Table 2.6 – Electrical Connection Checklist

Checklist Item	Verified	Inspector	Date
Is the proper voltage supplied to the Link CX-24 (PWR/LCL ALM LED on)?			
Is the Link CX-24 receiving signal from the radio link (RF LINK LED on)?			
When the Link CX-24 is connected to DS-3 or equipment, is the Link CX-24 receiving the expected signal (DATA LED on)?			
When the Link CX-24 is connected to Ethernet equipment on port ETHERNET 1, is the Link CX-24 receiving the expected signal (ENET 1 LED on or flashing)?			
When the Link CX-24 is connected to Ethernet equipment on port ETHERNET 2, is the Link CX-24 receiving the expected signal (ENET 2 LED on or flashing)?			

The next series of acceptance tests requires you to log in to the built-in web server with a computer equipped with a web browser.

52 Connect your computer to the Link CX-24 through the Ethernet equipment connected to the ETHERNET 1 or ETHERNET 2 port.

53 Log in to the Link CX-24 built-in web server to display the Monitor page as described in Section 2.10.2.

54 Make sure the Automatic Tx Power Control indicated in the lower half of the Monitor page is set to Disabled.

55 Record the RSSI indicated at the top of the Monitor page. Save this number for later troubleshooting.

56 If you are acceptance testing DS-3 versions of the Link CX-24, continue with Step 57. If you are acceptance testing Ethernet versions of the Link CX-24, continue with Step 58.

Testing DS-3 Link CX-24s

57 Go to the Test page and verify that the Link CX-24 passes the tests in Table 2.7.

Table 2.7 – DS-3 Internal Circuit and Radio Link Checklist

Checklist Item	Verified	Inspector	Date
Does the Link CX-24 input circuitry and DS-3 cabling work properly? (Set up Local + Remote Loopback and verify that the DS-3 equipment is receiving the looped-back signal it is transmitting to the Link CX-24.)			
Does the Link CX-24 radio circuitry work properly? (Set up Radio Loopback and verify that the DS-3 equipment is receiving the looped-back signal it is transmitting to the Link CX-24.)			
Do the near-end and far-end Link CX-24 radio circuits and radio paths work properly? (Set up BER Test and verify that the near-end Link CX-24 is receiving the looped-back BER test signal it is transmitting to the far-end Link CX-24.)			
Does the end-to-end radio link work properly? (Select No Test and verify that the DS-3 equipment at both ends of the radio link are receiving the signal transmitted to it by the remote DS-3 equipment.)			

Testing Ethernet Link CX-24s

58 Verify that the Link CX-24 passes the tests in Table 2.8. Note that this test uses Ethernet pings from to ensure that the Ethernet paths and links are working properly.

Table 2.8 – Ethernet Internal Circuit and Radio Link Checklist

Checklist Item	Verified	Inspector	Date
Does the near-end Link CX-24 input circuitry and Ethernet cabling work properly? (Use external equipment to ping the near-end Link CX-24 to verify that its Ethernet equipment is responding correctly.)			
Do the near-end and far-end Link CX-24 radio circuits and radio paths work properly? (Use external equipment to ping the far-end Link CX-24 to verify that its Ethernet equipment is responding correctly.)			
Does the end-to-end radio link work properly? (Connect a known-good external Ethernet equipment to the far-end Link CX-24 ETHERNET 1 or ETHERNET 2 connector. Use external equipment connected to the near-end Link CX-24 to ping the external equipment connected to the far-end Link CX-24 to verify that its Ethernet equipment is responding correctly.)			

When all of the acceptance tests in this section have been completed and all Checklist items have been verified, the Link CX-24 radio link has been verified. The Inspector marks for all tested items constitute acceptance of the Link CX-24 equipment and the associated radio link.

The user is now required to finish configuring the Link CX-24 after physical installation. The Link CX-24 includes a built-in HTML-based web server, which includes configuration, operating, monitoring and test pages. This web server can be accessed locally using a Web browser on a Craft PC, or remotely using any Web browser on the same Ethernet network as the Link CX-24. The initial configuration has already been done using a Craft PC at the Link CX-24 site, and all other operation and maintenance tasks can be performed remotely or locally, as required.

2.16 Final Link CX-24 Configuration

This section details final Link CX-24 setup using a Craft PC, and provides step-by-step software update instructions. The Link CX-24 should be in the following state:

- Powered on.
- Antenna aligned with far end antenna.
- Acceptance tested.
- No Loop-backs or other tests active.
- Carrying, or capable of carrying, payload data.
- Transmit attenuation disabled.
- Transmitting at minimum required transmit power (Automatic Tx Power Control disabled, unless required).

