchronous, selectable 300,1200, 2400, 4800, 9600, 19200, 38400 bps, asynch, selectable
Data Capacity, Aux Input	300,1200, 2400, 4800, 9600, 19200, 38400 bps, asynch, selectable
Digital Interface, Primary Input	V.35, EIA-530, or RS-232, selectable (DB-25F connector)
Digital Interface, Aux Input	RS-232 (DB-9F connector)
Remote Loopback	External test signal (front panel DIP switch selectable)

2.2.6 Auxiliary Connections

Aux Data	RS-232 300 to 38400 bps, DB-9, female
Alarm Connector	1 x Form C, Barrier strip, plug-in type
Test Points	Output power, near-end received signal level (RSL)

GLENAYRE™ Western Multiplex

2.2.7 Temperature and Environment

Operating Temperature Range	-30 to +65°C
Humidity	95% non-condensing
Altitude	15,000 feet, maximum

2.2.8 Power

DC Input Voltage	±11 to ±63 VDC
Power Consumption	< 25 watts
AC Adapter (optional)	100-250 VAC, 50-60 Hz
Connector	Barrier strip, plug-in type

2.2.9 Regulatory Information

	LYNX mini2
FCC Identifier	HZB-LYNX72
FCC Rule Parts	15.247
Industry Canada ID	TBD
IC Rule Parts	RSS 139

2.2.10 Mechanical

Width (for 19-inch EIA rack mounting)	17.2" (rack mounting brackets supplied)
Height	1.75" 4.45 cm (1RU)
Depth	14.5" 36.8 cm
Weight	10 lbs. 4.54 kg

2.3 Front Panel Description

2.3.1 General

The *LYNX mini2* front panel, as shown in Figure 2-1, has LED indicators, test points, controls DIP switches and connections that are used for installation, maintenance, operation and troubleshooting. Prior to installation, it is best to be familiar with the front panel of the *LYNX mini2.* Sections 2.3.2 through 2.3.5 briefly describe the front panel access and lights from left to right.

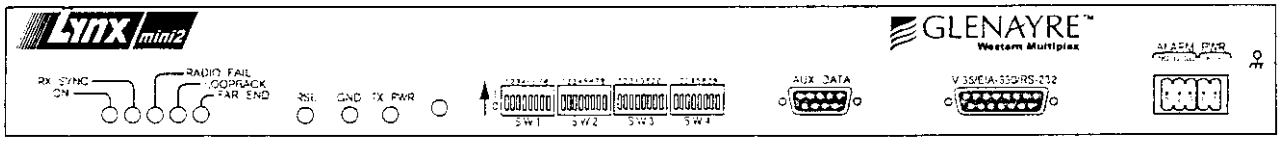


Figure 2-1: Front Panel, 2.4 GHz Fractional Radio

2.3.2 Test Points / Power Indicator

ON This is an LED indication. When lit GREEN, the *LYNX mini2* is powered.

The LYNX mini2 product does not have an on/off switch.

GND This is a test point reference to chassis ground. This is used in conjunction with the two next test points to measure voltages related to the radio performance.

RSL This is a test point which relates to the Received Signal Level (RSL). A voltage can be measured with a voltmeter (using the GND test point for reference) which corresponds to the actual power level of the incoming received signal. This measurement is used during installation, maintenance and troubleshooting.

TX PWR This is a test point which corresponds to the output transmit power of the radio. A voltage can be measured with a voltmeter (using the GND test point for reference) which corresponds to the actual power level of the outgoing signal. This measurement is used during installation, maintenance and troubleshooting

These voltages only apply to the near-end and does not allow measurement of the far-end output transmit power.

There is a receptacle on the front panel to the right of the TX PWR test point which is an installation adjustment allowing the output transmit power to be increased or decreased within the radio's specified limits. Using a small screwdriver, this adjustment is used to set the output power of the transmitter, in accordance to the path planning.

The LYNX mini2 requires professional installation. Transmitted output power limits may apply when using this radio. Consult FCC, IC, Glenayre Western Multiplex or other regulatory authorities for limits which may apply. See Section 3.13.1 for details on setting output power.

2.3.3 Alarm and Status Indicators

RX SYNC When extinguished, this is a condition indicating that the intended received signal is being received at the near end terminal and the receiver is synchronized to it. When lit RED, the receiver is not synchronized which may indicate problems related to the path, RF connections, or the near-end or far-end radio hardware.

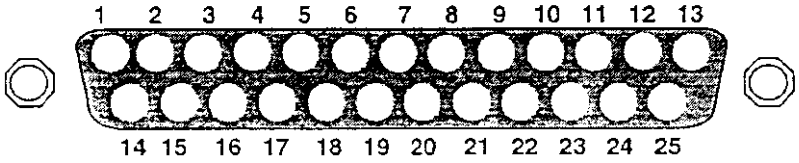
RADIO FAIL When lit RED, this is an alarm condition indicating a major failure with the near-end radio hardware. It can also indicate improper connections to the Data input ports.

LOOP BACK When flashing YELLOW, this is a condition indicating that the corresponding LOOPBACK DIP switch has been turned on and the far end *LYNX mini2* terminal has been looped back at the data channel.

FAR END When extinguished, this is a condition indicating that the intended received signal is being received at the far end terminal and the receiver is synchronized to it. When lit RED, the far end receiver is not synchronized which may indicate problems related to the path, RF connections, or the near-end or far-end radio hardware.

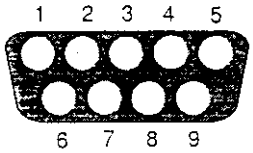
2.3.4 DATA Connections

There are two types of connections for the Data interface as shown in Figures 2-2 and 2-3. These connections provide the interface for the full duplex data signals. The V.35/EIA-530/RS-232, primary data channel connector carries 64, 128, 256, 384, or 512 kbps synchronous data signals or 300, 1200, 2400, 4800, 9600, 19200, or 38400 bps asynchronous data signals. The AUX DATA connector carries 300, 1200, 2400, 4800, 9600, 19200, or 38400 bps asynchronous data signals.



(as viewed from rear panel)

Figure 2-2: V.35/EIA-530/RS-232 Data Connector



(as viewed from front panel)

Figure 2-3: AUX DATA Connector

2.3.5 Alarm Connection

ALARM
This three pin, barrier strip connection is used to connect a single form-C radio alarm to a customers alarm monitoring system. This alarm point activates on any RADIO FAIL alarm.

2.3.6 Switches

There are four sets of 8-segment DIP switches (SW1, SW2, SW3 and SW4) as shown in Figure 2-1 on the front panel of the *LYNX mini2*. These switches provide user configuration of several radio parameters. A brief explanation for each function follows.

SW1-1, 2 Primary Port Mode — This set of switch segments allows the user to set the data port interface mode to V.35, EIA-530 synchronous or RS-232 asynchronous. (see Section 3.12.3)

SW1-3, 4, 5 Primary Port Data Rate — This set of switch segments allows selection of the input synchronous data rate of 64, 128, 256, 384 or 512 kbps or the asynchronous data rates of 300, 1200, 2400, 4800,9600, 19200, or 38400 bps for the Primary Port. (see Section 3.12.2)

SW1-6, 7, 8 Primary Port RTS/CTS — These switch segments allow the user to set the delay time of the CTS (Clear to Send) lead activation from 0 ms to 140 ms after the activation of the RTS (Ready to Send) lead. (see Section 3.12.6)

SW2-1 AUX DATA Port Mode — This switch segment allows the user to select either the 8N1 (8 bit word, No Parity, and 1 Stop bit) mode of asynchronous data transmission or the 7E2 (7 bit word, Even Parity, and 2 Stop bits) mode of asynchronous data transmission. (see Section 3.12.4)

SW2-2, 3, 4 AUX DATA Port Data Rate — This set of switch segments allows selection of the input data rate of 64, 128, 256, 384 or 512 kbps for the AUX DATA Port. (see Section 3.12.2)

SW2-5, 6, 7 AUX DATA Port RTS/CTS — These switch segments allow the user to set the delay time of the CTS (Clear to Send) lead activation from 0 ms to 140 ms after the activation of the RTS (Ready to Send) lead. (see Section 3.12.6)

SW2-8 AUX DATA Port DTR/DSR — This switch segment allow the user to set the DSR (Data Set Ready) lead activation to be always on or for it to follow the remote DTR (Data Terminal Ready) lead. (see Section 3.12.6)

2.3.6 Switches (Continued)

SW3-1 Primary Port DTR/DSR

This switch segment allow the user to set the DSR (Data Set Ready) lead activation to be always on or for it to follow the remote DTR (Data Terminal Ready) lead. (see Section 3.12.6)

SW3-2, 3, 4 Primary Port Clocking

This set of switch segments allows selection transmit timing or the receive timing to be TT (Terminal Timing), ST (Send Timing) or Channel Timing. (see Section 3.12.2)

SW3-5 Loopback enable

This switch segment allows the user to loopback the remote *LYNX mini2* Primary and AUX Data channels. (see Section 3.12.4)

SW3-6, 7 Spreading Code

This set of switch segments allows the user to select the spreading code for the spread spectrum signal. Both ends of a radio system must be set to the same code. Users may wish to change codes for radios that are nearby other similar radios to aid in interference rejection. (see Section 3.12.5)

SW4-1, 2, 3, 4, 5 Frequency

These switch segments allow the user to set the transmit and receive frequencies of the *LYNX mini2*. (see Section 3.12.6)

SW6-6 Master/Slave

This switch segment allows the user to set the *LYNX mini2* radio to master or slave operation. The master *LYNX mini2* radio synchronizes the VCXO (voltage controlled Oscillators) in both radios. The slave *LYNX mini2* radio adjusts its VCXO to match the master radios' frequency. (see Section 3.12.6)

2.4 Rear Panel Description

The *LYNX mini2* rear panel, as shown in Figures 2-4 has a single RF connection for the antenna system.

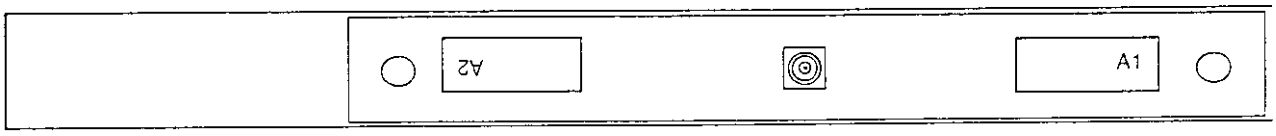


Figure 2-4: Rear Panel, LYNX mini2 Fractional Radio

2.4.1 RF Connection

The RF port of the *LYNX mimi2* radio is an N-type female connector that is an integral part of the filter assembly. The filter assembly occupies nearly the entire rear panel. The N-Type connector is used to connect to the antenna, typically using coaxial transmission line.

For the LYNX mini2, 1/2" or 5/8" coaxial cable (LDF4-50 or LDF4.5-50) is recommended

2.5 Installation Accessories

The *LYNX mini2* radio is shipped with several accessories commonly required for the radio as described below:

AC Power Supply — If ordered as an option, this power supply provides AC to DC conversion for use with AC powered locations.

AC Power Cord — This power cord connects the AC Power Supply, if ordered, to a standard 115V U.S. AC outlet.

Rack Mount Brackets — Two brackets (along with required mounting screws) are provided which allow 19-inch rack mounting of the *LYNX mini2* radio.

Terminal Connector 2-Pin — This is a 2-pin mating connector used for DC power supply or battery system.

DB-9M Connector — This mating connector is provided for the RS-232 AUX DATA port connection.

DB-25M Connector — This mating connector is provided for the V.35/EIA-530/RS-232 port connection.

Terminal Connector 3-Pin — This is a 3-pin mating connector used for the Form-C summary alarm output.

RF Power Adjustment Cover — A small plastic cap is provided which is placed over the RF output power adjustment receptacle after output power has been set by professional installation personnel.

Your Notes on the *LYNX mini2* Radio

3. Installation & Adjustments

3.1 Shipping Container

The equipment is shipped in boxes unless ordered as an integrated system and configured at the factory, in which case the equipment may be racked and shipped in a crate. The equipment is packaged so as to prevent damage in transit.

The boxes should be left intact and sheltered until arrival at the installation site.

If the shipping container shows signs of damage, the transportation company should be notified immediately. Extra care and inspection of the contents is advised immediately upon receipt.

It is recommended that all the packaging materials be retained. In the unlikely event that the equipment must be returned to the factory, use the original packing materials for return shipment. ***The original packaging materials are also recommended for transporting the equipment from location to location.***

Inside the primary shipping containers, internal boxes may contain other items. These boxes should also be saved for future use.

Also, save the LYNX mini2 test data sheet that is provided. The test data sheet can be placed where the LYNX.sc terminal will be installed for future quick reference. This sheet could also be placed in the front pocket of this manual, and the manual kept at the radio location for future reference. All LYNX mini2 units are individually tested and the actual measured performance recorded on the Factory Test Data Sheet. You will find this information to be of use during installation, troubleshooting and maintenance.

A set of quick installation instructions is also provided which can be useful for easy reference during installation.

3.2 Packing Items Identification

The primary shipping container houses the radio and an additional box. The box contains several related items inside including:

- This manual
- Installation accessory kit (see Section 2.5)

3.3 Before Installation Task List

There are several tasks that should be accomplished prior to installing the *LYNX mini2* radio system. This section briefly describes the following:

- Site selection
- Line-of-Sight and Path Clearance determination
- Anticipated RSL calculation
- Fade margin calculation
- Availability calculation
- Frequency plan determination
- Power supply planning
- Antenna (and accessories) purchase

Only directional antennas may be used with LYNX mini2 spread spectrum radios.

The LYNX mini2 Product Guide provides a more comprehensive description of these tasks.

3.3.1 Site Selection Requirements

The radio site must have:

- access to the appropriate power
- close proximity to the telephone or computer system you wish to interconnect
- line-of-sight to the other radio location with adequate clearance
- location for mounting the antenna

3.3.2 Line-of-Sight and Path Clearance Guidelines

The *LYNX min2* radios will not operate properly unless they have line-of-sight between their corresponding antennas. The *LYNX min2* radio transmission will not pass through trees or other obstacles. Factors to consider include:

- Earth curvature
- Future growth of trees
- Height of buildings

In addition to the line-of-sight requirement, a well-engineered path will also have additional path clearance to allow for signal loss due to partial obstructions, atmospheric ducting and ground reflections. To maximize radio reception, 0.6 times the first Fresnel zone should be calculated and this distance added to the path clearance (in addition to trees or buildings).

The LYNX min2 Product Guide should be consulted for further detail on performing these calculations.

3.3.3 RSL Calculation and Link Budget

The received signal level (RSL) can be estimated using the following formula:

$RSL\ (dBm) = P_{out} - FL_1 + G_1 + G_2 - FL_2 - L_p$

where: P_{out} is the transmitter output power (in dBm)

FL_1 is the feeder loss of the transmit side (in dB)

G_1 is the gain of the transmit antenna (in dB)

G_2 is the gain of the receive antenna (in dB)

FL_2 is the feeder loss of the receive side (in dB)

L_p is the Path loss, defined by:

$L_p\ (dB) = 92.6 + 20 \log_{10} F + 20 \log_{10} D$

where: F = Frequency in 2.4 GHz

D = Distance of path in kilometers

This link budget is very important for determining any potential problems during installation. If you have calculated the expected RSL, you can see if it has been achieved during installation, and troubleshoot if necessary.

The 2.4 GHz model may require power reduction where: $P_{out} - FL_1 + G_1$ is replaced by $30 - [(G_1 - 6)/3] + FL_1$

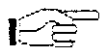
In some countries effective isotropic radiated power (EIRP) limits apply, such as +6 dBW (+36 dBm) in Canada. Output power may need to be reduced, and the above path planning equation changed such that: $EIRP\ (dBm) = P_{out} + G_1 - FL_1$

3.3.5 Availability Calculation

Availability of the microwave path is a measure of the percent of the time that the link will operate without producing an excessive BER due to multipath fading. In the absence of direct interference, availability is affected by the following:

- Path length
- Fade margin
- Frequency (2.4 GHz in the case of the *LYNX min2* radios)
- Terrain (smooth, average, mountainous)
- Climate (dry, temperate, hot/humid)

Depending on the type of traffic carried over the link, the system designer may wish to design for a specific availability. For example, if the data or voice traffic that is carried by the radio is critical then it may be designed for a very high availability (e.g. 99.999% or 5.3 minutes of outage per year). To improve availability, for example, the fade margin can be increased by making the path shorter, or by using higher gain antennas in conjunction with lower loss feeders (by using high quality transmission line or shortening feed length).



Refer to the LYNX min2 Product Guide for additional information on percentage availability performance for various operational conditions.

3.3.4 Fade Margin Calculation

The fade margin is the difference between the actual received signal and the radio's threshold. Using the formula provided in Section 3.3.3, the anticipated RSL can be calculated. Compare this RSL to the specified threshold of the *LYNX mini2* radio, which is shown in Section 2.2, and calculate the fade margin as the difference between the two signal levels.

Refer to the LYNX min2 Product Guide for additional information on fade margin performance for various operational conditions.

Dispersive fade margin is another factor that many microwave path engineers may use to plan their link budget. For the *LYNX min2*, the dispersive fade margin is in excess of 55 dB and therefore is not a determining factor in path planning. This excellent dispersive fade margin performance is important because the spread spectrum RF signal has considerably wide bandwidth.

3.3.6 Frequency Plan Determination

When configuring radios in a hub or repeater configuration, careful engineering of the *LYNX min2* radio frequency plans and antenna locations should be performed in order to minimize potential interference between the nearby radios. As a rule of thumb, do not place radios using the same frequency (e.g. two A1 channel 2s) at the same site. In most cases, it is desirable to use different frequencies (e.g. A1 channel 2 versus A1 channel 4). However, with careful engineering, placing more than one radio with the same frequency channel at the same site can be accomplished. In fact, the *LYNX min2* frequency plan is designed to allow complex hub configurations that may require re-using the same frequency. When designing these types of configurations, antenna sizes and antenna location are critical. If identical channels must be used at the same site, the same frequency (e.g. A1 channel 1) should be used at a site instead of A1 channel 1 and A2 channel 1 to minimize interference. Using alternate channels (e.g. A1 channel 2 and A1 channel 4) is less likely to be successful (and therefore not recommended) due to the high level of transmitter to receiver isolation required from the antenna system.

Sometimes it is required to locate the *LYNX mini2* radio nearby a transmitter that is the same as, or close to the *LYNX mini2* receive or transmit frequencies. In this case, the *LYNX mini2* terminal that should be placed closest to this interfering transmitter should be the specific terminal with the receive frequency which is furthest from this unwanted transmitted frequency. This approach minimizes the potential of interference. While interference conditions are rare when using the *LYNX mini2* radios, cases of interference may be overcome by exchanging the radios from end to end or simply reinstalling the filter unit, as described in Section 4.2 (thus swapping the frequencies of both ends of the radio link). In some cases, changing frequency channels (e.g. from 2 to 4) can also help mitigate any interference.

Section 4.8 of this manual describes interference countermeasures in further detail.

3.3.7 Power Supply Planning

The *LYNX mini2* radio must have access to a supply of appropriate power, either DC or AC (if the AC adapter option has been ordered). The *LYNX mini2* can be powered from a DC battery system, or from a solar or generator power plant, usually with battery reserves. Typically either a positive or negative ground 24 or 48 volt supply is used.

Before installing the radio, plan for the continuous power consumption needs in accordance with the specifications given in Section 2.2 of this manual. It is also wise to plan for backup power for critical communication circuits (including the *LYNX mini2* radio). Backup power allows the radios and associated equipment to continue operation when primary power is interrupted.

3.3.8 Antenna Planning

Using the path planning tools and equations presented in the *LYNX mini2* Product Guide, proper antenna size can be determined which will yield the desired path performance. In general, the larger the antenna that is used with the *LYNX mini2* radio, the better the link will perform. Larger antennas have narrower beamwidth and higher gain, which will yield better link performance (higher fade margin, better availability) and improve immunity to interference (due to the smaller beamwidths). However, larger antennas are more costly to purchase and install than smaller antennas, in some cases requiring special equipment for installation. All of these factors should be taken into consideration when selecting an antenna. Consult the *LYNX mini2* Product Guide for more details on selecting antennas.

In areas where transmitted output power restrictions apply, the use of larger antennas will maintain the benefit of narrow beamwidths and receive gain. However, output power may need to be reduced to meet regulations. (See Section 3.13.1)

Prior to installation, the specific antenna location and mounting should be determined. This advanced planning also yields the transmission line requirements.

Only directional antennas may be used with LYNX mini2 spread spectrum radios.

3.4 Tools Required

The following tools may be required for the installation of the *LYNX mini2* radios:

- Phillips (cross tip) screwdrivers (for 19-inch rack mounting and attachment of brackets)
- Small blade standard screwdriver (for power supply connector and RF output power adjust)
- Soldering iron (if using any D-type connectors)
- Wire strippers (for removing insulation from power supply and other wiring)
- Digital Voltmeter (to measure RSL, Tx output power, Alarms)

The following tools are recommended for the installation of the *LYNX mini2* radios:

- RF power meter (to measure transmitter output power)
- Cellular phone or two-way radio (for talking with far-end crew and tower crew)
- Bit Error Rate test set (to test link after installation)

Additional tools will likely be needed for antenna and transmission line installation and antenna alignment. Consult Sections 3.8 through 3.10 of this manual for more details.

3.5 Frequency Channel Plans

The *LYNX mini2* offers several non-overlapping channel plans. These channel plans are selected based upon the data transmission rate chosen by the radio operator and they are indicated by an asterisks (*) in Table 3-A below. For 64 and 128 kbps data rates there are 12 RF channels available. For 256 kbps data rate there are 6 RF channels available. For 384 and 512 kbps data rates there are 4 RF channels available. All of the other channels shown are over lapping channels. This channel plan arrangement allows users to implement *LYNX mini2* in the proximity of other *LYNXmini2* radios (planned or unplanned), hub and repeater applications, and can be used to mitigate interference. The channel plans are illustrated below in Table 3-A. Each RF channel is made up of two frequencies. Channel 0, A1 Tx A2 Rx is made up of 2409.472 GHz transmit and 2449.408 GHz receive frequencies. Section 4.2 and 4.3 describe how to change frequency channel assignments of a *LYNX mini2* radio.

Data Rates	**64 kbps & 128 kbps**		**256 kbps**		**384 kbps & 512 kbps**	
Channels	A1 Tx A2 Rx	A2 Tx A1 Rx	A1 Tx A2 Rx	A2 Tx A1 Rx	A1 Tx A2 Rx	A2 Tx A1 Rx
0	2409.472*	2449.408*	**	**	**	
1	2410.472	2450.432	2410.472*	2450.432*	**	**
2	2411.520*	2451.456*	2411.520	2451.456	2411.520*	2451.456*
3	2412.544	2452.480	2412.544	2452.480	2412.544	2452.480
4	2413.568*	2453.504*	2413.568	2453.504	2413.568	2453.504
5	2414.592	2454.528	2414.592*	2454.528*	2414.592	2454.528
6	2415.616*	2455.552*	2415.616	2455.552	2415.616	2455.552
7	2416.640	2456.576	2416.640	2456.576	2416.640	2456.576
8	2417.664*	2457.600*	2417.664	2457.600	2417.664*	2457.600*
9	2418.688	2458.624	2418.688*	2458.624*	2418.688	2458.624
10	2419.712*	2459.648*	2419.712	2459.648	2419.712	2459.648
11	2420.736	2460.672	2420.736	2460.672	2420.736	2460.672
12	2421.760*	2461.696*	2421.760	2461.696	2421.760	2461.696
13	2422.784	2462.720	2422.784*	2462.720*	2422.784	2462.720
14	2423.808*	2463.744*	2423.808	2463.744	2423.808*	2463.744*
15	2424.832	2464.768	2424.832	2464.768	2424.832	2464.768
16	2425.856*	2465.792*	2425.856	2465.792	2425.856	2465.792
17	2426.880	2466.816	2426.880*	2466.816*	2426.880	2466.816
18	2427.904*	2467.840*	2427.904	2467.840	2427.904	2467.840
19	2428.928	2468.864	2428.928	2468.864	2428.928	2468.864
20	2429.952*	2469.888*	2429.952	2469.888	2428.928*	2469.888*
21	2430.976	2470.912	2430.976*	2470.912*	**	**
22	2432.000*	2471.936*	**	**	**	

* These are non-overlapping channels
** These channels may not be used for 256, 384, or 512 kbps to prevent against out of band emissions. Selection of channel 0 or 1, will force the selection of channel 2 and selection of channel 21 or 22, will force the selection of channel 20 at these data rates

Table 3-A: Channel Plan, 2.4 GHz LYNX mini2

3.6 Mounting the LYNX mini2

The *LYNX mini2* can be mounted at any height in a standard 19-inch rack. Blank rack-mounting spaces above and below the *LYNX mini2* are recommended, especially if the surrounding equipment dissipates a considerable amount of heat (over 50W).

The *LYNX mini2* may be set up for mounting with the front edge projecting from the front face of a standard 19-inch rack using the rack mounting brackets enclosed with the screws in the Accessory Kit (4 per bracket). The rack mounting brackets may be reversed, in order to install for flush or cabinet mounting if preferred. Depending on rack configuration, it may be necessary to remove the four adhesive backed rubber feet on the bottom of the unit.

The LYNX mini2 has internal fans which intake and exhaust on the left and right sides of the chassis. When rack mounting, it is important to leave a small gap between the outer edges of the radio and the inside edge of the rack.

The LYNX mini2 may alternatively be placed on a table or shelf attached to a wall. Because of the low weight of the LYNX mini2, any mounting option other than rack mounting will be less secure.

3.7 Power Connection and Wiring

There is no ON/OFF switch on the LYNX mini2. As soon as power is applied, the equipment will be operational. This means that there can be up to 1W of RF power present at the antenna port. The antenna port should be terminated before power is applied.

Power is connected using the DC power plug contained in the Accessory Kit. Use Table 3-B or 3-C along with the associated diagram of Figure 3-2 or 3-3 to connect the DC power cables. For example, for a negative DC power input, use Table 3-A and Figures 3-2 .

NEGATIVE DC POWER INPUT (–11 TO –63 VDC)	
PIN	FUNCTION
1	Return (+DC)
2	Power (–DC)

Table 3-B: DC Power Connection for Negative Supply

POSITIVE DC POWER INPUT (+11 TO +63 VDC)	
PIN	FUNCTION
1	Power (+DC)
2	Return (–DC)

Table 3-C: DC Power Connection for Negative Supply

The DC power return connection should be connected to chassis ground at the screw terminal next to the power terminals to improve protection against lightening damage.

3.7.1 DC Power Wiring

Connect the power cable with adequate current rating (minimum of 20 AWG) to the terminals shown on the removed (not plugged into the radio) DC power plug using the screw connections. The recommended minimum current rating of external fuses and cables is 3 Amps. The *LYNX mini2* radios consume approximately 0.5 Amps at ±48V and less than 1 Amp at ±24V.