Obtain a copy of the information entered in Table 2.3, Radio Link Planning Worksheet, and continue with the following steps:

1. Record the RSSI level from Step 55 in the previous section for future reference. The Step 55 value is the RSSI level with Automatic Tx Power Control disabled.

2. Connect your computer to the Link CX-24 through the Ethernet equipment connected to the ETHERNET 1 or ETHERNET 2 port.

3. Log in to the Link CX-24 built-in web server to display the Monitor page as described in Section 2.10.2.

4. Go to the Test page, and verify that No Test is selected.

5. Go to the Commission Radio page, and verify that the entries on this page match the entries in Table 2.3, Radio Link Planning Worksheet. Make sure the Tx Attenuation is set to No attenuation, and that Automatic Tx Power Control is set to Enable.

6. Go to the Commission Manager Interfaces page, and verify that the entries on this page match the entries in Table 2.3, Radio Link Planning Worksheet.

   You can upgrade the login security of the Link CX-24 at this time. If you want to restrict access to the Link CX-24, consider the following:
   - If the Link CX-24 does not have a Login Name and Password, you can assign one now.
   - If the Link CX-24 allows login from any IP address, you may want to restrict login to only one or two IP addresses. MAKE SURE the Craft PC IP address is included if you select this option.
   - If the Link CX-24 is set to broadcast SNMP traps to the Public community, you can restrict broadcasts to a different community.
   - If the Link CX-24 is set to broadcast SNMP traps to multiple IP addresses, you can restrict broadcasts to fewer IP addresses.
   - If the Link CX-24 is set to allow read-write access from the Public community, you can restrict read-write access to a different community.
   - If the Link CX-24 is set to allow read-write access from any or multiple IP addresses, you can restrict read-write access to fewer IP addresses.
   - If the Link CX-24 is set to allow read-only access from the Public community, you can restrict read-only access to a different community.

- If the Link CX-24 is set to allow read-only access from any IP address, you can restrict read-only access to fewer IP addresses.

7. When required, make any security upgrades as described in Step 6.

The Link CX-24 is now fully configured, tested, and operational, and should continue to operate unattended. Continue with Section 3 for monitoring and trend analysis, and refer to Section 4 for troubleshooting information.

2.17 Updating the Link CX-24 Software

To update the Link CX-24 software, perform the following procedures at both ends of the radio link. Note that when you are updating Ethernet models of the Link CX-24, you should update the far-end Link CX-24 first, and the near-end Link CX-24 second to ensure that you do not lose radio communications with the far end.

Note: This procedure will take down the radio link until the update procedure is completed at both ends of the radio link.

1. Connect your web browser to the Link CX-24:
   - For a DS-3 Link CX-24, connect your web browser-equipped Craft PC or desktop PC to the Link CX-24 as described in Section 2.10.1.
   - For an Ethernet Link CX-24, make sure that your web browser-equipped Craft PC or desktop PC is connected to the same network as the Link CX-24.

2. Log into the Link CX-24 website by opening location **http://<IP Address>/** in your web browser.
   - For a DS-3 Link CX-24, your web browser-equipped Craft PC or desktop PC is directly connected to the Link CX-24.
   - For an Ethernet Link CX-24, make sure that you log into the Link CX-24 at the far end of the radio link and update it first.

3. Navigate to the **Update Software** web page. A sample **Update Software** page for DS-3 is shown in Fig 2.18, and for Ethernet in Fig. 2.19.

Figure 2.18 – Typical DS-3 Update Software Web Page

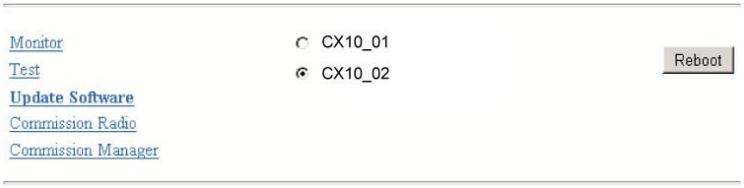
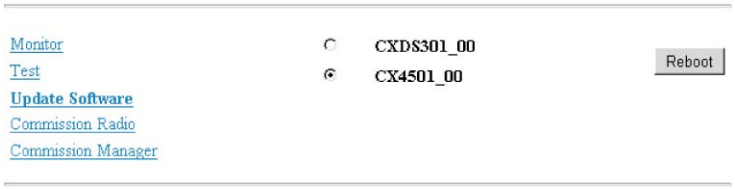


Figure 2.19 – Typical Ethernet Update Software Web Page



4. Using the radio buttons, select the software version you are to overwrite. Usually, this will be the lower-numbered version, or the version you are not currently using.