Each LYNX mini2 terminal should be externally fused separately with a 3 Amp maximum fuse.

If using **negative** power, connect the negative voltage to the " - " pin. Connect the ground return connection to the " + " pin. See Figure 3-1.

If using **positive** power, connect the positive voltage to the " + " pin. Connect the ground return connection to the " - " pin. See Figure 3-2.

The **chassis ground** connection is available at the screw terminal next to the power terminals. This terminal should be connected to the power return pin for improved Either pin may be used to ground the return side of the power supply. Do not ground both sides of the power supply.

Proper grounding, either through the chassis and/or the power supply, can be very important for protection from lightning. A grounding screw hole is provided on the front panel.

The ground connection may be left floating if the power supply is referenced to ground externally and to avoid ground loops in some configurations. However, this may not provide adequate grounding for lightning protection.

Use a DVM (digital voltmeter) to verify voltage and polarity on the DC power plug.

Do not connect the DC power plug to the front of the LYNX mini2 terminal until a load is connected to the antenna port (either an RF pad, or an RF cable and antenna).

Figure 3-1: Negative Voltage DC Connection

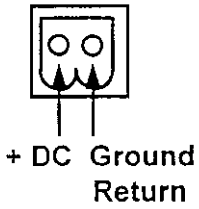
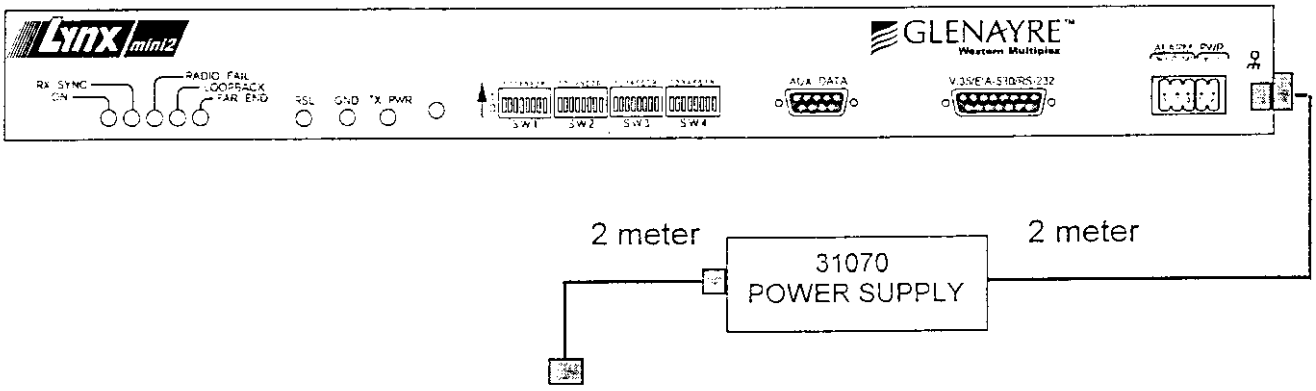


Figure 3-2: Positive Voltage DC Connection

Make sure that when connecting the mating plug that it is properly oriented (terminal screws pointing up) and securely fastened.

3.7.2 AC Power Connection

The optional AC power supply (P/N 31070) operates from any AC voltage 100V - 250V and 50 Hz or 60 Hz. The AC supply is equipped with a mating connector that plugs directly into the *LYNX mini2* and an AC cord with a 3-pin AC plug. The AC cord color code is shown in Figure 3-3 in case users wish to replace the AC plug supplied with a different type of plug.



AC Cord Color Code	
L (line)	Black
N (neutral)	White
G (ground)	Green

Figure 3-3: AC Connection

3.8 Antenna Connection

The *LYN mini2* is equipped with an N-type female connector at the antenna port located on the rear panel. A short length (~6 feet) jumper cable such as RG-214 coax (or "pigtail") fitted with two N-type male connectors can be used to connect the antenna port to the antenna transmission line (see Section 3.9). The recommended cable type for a jumper is RG-214.

A low loss 50-ohm cable (e.g. LDF4-50 1/2 inch or LDF4.5-50 5/8 inch coax) is recommended for the antenna transmission line between the top of the rack and the antenna. The return loss presented by the transmission line at the top of the rack should be as high as possible (20 dB, minimum recommended). The length of the antenna transmission line should be kept as short as possible (to minimize losses).

For the LYNX mini2, 1/2" or 5/8" coaxial cable (LDF4-50 or LDF4.5-50) is recommended.

3.9 Transmission Line Connection

The transmission line feeder (such as LDF4-50 1/2 inch coax) should be prepared first by cutting to the approximate length (allowing some excess) and installing the appropriate connector on the antenna end.

The prepared transmission line is then pulled through the cable ducts, trays or conduit (as required) to the antenna, while being careful not to kink or damage the transmission line in any way.

The transmission line should be supported in a tray on horizontal runs and by hangers on vertical runs. Hangers should be spaced according to the manufacturer's instructions (typically every 5 feet under conditions of no ice and not greater than 85 mph winds).

The transmission line should be grounded using the manufactures recommended grounding kit. Grounding kits attach to the outer copper conductor. Grounds must be installed at the antenna, at the bottom of the tower (if applicable) and where the transmission line enters the building. Long transmission line runs should be grounded every 100 feet. In areas of high incidence of lightning, dissipaters should be attached to antennas. In addition, coaxial, in-line, spark-gap type, lightning suppressors should be added at the bottom of the coax cable before entering the building/enclosure.

Any in-line lightning protection device must be rated for the operating frequency of the LYNX mini2.

Prior to operation, the electrical integrity of the transmission line, including all connectors, can be checked with a simple DC check between the center conductor and outer conductor.

The transmission line should ideally be connected directly to the antenna at one end and to the *LYNX mini2* antenna port at the other end. However, short RG-214 type jumper cables may be required to avoid sharp bends in the transmission line to limit stress on either connection.

Do not use a low quality N-type jumper cable with the LYNX mini2.

3.10 Antenna Installation & Alignment

Due to the possibility of exposure to RF radiation above the recommended levels, do not stand within two (2) feet of the antenna for prolonged periods during system operation. It is the responsibility of the installer to insure that the antenna is mounted in a place that is not accessible to the public.

The antenna installation consists of mounting the antenna on the tower, building roof, or other location that provides line-of-sight path clearance to the far-end location. In general, antennas smaller than 2 feet (0.6 m) diameter are not recommended for urban areas due to their wider beamwidths, which results in higher interference susceptibility. For *LYNX mini2* radios, a minimum of 4 foot (1.2m) diameter antennas, or larger, are recommended.

Antennas should be ordered with a suitable mounting kit specific to the site requirements. For example, specifying round or angle tower leg adapters, or a roof tripod as necessary.

If the antenna is to be mounted indoors, "looking" through a window, it is recommended that the antenna be placed approximately 12 inches away from the glass and within 10 degrees of a right angle to the glass. The glass should be lead-free or very low-lead content type and avoid any metallic glass coatings for best results.

The antenna must be very rigidly mounted, with adequate room for azimuth and elevation adjustment.

The antenna polarization must be the same at both ends of the link, either vertical or horizontal.

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 mini2* terminals are required to align the antennas. Alternatively, a CW generator may be used to transmit a signal toward the end under alignment with a spectrum analyzer used to receive the signal

The antenna is coarse aligned using visual sighting and then fine aligned using the receive signal level (RSL) voltage of the *LYNX min2*.

The RSL voltage reading can still be used to peak antennas even if the radios have not synchronized.

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 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 mini2.

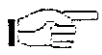
Once the coarse alignment has been set-up at both ends, then the link can be powered and some level of reliable communication established. The voltage at the *LYNX mini2* front panel RSL test point should be measured with a DVM to determine the relative receive RF signal level.

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 mini2*.

When aligning antennas it may be convenient to run two wires from the RSL and ground test points to the antenna so that the voltmeter reading is directly visible to the technicians aligning the antenna. Also, a cellular telephone or two-way radio may be useful for coordinating alignment activities between both ends of the link.

The larger the antenna size, the more critical alignment becomes: for example, with a 2 foot (0.6 m), 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 (1.8 m) antenna, which may only be moved ±1 degree for the same degradation.

The graph shown in Figure 3-5 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 mini2* 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 mini2 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. Refer to the *LYNX mini2* Product Guide for details of the Link Budget calculation. 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.)

LYNX mini2

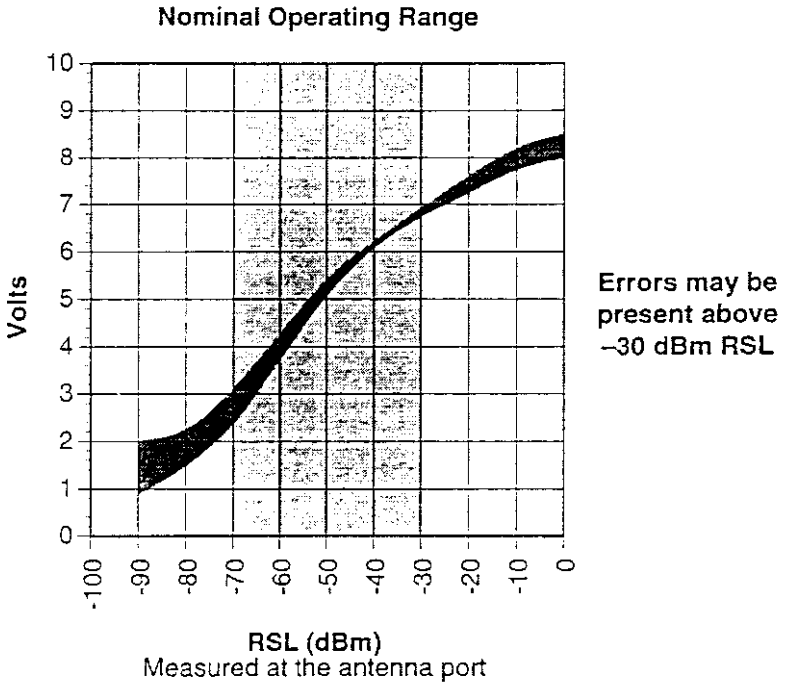


Figure 3-4: Typical RSL Voltage versus Received Signal Level (RSL)

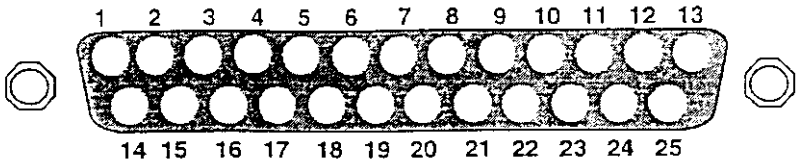
3.11 Data Interface Connections

3.11.1 V.35/EIA-530/RS-232 Interface Connections

The *LYNX mimi2* Fractional, Spread Spectrum radio, primary data connector is a DB-25F type connector. It is located on the front panel of the *LYNX mimi2* and it is labeled V.35/EIA-530/ RS-232. This data port may be connected directly to the customers Data Terminal Equipment (DTE) which has a V.35, EIA-530 or an RS-232 interface. This data port interface type (V.35, EIA-530 or an RS-232 interface) is selected by DIP switches on the front panel of the *LYNX mimi2* (See 3-7 for the DIP switch settings). The DTE terminals may have many different types of connectors such as Winchester 34 pin, DB-37 or DB-60 connectors. Therefore please refer to Figure 3-6 for the correct pin connections to build the data cable. The cabling distance to the data source is limited 20 ft. (6 m).

When the *LYNX mimi2* primary data connector is used for V.35 or EIA-530 operation data speeds may be set for 64,128, 256, 384 or 512 kbps. When the *LYNX mimi2* primary data connector is used for RS-232 operation data speeds may be set for 300 to 38400 bps. These data speeds are set using DIP switches settings shown in Figure 3-7.

Figure 3-5 shows the pin locations of the primary data connector. Tables 3-D, and 3-E show the V.35, EIA-530 and RS-232 pin assignments.



(as viewed from rear panel)

Figure 3-5: V.35/EIA-530/RS/232 Connector (front panel view)

Pin	Signal	Function		Description
1		Shield Ground		
2	TD	Transmit Data		Input
3	RD	Receive Data		Output
4	RTS	Request To Send		Input
5	CTS	Clear To Send		Output
6	DSR	Data Set Ready		Output
7	SG	Signal Ground		
8	DCD	Data Carrier Detect		Output
9	RT(B)	Receive Timing Inverse (B)		Output
10	DCD(B)	Data Carrier Detect (B)	(EIA-530 only)	Output
11	TT(B)	Terminal Timing Inverse (B)		Input
12	ST(B)	Send Timing Inverse (B)		Output
13	CTS(B)	Clear To Send Inverse (B)	(EIA-530 only)	Output
14	TD(B)	Transmit Data Inverse (B)		Input
15	ST	Send Timing		Output
16	RD(B)	Receive Data Inverse (B)		Output
17	RT	Receive Timing		Output
19	RTS(B)	Ready To Send Inverse (B)	(EIA-530 only)	Input
20	DTR	Data Terminal Ready		Input
22	DSR(B)	Data Set Ready Inverse (B)	(EIA-530 only)	Output
23	DTR(B)	Data Terminal Ready Inverse (B)	(EIA-530 only)	Input
24	TT	Terminal Timing		

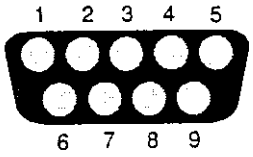
Table 3-D: V.35/EIA-530 Connector Pin Assignments

Pin	Signal	Function	Description
1		Shield Ground	
2	TD	Transmit Data	Input
3	RD	Receive Data	Output
4	RTS	Request To Send	Input
5	CTS	Clear To Send	Output
6	DSR	Data Set Ready	Output
7	SG	Signal Ground	
8	DCD	Data Carrier Detect (Receive Signal Line Detect)	Output
15	ST	Send Timing	Output
17	RT	Receive Timing	Output
20	DTR	Data Terminal Ready	Input
24	TT	Terminal Timing	Input

Table 3-E: RS-232 Connector Pin Assignments

3.11.2 AUX DATA Interface Connections

The *LYNX mimi2* Fractional, Spread Spectrum radio, AUX DATA connector is a DB-9F type connector. It is located on the front panel of the *LYNX mimi2*. This data port may be connected directly to the customers Data Terminal Equipment (DTE) which an RS-232 interface. The DTE terminals may have many different types of connectors such as a DB-9 or a DB-25 connector. Therefore please refer to Figure 3-6 for the correct pin connections to build the data cable. The cabling distance to the data source is limited 20 ft. (6 m).



(as viewed from front panel)

Figure 3-6: AUX DATA Connector (front panel view)

Pin	Signal	Function	Description
1		Shield Ground	
2	TD	Transmit Data	Input
3	RD	Receive Data	Output
4	RTS	Request To Send	Input
5	CTS	Clear To Send	Output
6	DSR	Data Set Ready	Output
7	SG	Signal Ground	
8	DCD	Data Carrier Detect (Receive Signal Line Detect)	Output

Table 3-F: AUX DATA, RS-232 Connector Pin Assignments

3.12 DIP Switch Settings

A quick reference guide to all DIP Switches is provided in Table 3-G or in Appendix B.

DIP switch settings are noted by their position, either up (1), or down (0), not by on/off as may be printed on the DIP switch assembly.

3.12.1 Channel Selection

The *LYNX mini2* offers several frequencies of operation (see Section 3.5). There are six DIP switch segments (numbers 1 through 6 on SW4) which define the frequency channel plan of the *LYNX mini2* radio (refer to Table 3-G or Appendix B). The DIP switches must be set to match the filter assembly that is mounted on the radio. (e.g. A1 or A2).

Radios are shipped from the factory with their DIP switch segments set to match the installed filter. In most cases, modification of these switches will be required. The customer should choose a frequency channel that is compatible with the data rate that they have set in the radios. The diplexer filter located on the rear panel of the *LYNX mini2* is labeled A1 for the low half of the frequency band and A2 for the high half of the frequency band. One label is right side up and the other is upside down. Set the DIP switch settings for the label that is right side up. If a new filter is installed, or the existing filter is rotated for opposite channel configuration (e.g. A1 to A2), reset the DIP switches to match the right side up label on the filter. Refer to Section 4.2 for more information.

The radio channel conversion from low band (A1 transmit) to high band (A2 transmit) is user adjustable by removing reversing the filter assembly. This allows units of the same with the same radio channel to be used as spares for several radios. For example, if a network of *LYNX mini2* radios has several radios using channel plans A1 to A2 or A2 to A1, a single spare unit of either A1 or A2, can be used to spare all the radios. If a radio failure were to occur in the network, the filter assembly of the spare unit could be changed to A1 or A2 by simply rotating the filter assembly. The DIP switch segments on the spare will need to change to match the frequency of the failed radio.

Consult Section 4.2 of this manual for more information on changing RF channels. Consult Appendix B for proper frequency channel switch settings.

NON-overlapping frequencies should be used to minimize the possibility of inter-system interference.

GLENAYRE™ Western Multiplex

Data Rates	SW4	64 kbps & 128 kbps		256 kbps		384 kbps & 512 kbps	
Channels	SWITCH POSITION 1 2 3 4 5 6	A1 Tx	A2 Rx	A1 Tx	A2 Rx	A1 Tx	A2 Rx
0	0 0 0 0 0 0	2409.472*	2449.408*	**	**	**	
1	0 0 0 0 1 0	2410.472	2450.432	2410.472*	2450.432*	**	**
2	0 0 0 1 0 0	2411.520*	2451.456*	2411.520	2451.456	2411.520*	2451.456*
3	0 0 0 1 1 0	2412.544	2452.480	2412.544	2452.480	2412.544	2452.480
4	0 0 1 0 0 0	2413.568*	2453.504*	2413.568	2453.504	2413.568	2453.504
5	0 0 1 0 1 0	2414.592	2454.528	2414.592*	2454.528*	2414.592	2454.528
6	0 0 1 1 0 0	2415.616*	2455.552*	2415.616	2455.552	2415.616	2455.552
7	0 0 1 1 1 0	2416.640	2456.576	2416.640	2456.576	2416.640	2456.576
8	0 1 0 0 0 0	2417.664*	2457.600*	2417.664	2457.600	2417.664*	2457.600*
9	0 1 0 0 1 0	2418.688	2458.624	2418.688*	2458.624*	2418.688	2458.624
10	0 1 0 1 0 0	2419.712*	2459.648*	2419.712	2459.648	2419.712	2459.648
11	0 1 0 1 1 0	2420.736	2460.672	2420.736	2460.672	2420.736	2460.672
12	0 1 1 0 0 0	2421.760*	2461.696*	2421.760	2461.696	2421.760	2461.696
13	0 1 1 0 1 0	2422.784	2462.720	2422.784*	2462.720*	2422.784	2462.720
14	0 1 1 1 0 0	2423.808*	2463.744*	2423.808	2463.744	2423.808*	2463.744*
15	0 1 1 1 1 0	2424.832	2464.768	2424.832	2464.768	2424.832	2464.768
16	1 0 0 0 0 0	2425.856*	2465.792*	2425.856	2465.792	2425.856	2465.792
17	1 0 0 0 1 0	2426.880	2466.816	2426.880*	2466.816*	2426.880	2466.816
18	1 0 0 1 0 0	2427.904*	2467.840*	2427.904	2467.840	2427.904	2467.840
19	1 0 0 1 1 0	2428.928	2468.864	2428.928	2468.864	2428.928	2468.864
20	1 0 1 0 0 0	2429.952*	2469.888*	2429.952	2469.888	2428.928*	2469.888*
21	1 0 1 0 1 0	2430.976	2470.912	2430.976*	2470.912*	**	**
22	1 1 0 0 0 0	2432.000*	2471.936*	**	**	**	

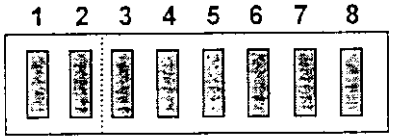
Data Rates	SW4	64 kbps & 128 kbps		256 kbps		384 kbps & 512 kbps	
Channels	SWITCH POSITION 1 2 3 4 5 6	A2 Tx	A1 Rx	A2 Tx	A1 Rx	A2 Tx	A1 Rx
0	0 0 0 0 0 1	2449.408*	2409.472*	**	**	**	
1	0 0 0 0 1 1	2450.432	2410.472	2450.432*	2410.472*	**	**
2	0 0 0 1 0 1	2451.456*	2411.520*	2451.456	2411.520	2451.456*	2411.520*
3	0 0 0 1 1 1	2452.480	2412.544	2452.480	2412.544	2452.480	2412.544
4	0 0 1 0 0 1	2453.504*	2413.568*	2453.504	2413.568	2453.504	2413.568
5	0 0 1 0 1 1	2454.528	2414.592	2454.528*	2414.592*	2454.528	2414.592
6	0 0 1 1 0 1	2455.552*	2415.616*	2455.552	2415.616	2455.552	2415.616
7	0 0 1 1 1 1	2456.576	2416.640	2456.576	2416.640	2456.576	2416.640
8	0 1 0 0 0 1	2457.600*	2417.664*	2457.600	2417.664	2457.600*	2417.664*
9	0 1 0 0 1 1	2458.624	2418.688	2458.624*	2418.688*	2458.624	2418.688
10	0 1 0 1 0 1	2459.648*	2419.712*	2459.648	2419.712	2459.648	2419.712
11	0 1 0 1 1 1	2460.672	2420.736	2460.672	2420.736	2460.672	2420.736
12	0 1 1 0 0 1	2461.696*	2421.760*	2461.696	2421.760	2461.696	2421.760
13	0 1 1 0 1 1	2462.720	2422.784	2462.720*	2422.784*	2462.720	2422.784
14	0 1 1 1 0 1	2463.744*	2423.808*	2463.744	2423.808	2463.744*	2423.808*
15	0 1 1 1 1 1	2464.768	2424.832	2464.768	2424.832	2464.768	2424.832
16	1 0 0 0 0 1	2465.792*	2425.856*	2465.792	2425.856	2465.792	2425.856
17	1 0 0 0 1 1	2466.816	2426.880	2466.816*	2426.880*	2466.816	2426.880
18	1 0 0 1 0 1	2467.840*	2427.904*	2467.840	2427.904	2467.840	2427.904
19	1 0 0 1 1 1	2468.864	2428.928	2468.864	2428.928	2468.864	2428.928
20	1 0 1 0 0 1	2469.888*	2429.952*	2469.888	2429.952	2469.888	2429.952
21	1 0 1 0 1 1	2470.912	2430.976	2470.912*	2430.976*	**	**
22	1 1 0 0 0 1	2471.936*	2432.000*	**	**	**	

* These are non-overlapping channels
** These channels may not be used for 256, 384, or 512 kbps to prevent against out of band emissions. Selection of channel 0 or 1, will force the selection of channel 2 and selection of channel 21 or 22, will force the selection of channel 20 at these data rates

Table 3-G: RF Channel Switch Settings

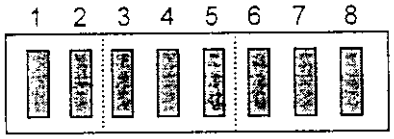
3.12.2 V.35/EIA-530/RS-232 Port, Interface Mode and Data Rate Selection

The *LYNX mini2* is equipped with a DB-25 female connector. This V.35/EIA-530/RS-232 connector may be used for V.35 or EIA-530 synchronous data rates of 64, 128, 256, 384, or 512 kbps. It may also be used for RS-232 asynchronous data rates of 300, 1200, 2400, 4800, 9600, 19200, or 38400 bits/s. Figure 3-7 below shows the DIP switch settings for choosing the Interface modes and the corresponding data rates. The cabling distance to the data source (DTE to DCE) is limited to 100 ft (30 m). SW1 and SW3 located on the front of the *LYNX mini2* must be selected to choose the data interface mode, data rates and clocking mode of the V.35/EIA-530/RS-232 connector.



SW1

Switch Position 1	2	Primary Channel Interface Mode V.35/EIA-530/RS-232
0	0	V.35 Synchronous
0	1	EIA-530 Synchronous
1	0	RS-232 Asynchronous (8N1)
1	1	RS-232 Asynchronous (7E2)



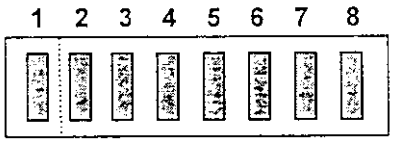
SW1

Switch Position			Primary Channel Data rate V.35/EIA-530/RS-232	
3	4	5	**RS-232**	**V.35 & EIA-530**
0	0	0	300 bps	Reserved
0	0	1	1200 bps	Reserved
0	1	0	2400 bps	64 kbps
0	1	1	4800 bps	128 kbps
1	0	0	9600 bps	256 kbps
1	0	1	19200 bps	384 kbps
1	1	0	38400 nps	512 kbps
1	1	1	Reserved	Reserved

Figure 3-7: Interface Mode and Data Rate Switches for V.35/EIA-530/RS-232 Data Channel

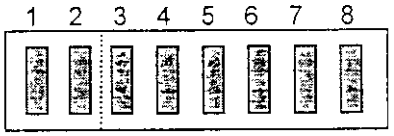
3.12.3 AUX DATA Port Data Rate Selection

The *LYNX mini2* is equipped with a DB-9 female connector. This AUX DATA connector may be used for RS-232 asynchronous data rates of 300, 1200, 2400, 4800, 9600, 19200, or 38400 bits/s. Figure 3-8 below shows the DIP switch settings for choosing the data rates. The cabling distance to the data source (DTE to DCE) is limited to 100 ft (30 m). SW2 located on the front of the *LYNX mini2* must be selected to choose the data rate of the AUX DATA port.



SW2

Switch Position 1	AUX DATA Port Interface Mode
0	RS-232 Asynchronous (8N1)
1	RS-232 Asynchronous (7E2)



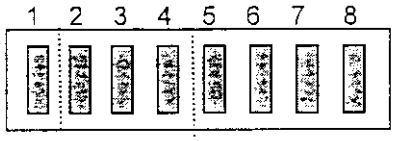
SW2

Switch Position			AUX DATA Port Data Rates
2	3	4	RS-232
0	0	0	300 bps
0	0	1	1200 bps
0	1	0	2400 bps
0	1	1	4800 bps
1	0	0	9600 bps
1	0	1	19200 bps
1	1	0	38400 nps
1	1	1	Reserved

Figure 3-8: Interface Mode and Data Rate Switches for AUX DATA Port

3.12.4 Synchronous Data Clocking Mode Selection

The *LYNX mini2* has several clocking modes available. DIP switch segments 2, 3, and 4 of SW3 are used to choose various clocking modes. Figure 3-9 below lists the clocking mode choices of the *LYNX mini2* radio.