5. Contact Customer Support for instructions to FTP the software files to the Link CX-24.

6. When the software has been FTPd to the Link CX-24, return to the **Update Software** page. This process has deleted the selected software load with the new software load. Do not activate the new software load until both ends have received their new software loads.

7. Repeat Step 1 through Step 6 of this update process for the near-end Link CX-24, and then continue with Step 8.

8. Now that both ends of the radio link have the new software load in memory, do the following to activate the new software load as follows:

9. Log into the far-end Link CX-24 and navigate to the **Update Software** page.

10. Select the new software load and click **Reboot**. The far-end Link CX-24 reboots and activates the new software load.

11. Log into the near-end Link CX-24 and navigate to the **Update Software** page.

12. Select the new software load and click **Reboot**. The near-end Link CX-24 reboots and activates the new software load. Should the radio link not be restored, make sure that both ends of the radio link are using the same software load.

Both of the Link CX-24s on the radio link now are using the new software load and the previous configuration parameters, and as soon as they resynchronize their signals, the radio link is restored.

Section 3
Monitoring and Trend Analysis

3.1 Built-In Web Server Interface

Each Link CX-24 and radio link can be monitored through either the built-in Web server or SNMP agent interfaces.

A subset of the SNMP-accessible statistics is available through the Web server interface connected to a web browser over an Ethernet link. These statistics can be read by logging in to display the Monitor page, as shown in Appendix C. Statistics can be repeatedly sampled using the Web browser reload or refresh feature.

The easiest indicator to monitor is the RSSI. Keep a record of the RSSI levels measured in Step 55 in Section 2. The Step 55 value is the RSSI level with Automatic Tx Power Control disabled (transmitting at maximum power), with Automatic Tx Power Control disabled.

A properly designed radio link with a 20 dB or greater fade margin should indicate receive levels in the area of -60 dBm at Link CX-24 sites. The accuracy of the indicated RSSI is approximately ±5 dB over a range of -90 dBm to -65 dBm.

3.2 SNMP Network and Element Management Systems

3.2.1 SNMP Details

All monitored statistics are available through SNMP queries. In addition to MIB-II variables, product-specific variables are available through the Link CX-24 enterprise MIB, which can be retrieved via FTP from F:/PUB/link_cx.mib (text file) in the Link CX-24 file system. Most commercial SNMP NMSs and EMSs have the ability to sample variables over time and display trends and raise alarms based on defined thresholds. In addition, applicable SNMP traps are supported and can be used to raise alarms on the NMS and/or EMS.

Any standard SNMP NMS or EMS can be used to monitor and control the Link CX-24 network and individual Link CX-24 radios.

The Link CX-24 has an enterprise MIB provided in standard ASCII format, which can be accessed for printing. When a software upgrade is performed, the self-extracting file places all directories and associated files necessary for the upgrade in a location specified by the operator at the time the self-extracting file is executed. One of the directories created is /PUB, which contains the printable enterprise ASCII text MIB file named link_cx.mib.

The enterprise MIB file is also stored in FLASH memory on the Link CX-24 in F:/PUB. A copy of the link_cx.mib file can be extracted from the Link CX-24 using an ASCII FTP file transfer.

3.2.2 Monitoring Error Messages and Traps

The Link CX-24 supports the generic SNMP traps and Link CX-24 enterprise traps. When an error (or informational) message is generated by the router, an SNMP trap is issued (when enabled), and the message is also written to an error log maintained within the router. The router's error log table holds the last 256 error messages and can be queried through SNMP reads. Refer to Appendix E for a detailed list of router-specific messages and traps.

The error log is read ten entries at a time. To do an SNMP read of the first (oldest) ten entries, perform the following SNMP operations:

1. Set elLogEntryNumber to start at the oldest entry 0.

2. Set elScrollControl to forward to read log in FORWARD direction – oldest entries first.

3. Get elTrapTable retrieves the most recent ten entries – repeat for next ten entries.

The following SNMP operations also can be used to access or modify information in the error log:

- To read the log in the BACKWARDS direction, set elScrollControl to backward.
- To clear the log, set elScrollControl to clearLog.
- To set the threshold for the lowest severity of messages to be generated, set elLevelDisable to 1 (normal) through 5 (critical). Setting the threshold properly avoids filling the log with informational or non-serious errors.
- To set the current date and time (default after reboot is 12 Midnight, January 1, 1970), set the appropriate fields of elTimeDate, or use the Control page on the UI. The timestamps included in error messages are generated relative to this date and time.