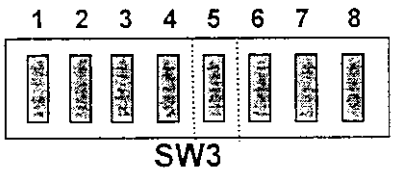
SW3

Switch Position			Primary Channel Clocking V.35/EIA-530/RS-232
2	**3**	**4**	
0	0	0	Transmit uses TT timing/Receive uses channel timing
0	0	1	Transmit uses ST timing/Receive uses channel timing
0	1	0	Transmit uses channel timing/Receive uses channel timing
0	1	1	Transmit uses TT timing/Receive TT timing
1	0	0	Transmit uses ST timing/Receive ST timing
1	0	1	Reserved
1	1	0	Reserved
1	1	1	Reserved

Figure 3-9: Synchronous Data Clocking Mode Switch Selections

3.12.5 Loopback Test Signal Selection

The *LYNX mini2* allows loopback operation using an externally generated test signal. A single DIP switch segment on SW3, as shown in Figure 3-10, allows the operator to loopback the data signals in the remote *LYNX mini2* radio terminal. When this DIP switch is activated by the system operator the both the primary data and AUX DATA signals are looped back at the far end radio terminal. On the near end terminal the LOOPBACK LED flashes on the front panel to indicate that the loopback mode is activated. The loopback mode provides the system operator a means to isolate equipment problems and to do Bit Error Rate testing. The loopback



Switch Position 5	Loopback Function
0	Normal Operation
1	Remote Unit Loopback Enabled

Figure 3-10: Loopback Mode Selection

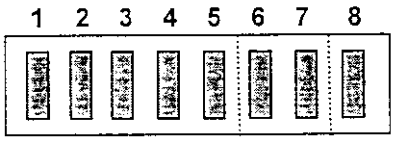
3.12.6 Spreading Code Selection

The spreading code is the pseudo-random chip sequence that is mixed with the data to produce the spread spectrum signal. The spreading code is generated by the *LYNX mini2* internally. Different codes can be selected using the DIP switches on the *LYNX mini2* front panel.

*The spreading code **must** be the same for both ends of a radio link.*

Spreading codes are all set in the factory to code 1. Should the code need to be changed, then both ends of the link must be changed.

Changing the spreading code is an out-of-service adjustment. There are two DIP switch, segments on SW3 located on the front panel which select the spreading codes. See Figure 3-11 for DIP switch segment settings.



SW3

Switch Position 6	7	Spreading Code
0	0	Code #1
0	1	Code #2
1	0	Code #3
1	1	Code #4

Figure 3-11: Spreading Code Selection

3.13 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 mini2* radio pair. Consult section 4.9 for further details. Back-to-back testing is a simple way to verify that the *LYNX mini2* 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.

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. See Section 3.10 for more details.

3. Connect the transmission line to the antenna, and feed it to the *LYNX mini2* radio location (see Section 3.9). Connect the opposite end of the transmission line to the N-type female connector located on the filter assembly on the *LYNX mini2* rear panel. The connection must be terminated into an antenna or a load before DC power is applied to the radio.

4. Verify that DIP switch settings for frequency channel selection match that of the filter that is installed on the rear of the radio. Consult 3.12.1 for further details. The far-end radio must have the same channel plan as the near-end radio, and the opposite Tx and Rx frequencies (e.g. A1 and A2 make up a matched pair of radios).

5. Verify that the DIP switch settings for spreading code are the same for both ends of the radio link (see Section 3.12.5).

6. With the DC power source active, but not plugged into the *LYNX mini2* 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.

7. Connect power to the *LYNX mini2* radios on both ends of the system. Verify that the Front Panel "ON" LED indication is illuminated. This confirms that power has been properly applied.

Ensure that the RF Antenna port connection is properly terminated before applying power to the LYNX mini2 terminal, as in step 3.

When the LYNX mini2 radio is initially powered-on, some alarm conditions may be present. This is normal and alarms can be ignored at this time.

8. Place a voltmeter across the GND and PWR front panel test points. See Figure 3-12 for voltage setting information and Table 3-G for typical output power levels for given cable lengths where EIRP limits apply. Consult the *LYNX mini2* Product Guide for Path Planning to establish proper level for this setting. If necessary, use a small screwdriver at the front panel receptacle to adjust the output power of the local transmitter in accordance with the path analysis calculations. The recessed potentiometer is rotated clockwise to increase transmit output power and counter clockwise to decrease transmit output power. After verifying correct setting of the transmit, output power disconnect the voltmeter. Place the cover cap found in the installation accessory kit over the front panel receptacle.

The LYNX mini2 requires professional installation. With some LYNX mini2 models, in certain countries, there may be Effective Isotropic Radiated Power (EIRP) limits which dictate the maximum output power that the LYNX mini2 radio can transmit given the transmission line loss and the gain of the antenna. Consult with appropriate government agencies or Glenayre Western Multiplex if there is any question regarding maximum output power allowed.

In the USA, 2.4 GHz radios may require a power reduction of 1 dB from +30 dBm input power, as measured at the antenna feed, for every 3 dB that the antenna gain exceeds +6 dB. See Section 3.3.3 and Table 3-D for more details.

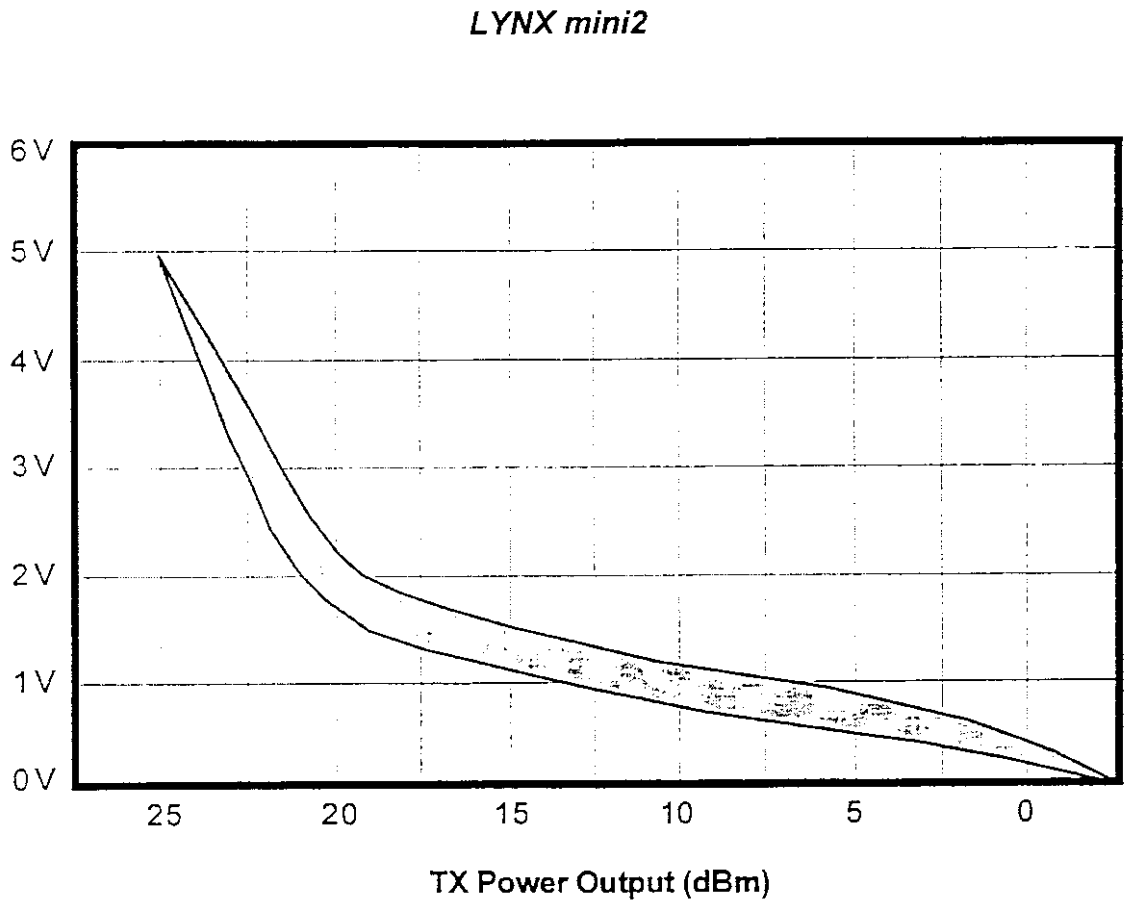


Figure 3-12: Typical RF Output Power versus PWR Voltage

Use the LYN mini2 Factory Test Data sheet to determine more precisely the voltage corresponding to the RF output power.

For precision measurement of transmit output power, it is best to connect an RF power meter to the antenna port. The PWR port voltage may not provide enough precision. This is especially important where EIRP limits apply to the installation.

In cases of no EIRP limits, the radio transmitter output power can be adjusted to maximum for installation, except for very short paths using very high gain antennas, where excessive power may not be advised.

Don't forget that the RF output port should be terminated at all times when power is applied to the LYNX mini2 radio. Therefore, disconnect power to the radio before connecting a power meter and reapply power once connected. Often, an RF power meter may have a limit to the input power that it can measure without damage. It is advised to place a calibrated fixed value RF attenuator (typically 20 dB or more) between the LYNX mini2 radio and the power meter to assure proper operation and safety for the RF power meter. The value of this fixed attenuation can then be added to the value of the RF power meter reading to obtain the actual LYNX mini2 radio transmitter output power.

9. Connect a voltmeter across the GND and RSL front panel test points. 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 mini2* terminals. Use the RSL voltage reading to align the antennas. Align one antenna at a time in accordance with Section 3.10. Complete alignment of both ends of the radio link before going further.

The RSL voltage output on the radio's front panel will output a voltage range over the full receiving capability of the radio (approximately 10 VDC at 0 dBm to 0.0 VDC at threshold).

The RSL of both ends of the system 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)
- 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 mini2 requires professional installation. Don't forget that the transmitter output power adjustment on the LYNX mini2 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 SYNCH and FAR END LEDs will be extinguished. These LEDs will be RED if radio synchronization has not occurred. 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 to will help determine the source of the problem.

10. Once RSL is verified to be near the predicted value, the radio link is ready for data. You may verify error-free operation by using the loopback function, as described in Section 3.13.2 or BER testing, as described in Section 4.10. If the link is not error-free, see Section 4.7 for troubleshooting guidelines.

11. Once radio performance is verified and acceptable, with loopback mode turned off (switch SW3-5 off and the LOOPBACK LED will turn off), the *LYNX mini2* radios can now be put into service with the intended data traffic. Connect the primary data signal to the V.35/EIA-530/RS-232 Interface 25-pin D connector. Refer to Section 3.11.2 for pin configurations of this connection. The AUX DATA interface 9 pin D connector may be used for slow speed, RS-232 data traffic. Refer to Section 3.11.2 for pin configurations of this connection.

12. Now that the link is operational, other services can be connected including alarms. Consult Section 3.14 for details on these connections.

		TRANSMITTER POWER (dBm)					
Feeder Length meters	Feeder Length Feet	2.4 GHz, 1/2" Coax			2.4 GHz, 7/8" Coax		
		4' Dish	6' Dish	8' Dish	4' Dish	6' Dish	8' Dish
3.0	10	9.4	4.9	3.4	9.2	4.7	3.2
6.1	20	9.8	5.3	3.8	9.4	4.9	3.4
9.1	30	10.1	5.6	4.1	9.7	5.2	3.7
12.2	40	10.5	6.0	4.5	9.9	5.4	3.9
15.2	50	10.9	6.4	4.9	10.1	5.6	4.1
18.3	60	11.3	6.8	5.3	10.3	5.8	4.3
21.3	70	11.7	7.2	5.7	10.5	6.0	4.5
24.4	80	12.0	7.5	6.0	10.8	6.3	4.8
27.4	90	12.4	7.9	6.4	11.0	6.5	5.0
30.5	100	12.8	8.3	6.8	11.2	6.7	5.2
33.5	110	13.2	8.7	7.2	11.4	6.9	5.4
36.6	120	13.6	9.1	7.6	11.6	7.1	5.6
39.6	130	13.9	9.4	7.9	11.9	7.4	5.9
42.7	140	14.3	9.8	8.3	12.1	7.6	6.1
45.7	150	14.7	10.2	8.7	12.3	7.8	6.3
48.8	160	15.1	10.6	9.1	12.5	8.0	6.5
51.8	170	15.5	11.0	9.5	12.7	8.2	6.7
54.9	180	15.8	11.3	9.8	13.0	8.5	7.0
57.9	190	16.2	11.7	10.2	13.2	8.7	7.2
61.0	200	16.6	12.1	10.6	13.4	8.9	7.4
64.0	210	17.0	12.5	11.0	13.6	9.1	7.6
67.1	220	17.4	12.9	11.4	13.8	9.3	7.8
70.1	230	17.7	13.2	11.7	14.1	9.6	8.1
73.2	240	18.1	13.6	12.1	14.3	9.8	8.3
76.2	250	18.5	14.0	12.5	14.5	10.0	8.5
79.3	260	18.9	14.4	12.9	14.7	10.2	8.7
82.3	270	19.3	14.8	13.3	14.9	10.4	8.9
85.4	280	19.6	15.1	13.6	15.2	10.7	9.2
88.4	290	20.0	15.5	14.0	15.4	10.9	9.4
91.5	300	20.4	15.9	14.4	15.6	11.1	9.6
94.5	310	20.8	16.3	14.8	15.8	11.3	9.8
97.6	320	21.2	16.7	15.2	16.0	11.5	10.0
100.6	330	21.5	17.0	15.5	16.3	11.8	10.3
103.7	340	21.9	17.4	15.9	16.5	12.0	10.5
106.7	350	22.3	17.8	16.3	16.7	12.2	10.7
109.8	360	22.7	18.2	16.7	16.9	12.4	10.9

Table 3-G: Transmitter Output Power Adjustment for +6 dBW EIRP Installations (Such as Canada)

		TRANSMITTER POWER (dBm)				
Feeder Length Feet	Feeder Length Feet	2.4 GHz, 1/2" Coax			2.4 GHz, 7/8" Co	
		4' Dish	6' Dish	8' Dish	4' Dish	6' Dish
3.0	10	23.4	22.0	21.2	23.2	21.9
6.1	20	23.8	22.4	21.6	23.5	22.1
9.1	30	24.1	22.8	22.0	23.7	22.4
12.2	40	24.5	23.2	22.4	23.9	22.6
15.2	50	24.9	23.6	22.7	24.2	22.8
18.3	60	25.3	23.9	23.1	24.4	23.0
21.3	70	25.7	24.3	23.5	24.6	23.3
24.4	80	26.0	24.7	23.9	24.8	23.5
27.4	90	26.4	25.1	24.3	25.1	23.7
30.5	100	26.8	25.5	24.6	25.3	24.0
33.5	110	27.2	25.8	25.0	25.5	24.2
36.6	120	27.6	26.2	25.4	25.8	24.4
39.6	130	27.9	26.6	25.8	26.0	24.7
42.7	140	28.3	27.0	26.2	26.2	24.9
45.7	150	28.7	27.4	26.5	26.5	25.1
48.8	160	29.1	27.7	26.9	26.7	25.3
51.8	170	29.5	28.1	27.3	26.9	25.6
54.9	180	29.8	28.5	27.7	27.1	25.8
57.9	190	MAX	28.9	28.1	27.4	26.0
61.0	200	MAX	29.3	28.4	27.6	26.3
64.0	210	MAX	29.6	28.8	27.8	26.5
67.1	220	MAX	MAX	29.2	28.1	26.7
70.1	230	MAX	MAX	29.6	28.3	27.0
73.2	240	MAX	MAX	MAX	28.5	27.2
76.2	250	MAX	MAX	MAX	28.8	27.4
79.3	260	MAX	MAX	MAX	29.0	27.6
82.3	270	MAX	MAX	MAX	29.2	27.9
85.4	280	MAX	MAX	MAX	29.4	28.1
88.4	290	MAX	MAX	MAX	29.7	28.3
91.5	300	MAX	MAX	MAX	29.9	28.6
94.5	310	MAX	MAX	MAX	MAX	28.8
97.6	320	MAX	MAX	MAX	MAX	29.0
100.6	330	MAX	MAX	MAX	MAX	29.3
103.7	340	MAX	MAX	MAX	MAX	29.5
106.7	350	MAX	MAX	MAX	MAX	29.7
109.8	360	MAX	MAX	MAX	MAX	29.9
112.8	370	MAX	MAX	MAX	MAX	MAX
115.9	380	MAX	MAX	MAX	MAX	MAX
118.9	390	MAX	MAX	MAX	MAX	MAX

Table 3-H: Transmitter Output Power Adjustment for 2.4 GHz USA Installations

3.13.1 Output Power Adjustment

The *LYNX mini2* requires professional installation. In certain cases, it is necessary to adjust the output power from the factory setting, for example:

- to meet EIRP (effective isotropic radiated power) limits, such as +6 dBW in Canada.
- to meet transmitter output limits in the 2.4 GHz band for USA installations.
- to avoid exceeding the maximum far-end RSL of 0 dBm.
- to coordinate a hub or repeater location.

To ensure maximum protection of the radio circuits, always ensure the antenna connector is terminated when power is applied.

For precise measurement of transmitter power, a calibrated RF power meter (such as the HP 435B with Power Sensor HP8481) is recommended. This power sensor can be connected directly to the output of the radio without exceeding the power rating. With some power meters, it may be necessary to place a calibrated in-line fixed attenuator between the radio antenna port and the power meter so as to not exceed the power meter's maximum input level. Thruline power meters do not operate at *LYNX mini2* RF frequencies.

If adjusting the output power to meet an EIRP limit, it will be first necessary to calculate the overall system gains and losses, including feeder losses for the type of transmission line installed and the antenna gain, as shown in the *LYNX mini2* Product Guide. Also refer to Table 3-G or 3-H for transmitter output power settings where installed with various transmission line lengths and antenna sizes. You may determine the radio transmit power for EIRP limited installations by the following equation:

Tx Power (dBm) = EIRP Limit (dBm) + Feeder Loss(dB) - Antenna Gain(dB)

In the USA, 2.4 GHz models have an output limit which is determined by:

Tx Power (dBm) = 30 - [(Antenna Gain - 6)/ 3] + Feeder Loss

Output power may be adjusted using a small screwdriver and rotating the potentiometer that is recessed behind the front panel. Counter-clockwise rotation increases output power while clockwise rotation decreases output power.

In lieu of a calibrated RF power meter, the PWR test port voltage can be used to estimate the output power. Figures 3-12 illustrates the voltage reading for various output power levels. The factory test data sheet should be used to establish a more precise setting of this adjustment.

After setting the correct output power, place the cover cap found in the installation accessory kit over the front panel receptacle.

3.13.2 Loopback/BER Testing

When a pair of *LYNX mini2* radios is installed and communicating with each other, a loopback or BER test can be performed to evaluate the link performance.

The *LYNX mini2* requires an external BER test signal from a BER Test Set for simulating a data signal, as described in Section 3.12.5. Any data test pattern may be used to make measurements at one end of the link, provided the test sequence contains adequate 1's density, which is no more than 15 consecutive zeros.

A 2^{15}-1, QRSS or 3 in 24 test may be used. However a 2^{23}-1 test will violate the 1's density requirement.

To loop around the far-end radio, turn SW3-5 to the on (up) position on the near end radio. The LOOPBACK LED should now be flashing. Now the BER test can be initiated. Section 4.10 describes BER testing in more detail.

An external BER test set is required for statistical BER analysis. Disconnect all external DS-1 signals and connect the BER test set to the input and output DS-1 MONITOR bantam jacks. Select external test mode (see Section 3.12.4) and initiate loopback using the ENABLE loopback button. Now the BER test can be initiated. Section 4.10 describes BER testing in more detail.

Loopback can only be turned off at the end of the link where SW3-5 is actuated.

If two BER test sets are used to measure the link performance (one at each end) separately in each direction, frame slips will occur unless the BER test sets are synchronized with one test set as the master and the other as the slave.

3.14 Additional Connections

There is an additional customer connection that is optional and is **not required** to make the *LYNX mini2* operational, but may prove useful.

3.14.1 Alarm Connection

An external summary alarm output is provided on the front panel of *LYNX mini2*. This alarm output is a Form C relay output with NC, C, and NO contacts made available on a three-terminal socket. This relay is capable of switching 48 VDC at 1 A. These alarm points may be connected to the customers alarm reporting system using a three terminal plug that is provided in the *LYNX mini2* accessory kit. See Table 3-E and Figure 3-23 for Alarm Connections.

Any near-end front panel LED alarm condition, including the loopback mode, will activate the "summary" alarm (Form C relay).

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

- RX SYNC
- Radio Fail
- Loopback Enabled

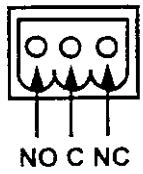


Figure 3-13: Pin Connections, ALARM Interface

13.14.2 Repeater Configuration

The V.35/EIA-530/RS-232 and AUX DATA ports can be connected back-to-back for a repeater configuration with another *LYNX mini2* radio or DCE (see Figure 3-14). A V.35, EIA-530, or RS-232 cross-over or Null Modem cable must be used to make these back-to-back connections. Figures 3-15 and 3-16 show the pin connections for these types of cables.

Not Available

Figure 3-14: Repeater and Hub Diagram

Not Available

Figure 3-15: V.35/EIA-530 Cross Cable

Not Available

Figure 3-16: RS-232 Null-Modem Cable

Your Notes on the *LYNX mini2* Radio

4. Troubleshooting

4.1 Regular Maintenance

The *LYNX mini2* 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 Voltage
- PWR Voltage
- Alarm conditions
- Verify radio has adequate ventilation
- Check alarm conditions of the DTEs

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

4.2 Changing Frequency Plans

The *LYNX mini2* RF frequency selections are listed in Section 3.5. The near-end radio and the far-end radio must be corresponding (e.g. A1 / A2). The frequency of a given *LYNX mini2* terminal is set by the physical orientation of this diplexer filter assembly, and the setting of corresponding DIP Switches. (See Section 3.12.1 for more details.)

With respect to a given filter, the frequencies are fixed, because tuned RF filters are required for normal operation. Changing of the (pretuned) radio frequencies may be required when installing spares or for special situations, such as interference mitigation. This is accomplished by reorienting the external filter.

For any given model of *LYNX mini2* the frequency channel can be changed by swapping and /or reorienting the filter.

It is not necessary to remove the cover assembly of the LYNX.sc

1. Remove the two screws which mount the filter to the *LYNX.sc* chassis.
2. Slowly remove the filter from the chassis being careful to not endanger the cables that are connected to the rear side of the filter.
3. Disconnect the two SMA connectors that are attached to the rear of the filter.
4. Select the new filter or orient the existing filter such that the frequency channel label on the filter (showing the DIP switch positions) is right-side-up corresponding to the desired frequency channel.
5. Connect the two SMA connectors to the new or reoriented filter.
6. Slowly place the wired filter assembly so that it is flush with the rear panel.
7. Install the two screws which mount the filter to the rear panel.
8. Refer to the rear panel filter label and Section 3.12.1 for DIP Switch settings to correspond to the new filter.

As an example, the filter assemblies of an A1 and A2 terminal are identical. They are simply installed differently. An A1 terminal can be changed into an A2 by removing the filter and rotating it 180 degrees and reinstalling the filter. The DIP switch positions need to match the filter orientation and the DIP switch settings in Section 3.12.1.

4.3 Using a Spare Terminal

One spare *LYN mini2* terminal of a given model type (A1 or A2) will service any other radio independent of frequency channel plan. For example, a channel A2 can be used as a spare for an A1. See Section 4.2 for changing frequencies of a spare radio.

Customers with several radios, or radios in critical operations are encouraged to purchase one or more spare radios. This will allow rapid restoration of radio service in the unlikely event of a radio failure.

4.4 Technical Support

Glenayre Western Multiplex provides 24-hour telephone technical support for installed *LYNX mini2* radios. Customers are encouraged to troubleshoot the radio and link in accordance with the latter part of this section in this manual before contacting Glenayre Western Multiplex. Glenayre Western Multiplex also has a limited supply of *LYNX mini2* radios that can be loaned to out-of-service customers for installation while units are being repaired. Loaner supply is limited, and is only used for critical applications on a first-come, first-served basis.

Customer service #: +1 (408) 542-5200.

4.5 Repair Policy

The *LYNX mini2* terminal includes comprehensive alarm indicators designed to diagnose potential faults. Should a fault occur, it often may be resolved by operator adjustment.

Should a fault occur that cannot be resolved by operator adjustment and has been confirmed by looping terminals together on the bench (See Section 4.9), then the equipment should be returned to the factory for repair.

The *LYNX mini2* is a complex system not designed for user repair. Do not remove the cover or open any part of the *LYNX mini2* terminal. The complete *LYNX mini2* terminal should be sent back in its original packing material for factory repair.

Please contact the factory in advance of returning the product. You will be assigned a Return Material Authorization (RMA) number that authorizes your return. Units sent to the factory without an RMA number may be delayed in the processing of the repair. Be sure to include the following information:

- RMA number
- description of the problem
- your name and telephone number
- return shipping address
- urgency of repair

Please refer to the published Warranty policy W96-10 for complete repair policy details. This document is included in the front of this manual.

LYNX radios should be packaged in their original packing boxes for shipment whenever possible. Glenayre Western Multiplex can provide an empty box shipment to facilitate proper packaging. Regardless, proper and adequate packaging must be used for shipments to protect the radio(s) from damage. Glenayre Western Multiplex can not be held responsible for any repairs due to inadequately packed materials. Damage caused by improper packing will likely result in higher repair costs and delays (refer to the Warranty section at the beginning of this manual).

4.6 Front Panel Status LEDs

There are several front panel status LEDs on the *LYNX mini2*. 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.

4.6.1 RX SYNCH (Receiver Synchronization) Alarms

Function:

The RX SYNCH LED lights RED, when the near end receiver is not synchronized to the far end RF transmit signal. When this LED is extinguished it indicates that the receiver is synchronized to the far end transmit RF signal.

When the RX SYNC alarm is active, the *LYNX mini2* radio mutes the received data (line transmit out)

Possible Causes:

- Severe path fading due to atmospheric conditions (usually accompanied by FAR END alarm) and low RSL voltage reading
- Poor transmission line connections (usually accompanied by FAR END alarm) and low RSL voltage reading
- Antenna problems, misalignment, or path clearance (usually accompanied by FAR END alarm) and low RSL voltage reading
- Improper radio settings (frequency channel, spread code)
- Interference
- Far-End radio transmitter circuitry is faulty
- Near-End radio receiver circuitry is faulty

Recommended Actions:

Check the following at each end of the link:

- Verify that rear panel filters are opposite channel plans on each end (e.g. one is A1 and other is A2).
- Verify that front panel DIP switch settings match each installed filter and those shown in Section 3.12.1.
- Verify that each radio is set to the same spreading code (see Section 3.12.5).
- Verify that all connections between radios and antennas are secure and all devices between radios and antennas are rated for the radio frequency band (2.4 GHz).

4.6.2 RADIO FAIL Alarm

Function:

The RADIO FAIL alarm indicates a known problem with the radio hardware.

Possible Causes:

- Internal synthesizers are unlocked
- Internal digital circuits have failed
- Data connection is incorrect

Recommended Actions:

1. Disconnect the data connections from the rear panel.
2. If RADIO FAIL alarm clears, check the data connections for proper pin connections and impedance as described in Section 3.11. Check front panel interface, DIP switch settings as described in Section 3.12.3.
3. If RADIO FAIL alarm does not clear, remove power from the unit.
4. Check to make sure power supply voltages are within specification.
5. Even if the voltages were within specification, reapply power to the unit.
6. If RADIO FAIL alarm clears, place the radio back into service.
7. If RADIO FAIL alarm does not clear, perform a back-to-back test to verify radio operation, as described in Section 4.9.
8. If RADIO FAIL alarm is still active in a back-to-back test, return the radio to the factory for repair (see Section 4.5).

4.6.3 FAR END (Far End Receiver Synchronization) Alarms

Function:

The FAR END LED lights RED, when the far end receiver is not synchronized to the near end RF transmit signal. When this LED is extinguished it indicates that the far end receiver is synchronized to the near end transmit RF signal.

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 RX SYNCH alarm) and low RSL voltage reading
- Poor transmission line connections (usually accompanied by RX SYNCH alarm) and low RSL voltage reading
- Antenna problems, misalignment, or path clearance (usually accompanied by RX SYNCH alarm) and low RSL voltage reading
- Improper radio settings (frequency channel, spread code)
- Interference
- Far-End radio Receiver circuitry is faulty
- Near-End radio transmitter circuitry is faulty

Recommended Actions:

Check the following at each end of the link:

- Verify that rear panel filters are opposite channel plans on each end (e.g. one is A1 and other is A2).
- Verify that front panel DIP switch settings match each installed filter and those shown in Section 3.12.1.
- Verify that each radio is set to the same spreading code (see Section 3.12.5).
- Verify that all connections between radios and antennas are secure and all devices between radios and antennas are rated for the radio frequency band (2.4 GHz).

4.7 Errors in the Data Stream

When the radios are in service, errors in the data stream may occur. This is usually indicated to the operator by data errors, frame slips or packet error indications in the data terminal equipment (DTE).

If errors are detected the operator should do loopback testing to isolate the source of the problem. Sometimes loopback testing may be performed with the DTE equipment attached to the radios. However, the best method is to do loopback testing on the radios while they are separated from the DTEs. This may be done by connecting the BER test set to the V.35/EIA/RS-232 data port on the near end radio, setting the BER test set to the same data rate as the radio and setting SW3-5 loopback switch to on. The BER test set is usually set to DTE, V.35, and Receive Clocking.

Indications:

- In Loopback Mode, errors are indicated on the BER Test Set

Possible Causes:

- Incorrect setting for the clock source (i.e. external vs. internal)
- Incorrect setting for the external interface (i.e. V.35 vs. EIA-530)
- Pat fading due to atmospheric conditions
- Antenna problems, misalignment or path clearance
- Received signal level (RSL) is too strong
- Incorrect Line Code setting
- Incorrect data rate or clocking mode DIP switches
- Far-End radio transmitter circuitry is faulty
- Near-End radio receiver circuitry is faulty
- Interference

Recommended Actions:

1. Verify DIP switch settings corresponding to data rate and clocking mode on both radios, as described in Section 3.12.2. They must be the same setting for both ends of the radio system.

2. Verify the clocking source (Internal or external) and the external interface setting (DTE vs. DCE) for the connected equipment.

3. Verify spreading code DIP switch settings as described in Section 3.12.5.

4. **Verify that the system only has one cocking source.**

4.8 Interference Countermeasures

The recommended interference countermeasures available to the *LYNX mini2* operator are as follows:

1. Short Paths

The single most effective countermeasure against interference is to maintain "short path" length. This may be achieved by dividing long paths into multiple small paths by cascading hops. Intermediate repeaters may be formed using back-to-back *LYNX mini2* terminals and transmit output power reduced, if required.

By definition, "short path" is defined as a path where fades are extremely rare and signal levels vary by no more than ±3 dB during fades. This distance will vary with the RF frequency. Typically a "short path" is defined as any path length shorter than 7 miles (12 km) at 2.4 GHz.

2. Narrow Beam Antennas (high gain)

This is the next most effective countermeasure. Narrow beam antennas ensure that the transmitted power is sent in a single direction and this minimizes the possibility of causing interference inadvertently to other users. Narrow beam antennas also reject off-azimuth signals being received from potential sources of interference and have high gain which boosts desired receive levels and improves the carrier to interference ratio. When selecting narrow beam antennas, it is helpful to know that larger antennas generally outperform smaller antennas. Another important antenna specification is the front-to-back ratio which ensures rejection of unwanted signals from azimuth angles behind the antenna.

3. Frequency Selection

This is another very effective countermeasure. The *LYNX mini2* offers several distinct non-overlapping frequency channel plans (see Sections 3.5 and 4.2) and the radio's filtering is able to reject interference more than 10 MHz away from the receive frequency. Offset frequencies combined with other countermeasures may enable several receive channels to operate at a single hub site. Because of the limited spreading ratio used, frequency selection is more efficient than code selection for interference rejection when operating multiple *LYNX mini2* terminals at a single site. Interference can often be overcome by exchanging frequencies of both-ends of the radio link (e.g. change your A1 terminal to an A2 and change the other end from an A2 to an A1). Also, changing channel plans (e.g. from 2 to 4) can be very effective. (refer to Section 4.2).

4. Antenna Polarization

Changing the polarization of the antennas can provide approximately 20 to 30 dB discrimination of unwanted signals. The actual discrimination will depend upon the antenna design and any rotation of polarization along the path, for example, due to reflections. Discrimination only exists between two orthogonal polarizations:

- vertical vs. horizontal

5. Spreading Code Selection

There are 4 selectable spreading codes provided for the *LYNX mini2* (See Section 3.10.5). These codes are selected by DIP switches and provide some discrimination against interference from other *LYNX mini2* transmitters. The discrimination is limited to approximately 3 to 6 dB. This is the difference between the co-channel C/I when using different codes for the wanted and unwanted signals. When combined with a different frequency channel, the code discrimination improves significantly beyond 3 to 6 dB. See Section 3.12.5 for code selection details.

6. Transmit Power

The maximum level into the receiver is 0 dBm. Above this level, errors may occur in the receive data stream. Transmit output power should be reduced on very short paths to avoid overload.

7. Equipment/Antenna Location

Occasionally, interference is caused by the radio or the antenna being too close to another similar transmitter. For example, at 2.4 GHz, microwave ovens can exhibit interference if mounted near the radio or antenna. Other high powered transmitters may also cause interference. Moving the radio, the antennas, or the interfering equipment can reduce or eliminate interference.

Interference countermeasures rely to some extent on the measurement of the received interference level and frequency. Prior to turning up a new hop, a spectrum analyzer can be used to monitor the spectrum at each end to check for possible interfering signals. See Section 4.8.1 for more details.

4.8.1 Use of a Spectrum Analyzer to Evaluate Potential Interference

Connecting to the antenna and using "peak hold" on a spectrum analyzer, the spectrum between 2.4 GHz and 2.5 GHz can be swept and any signals being received at levels above radio's specified threshold identified. If potential interfering signals are found, then the *LYNX mini2* frequency plan can be changed to avoid a receive channel which may contain significant interference (see Section 4.2).

For example, interference may be reduced by swapping terminals or RF filters so that A1 becomes A2.

Signals outside the range of 2.4 GHz to 2.5 GHz (for 2.4 GHz radios may be ignored: they will not cause interference.

If a spectrum analyzer is not available, the RSL voltage can be used to indicate the background noise and interference level within the receiver RF filter band when the far-end transmitter is turned off. With the far-end radio turned off, if an RSL voltage level above the radio's threshold level is measured, there is potentially interference in this frequency channel.

When using a spectrum analyzer for determining the presence of interference, very narrow resolution bandwidth settings must be used to detect signals down to the radio's threshold (approximately -87 to -95 dBm, depending on radio type).

4.9 Back-to-Back Testing

Back-to-back testing, as shown in Figure 4-1, is an ideal method of testing the *LYNX mini2* radios. This testing eliminates link problems caused by auxiliary equipment, installation, or the radio path, isolating 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 90 Watts (total) to the radios (or two AC adapters)
- One low-loss coaxial cable, N-to-N male
- Two coaxial in-line calibrated fixed attenuators, 40 to 80 dB total attenuation

The following test equipment may also be useful to perform further testing of the *LYNX mini2* radio:

- BER tester
- Variable (60 dB range or more) RF attenuator (rated for the proper frequency, 2.4 or 5.8 GHz)
- RF power meter

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

When the equipment is connected as shown in Figure 4-1, without connecting the BER tester, both *LYNX mini2* radios should have no alarm conditions. If further troubleshooting is required for the radios themselves, a BER tester can be connected to the V.35/EIA-530/RS-232 data port on the front of the radio. An end-to-end or loopback test can be performed to assure that no errors are present in the radio link. In addition, a variable RF attenuator can be inserted between the radios to fade down the path to determine that the threshold specification is being met. The BER and threshold tests can be run in both directions to isolate the radio problem (if any). More information on BER testing is provided in Section 4.10. An RF power meter can be used to individually test each radio's output power.

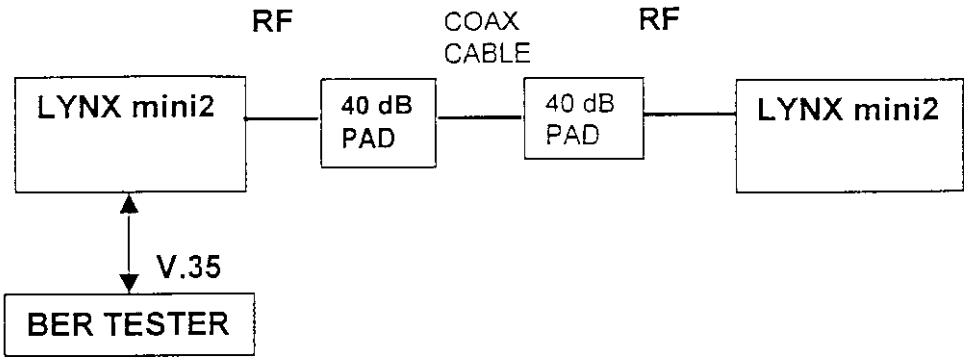


Figure 4-1: Back-to-Back Test Configuration

(When using a BER tester, initiate loopback on connected *LYNX mini2* and select external test mode as described in Section 3.12.4.)

The LYNX mini2 radios will be damaged if appropriate attenuation is not supplied between radios. You must provide a minimum of 40 dB and no more than 80 dB attenuation between the two radios.

4.10 BER (Bit Error Rate) Testing

Bit error rate (BER) testing is the preferred way to evaluate a radio link's performance. It can be performed from end-to-end or in loopback mode (which tests both directions of the radio path). Figure 4-1 illustrates a typical BER test configuration for loopback testing (which may include the radio's path instead of in-line attenuators). Figure 4-2 illustrates a typical BER test configuration for end-to-end testing.

When performing BER testing, make sure of the following:

- Disconnect all data inputs and outputs to both radios.
- Connect BER tester to bantam jacks or data connector
- Select external test signal for loopback testing using the DIP switches as defined in Section 3.12.
- Verify all DIP switch settings.
- The BER test pattern chosen must contain adequate 1's density

A 2^{15-1}, QRSS, or 3 in 24 test pattern may be used.

If two BER test sets are used to measure the link performance separately in each direction, frame slips will occur unless the BER test sets are synchronized with one test set as the master and the other as the slave.

BER 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 BER test sets over a link, the far-end unit slaved to the near-end unit's clock) or in loopback mode, as described in Section 4.9.

If BER testing indicates an unacceptable level of errors, follow the instructions in Section 4.6.2. or perform a back-to-back test as described in Section 4.9.

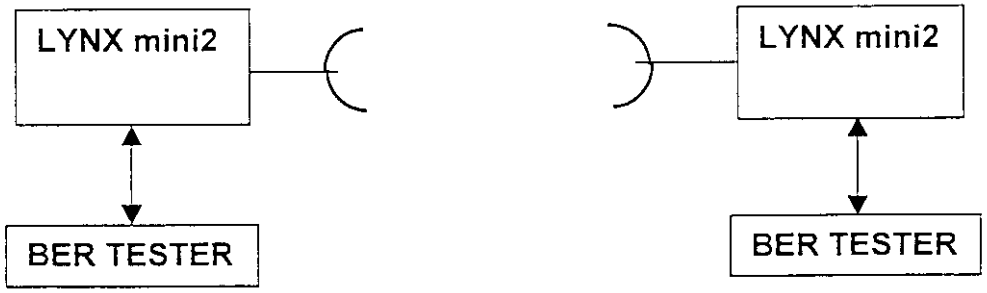


Figure 4-2: End-to-End BER Test Configuration

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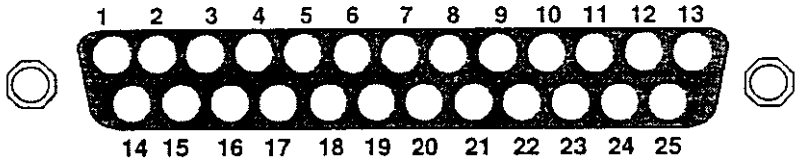
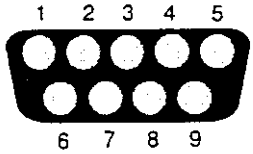


Figure 3-5: V.35/EIA-530/RS-232 Connector (front panel view)



(as viewed from front panel)

Figure 3-6: AUX DATA Connector (front panel view)

Pin	Signal	Function	Description
1		Shield Ground	
2	TD	Transmit Data	Input
3	RD	Receive Data	Output
4	RTS	Request To Send	Input
5	CTS	Clear To Send	Output
6	DSR	Data Set Ready	Output
7	SG	Signal Ground	
8	DCD	Data Carrier Detect (Receive Signal Line Detect)	Output

5. Appendices

Appendix A - Data Line Interface Specifications

To be provided

Appendix B - Front Panel DIP Switches

The *LYNX mini2* has three separate eight-segment rear panel DIP switches, labeled SW1, SW2, SW3 and SW4. Upon shipment from the factory, these switches are set for factory default configuration, which is all switches down (in the "zero" position), except for SW4 positions 1 through 6, which are set to match the installed rear panel RF filter assembly (which determines the frequency channel for transmit and receive, such as A1 or A2.). The tables in this section provide a quick reference for the DIP switch functions and their settings.

DIP switch settings are noted by their position, either up (1), or down (0), not by on/off as may be printed on the DIP switch assembly.

Appendix B - Rear Panel DIP Switches

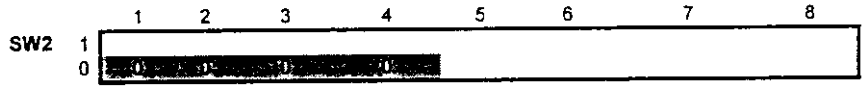
The *LYNX mini2* has three separate eight-segment rear panel DIP switches, labeled SW1, SW2, SW3 and SW4. Upon shipment from the factory, these switches are set for factory default configuration, which is all switches down (in the "zero" position), except for SW4 positions 1 through 6, which are set to match the installed rear panel RF filter assembly (which determines the frequency channel for transmit and receive, such as A1 or A2.). The tables in this section provide a quick reference for the DIP switch functions and their settings.

DIP switch settings are noted by their position, either up (1), or down (0), not by on/off as may be printed on the DIP switch assembly.

Shaded switch positions are factory default

1	2	Prim. Chan. Interface
0	0	V.35 Synchronous
0	1	EIA-530 Synchronous
1	0	RS-232 Asynch (8N1)
1	1	RS-232 Asynch (7E2)

3	4	5	Prim. Chan. Data Rate	
			RS-232	V.35 & EIA-530
0	0	0	300 bps	Reserved
0	0	1	1200 bps	Reserved
0	1	0	2400 bps	64 kbps
0	1	1	4800 bps	128 kbps
1	0	0	9600 bps	256 kbps
1	0	1	19200 bps	384 kbps
1	1	0	38400 bps	512 kbps
1	1	1	Reserved	Reserved

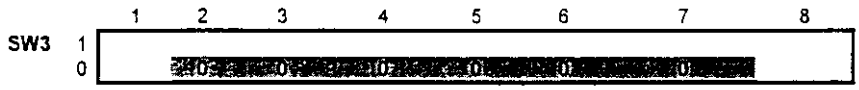


1	AUX DATA Interface Mode
0	RS-232 Asychronous (8N1)
1	RS-232 Asychronous (7E2)

2	3	4	AUX DATA Rate
			RS-232
0	0	0	300 bps
0	0	1	1200 bps
0	1	0	2400 bps
0	1	1	4800 bps
1	0	0	9600 bps
1	0	1	19200 bps
1	1	0	38400 bps
1	1	1	Reserved

Table B-1: *LYNX mini2* DIP Switch Settings

Shaded switch positions are factory default



2	3	4	Spreading Code
0	0	0	Transmit uses TT timing/Receive uses channel timing
0	0	1	Transmit uses ST timing/Receive uses channel timing
0	1	0	Transmit uses channel timing/Receive uses channel timing
0	1	1	Transmit uses TT timing/Receive uses TT timing
1	0	0	Transmit uses ST timing/Receive uses ST timing
1	0	1	Reserved
1	1	0	Reserved
1	1	1	Reserved

Loopback Function	5
Normal Operation	0
Remote Unit Loopback enable	1

Spreading Code	6	7
Code 1	0	0
Code 2	0	1
Code 3	1	0
Code 4	1	1

Table B-1: *LYNX mini2* DIP Switch Settings (Continued)

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Data Rates	SW4	64 kbps & 128 kbps		256 kbps		384 kbps & 512 kbps	
Channels	SWITCH POSITION 1 2 3 4 5 6	A1 Tx	A2 Rx	A1 Tx	A2 Rx	A1 Tx	A2 Rx
0	0 0 0 0 0 0	2409.472*	2449.408*	**	**	**	
1	0 0 0 0 1 0	2410.472	2450.432	2410.472*	2450.432*	**	**
2	0 0 0 1 0 0	2411.520*	2451.456*	2411.520	2451.456	2411.520*	2451.456*
3	0 0 0 1 1 0	2412.544	2452.480	2412.544	2452.480	2412.544	2452.480
4	0 0 1 0 0 0	2413.568*	2453.504*	2413.568	2453.504	2413.568	2453.504
5	0 0 1 0 1 0	2414.592	2454.528	2414.592*	2454.528*	2414.592	2454.528
6	0 0 1 1 0 0	2415.616*	2455.552*	2415.616	2455.552	2415.616	2455.552
7	0 0 1 1 1 0	2416.640	2456.576	2416.640	2456.576	2416.640	2456.576
8	0 1 0 0 0 0	2417.664*	2457.600*	2417.664	2457.600	2417.664*	2457.600*
9	0 1 0 0 1 0	2418.688	2458.624	2418.688*	2458.624*	2418.688	2458.624
10	0 1 0 1 0 0	2419.712*	2459.648*	2419.712	2459.648	2419.712	2459.648
11	0 1 0 1 1 0	2420.736	2460.672	2420.736	2460.672	2420.736	2460.672
12	0 1 1 0 0 0	2421.760*	2461.696*	2421.760	2461.696	2421.760	2461.696
13	0 1 1 0 1 0	2422.784	2462.720	2422.784*	2462.720*	2422.784	2462.720
14	0 1 1 1 0 0	2423.808*	2463.744*	2423.808	2463.744	2423.808*	2463.744*
15	0 1 1 1 1 0	2424.832	2464.768	2424.832	2464.768	2424.832	2464.768
16	1 0 0 0 0 0	2425.856*	2465.792*	2425.856	2465.792	2425.856	2465.792
17	1 0 0 0 1 0	2426.880	2466.816	2426.880*	2466.816*	2426.880	2466.816
18	1 0 0 1 0 0	2427.904*	2467.840*	2427.904	2467.840	2427.904	2467.840
19	1 0 0 1 1 0	2428.928	2468.864	2428.928	2468.864	2428.928	2468.864
20	1 0 1 0 0 0	2429.952*	2469.888*	2429.952	2469.888	2428.928*	2469.888*
21	1 0 1 0 1 0	2430.976	2470.912	2430.976*	2470.912*	**	**
22	1 1 0 0 0 0	2432.000*	2471.936*	**	**	**	

Data Rates	SW4	64 kbps & 128 kbps		256 kbps		384 kbps & 512 kbps	
Channels	SWITCH POSITION 1 2 3 4 5 6	A2 Tx	A1 Rx	A2 Tx	A1 Rx	A2 Tx	A1 Rx
0	0 0 0 0 0 1	2449.408*	2409.472*	**	**	**	
1	0 0 0 0 1 1	2450.432	2410.472	2450.432*	2410.472*	**	**
2	0 0 0 1 0 1	2451.456*	2411.520*	2451.456	2411.520	2451.456*	2411.520*
3	0 0 0 1 1 1	2452.480	2412.544	2452.480	2412.544	2452.480	2412.544
4	0 0 1 0 0 1	2453.504*	2413.568*	2453.504	2413.568	2453.504	2413.568
5	0 0 1 0 1 1	2454.528	2414.592	2454.528*	2414.592*	2454.528	2414.592
6	0 0 1 1 0 1	2455.552*	2415.616*	2455.552	2415.616	2455.552	2415.616
7	0 0 1 1 1 1	2456.576	2416.640	2456.576	2416.640	2456.576	2416.640
8	0 1 0 0 0 1	2457.600*	2417.664*	2457.600	2417.664	2457.600*	2417.664*
9	0 1 0 0 1 1	2458.624	2418.688	2458.624*	2418.688*	2458.624	2418.688
10	0 1 0 1 0 1	2459.648*	2419.712*	2459.648	2419.712	2459.648	2419.712
11	0 1 0 1 1 1	2460.672	2420.736	2460.672	2420.736	2460.672	2420.736
12	0 1 1 0 0 1	2461.696*	2421.760*	2461.696	2421.760	2461.696	2421.760
13	0 1 1 0 1 1	2462.720	2422.784	2462.720*	2422.784*	2462.720	2422.784
14	0 1 1 1 0 1	2463.744*	2423.808*	2463.744	2423.808	2463.744*	2423.808*
15	0 1 1 1 1 1	2464.768	2424.832	2464.768	2424.832	2464.768	2424.832
16	1 0 0 0 0 1	2465.792*	2425.856*	2465.792	2425.856	2465.792	2425.856
17	1 0 0 0 1 1	2466.816	2426.880	2466.816*	2426.880*	2466.816	2426.880
18	1 0 0 1 0 1	2467.840*	2427.904*	2467.840	2427.904	2467.840	2427.904
19	1 0 0 1 1 1	2468.864	2428.928	2468.864	2428.928	2468.864	2428.928
20	1 0 1 0 0 1	2469.888*	2429.952*	2469.888	2429.952	2469.888	2429.952
21	1 0 1 0 1 1	2470.912	2430.976	2470.912*	2430.976*	**	**
22	1 1 0 0 0 1	2471.936*	2432.000*	**	**	**	

* These are non-overlapping channels

** These channels may not be used for 256, 384, or 512 kbps to prevent against out of band emissions. Selection of channel 0 or 1, will force the selection of channel 2 and selection of channel 21 or 22, will force the selection of channel 20 at these data rates

Table B-2: RF Channel Switch Settings

Appendix C – Front Panel Data Connectors

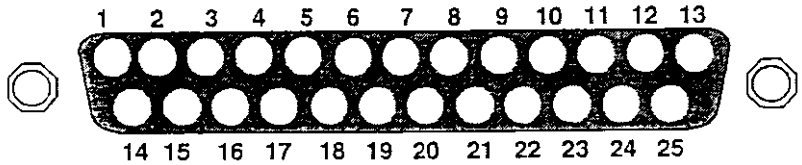
The following figures illustrate the pin structure for all front panel data connections. All figures are oriented as a customer would view them, facing the front panel. DC power connection information is found in Section 3.7 of the manual.

Pin	Signal	Function		Description
1		Shield Ground		
2	TD	Transmit Data		Input
3	RD	Receive Data		Output
4	RTS	Request To Send		Input
5	CTS	Clear To Send		Output
6	DSR	Data Set Ready		Output
7	SG	Signal Ground		
8	DCD	Data Carrier Detect		Output
9	RT(B)	Receive Timing Inverse (B)		Output
10	DCD(B)	Data Carrier Detect (B)	(EIA-530 only)	Output
11	TT(B)	Terminal Timing Inverse (B)		Input
12	ST(B)	Send Timing Inverse (B)		Output
13	CTS(B)	Clear To Send Inverse (B)	(EIA-530 only)	Output
14	TD(B)	Transmit Data Inverse (B)		Input
15	ST	Send Timing		Output
16	RD(B)	Receive Data Inverse (B)		Output
17	RT	Receive Timing		Output
19	RTS(B)	Ready To Send Inverse (B)	(EIA-530 only)	Input
20	DTR	Data Terminal Ready		Input
22	DSR(B)	Data Set Ready Inverse (B)	(EIA-530 only)	Output
23	DTR(B)	Data Terminal Ready Inverse (B)	(EIA-530 only)	Input
24	TT	Terminal Timing		

Table 3-D: V.35/EIA-530 Connector Pin Assignments

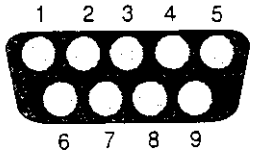
Pin	Signal	Function	Description
1		Shield Ground	
2	TD	Transmit Data	Input
3	RD	Receive Data	Output
4	RTS	Request To Send	Input
5	CTS	Clear To Send	Output
6	DSR	Data Set Ready	Output
7	SG	Signal Ground	
8	DCD	Data Carrier Detect (Receive Signal Line Detect)	Output
15	ST	Send Timing	Output
17	RT	Receive Timing	Output
20	DTR	Data Terminal Ready	Input
24	TT	Terminal Timing	Input

Table 3-E: RS-232 Connector Pin Assignments



(as viewed from rear panel)

Figure C-1: V.35/EIA-530/RS-232 Connector (front panel view)



(as viewed from front panel)

Figure C-2: AUX DATA Connector (front panel view)

Pin	Signal	Function	Description
1		Shield Ground	
2	TD	Transmit Data	Input
3	RD	Receive Data	Output
4	RTS	Request To Send	Input
5	CTS	Clear To Send	Output
6	DSR	Data Set Ready	Output
7	SG	Signal Ground	
8	DCD	Data Carrier Detect (Receive Signal Line Detect)	Output