Section 4
Troubleshooting the Link CX-24

4.1 Troubleshooting Tables

This section includes a troubleshooting table for different symptoms:

Table 4.1 – Symptoms and Probable Causes

Symptoms	Probable Cause
No response from Link CX-24 No payload data being transmitted	Power loss to Link CX-24 New obstructions (leafy trees and/or buildings, for example) Antenna no longer in alignment Damaged cables Defective transmission equipment
Reduced RSSI High BER Reduced payload data transmission rate	New obstructions (leafy trees and/or buildings, for example) Antenna no longer in alignment Damaged or degraded cables New interferers (multipath reflections from flooded fields or new buildings, or new consumer applications, for example)
Intermittent transmissions	ATPC unable to block a frequency hopping transmitter or other intermittent interferer -- disable ATPC

4.2 Using the Link CX-24 LEDs

Link CX-24 operation can be monitored using the LEDs. The LEDs show general radio link status at a glance. See Figure 1.4 for LED locations on the Link CX-24 radio. The LEDs operate in the following modes.

Table 4.2 – LEDs and Alarm Indication Modes

LED	Normal State	Alarm State
PWR/LCL ALM	ON -- Power on and no alarm	Flashing -- Local alarm OFF -- Power off
RF LINK	ON -- Receive RF OK	OFF -- Receive radio link alarm
DATA	ON -- DS-3 input OK	OFF -- DS-3 input LOS
ENET 2	ON -- Ethernet input OK Flashing -- Receiving Ethernet data	OFF -- No Ethernet input
ENET 1	ON -- Ethernet input OK Flashing -- Receiving Ethernet data	OFF -- No Ethernet input

4.3 Using RSSI

When you connect a voltmeter with BNC adapter to the Link CX-24 RSSI port, you can measure an indication of the received RF signal level. When the Receive Level falls below -70 dBm, see Table 4.1 for a list of possible causes.

Note: Make sure you replace the Link CX-24 RSSI connector cover after troubleshooting the radio link.

4.4 Using a Web Browser

As described in Appendix C, most of the Link CX-24 configuring, operating, and maintenance are performed using the Link CX-24 Web pages. Use the error indications in the web server interface and Table 4.1 to troubleshoot alarm indications.

4.5 Customer Support Services

Your primary source of assistance is the support staff of the organization from which you purchased this product. The YDI support staff should only be contacted directly if you purchased this product directly from YDI, or if you are unable to obtain sufficient assistance from your primary support contact.

Note: Before you contact Technical Support, please make sure that you have read and thoroughly understood all instructions outlined on this manual.

4.5.1 Detailed Company and Product Information, Sales, Pricing, and Technical Support for the East Coast

YDI Wireless
8000 Lee Highway
Falls Church, VA 22042
USA

Tel.:	703-205-0600
Fax:	703-205-0610
E-mail:	tech@ydi.com
Website:	www.ydi.com
Sales:	1-888-297-9090

4.5.2 Detailed Company and Product Information, Sales, Pricing, and Technical Support for the West Coast

YDI Wireless
990 Almanor Avenue
Sunnyvale, CA 94085
USA

Tel:	408-617-8150
Fax:	408-617-8151
E-mail:	tech@ydi.com
Website:	www.ydi.com
Sales:	1-800-664-7060

4.5.3 Return Procedure

All material returned to YDI must be accompanied by a Return Material Authorization (RMA) number from YDI's Customer Service department. An RMA number is necessary to assure proper tracking and handling of returned material at the factory. YDI reserves the right to refuse shipments not accompanied by an RMA number. Refused shipments will be returned to the shipper via collect freight. To obtain an RMA number, get an RMA form, and learn about the Return Procedures, please visit: www.ydi.com/RMA

The customer is responsible to properly label and package repairs and prepay shipping to YDI If possible. The original packaging material should be used to return electronic parts. The RMA number must be visible on the outside of all packages returned. Unless other arrangements have been made, all repairs are shipped back to the customer prepaid via ground carrier.

Appendix A - Interface Cable Pinouts

Table A.1 – DS-3 Data Cables

Link CX-24 IN/OUT TNC Connectors		Wire Color	DS-3 Equipment BNC Port	
Pin	**Function**		**Function**	**Pin**
1	RX	–	TX	1
Shield	GND	Foil	GND	Shield
2	TX	–	RX	2
Shield	GND	Foil	GND	Shield

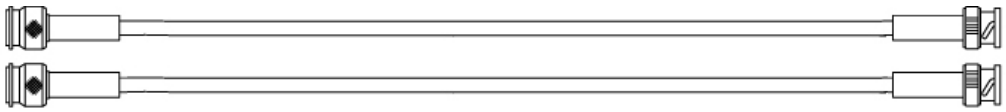


Table A.2 – 10/100 Ethernet Data or Control Cable

Link CX-24 ETHERNET 1/2 Connectors		Wire Color	Ethernet Equipment RJ-45 Port	
Pin	**Function**		**Function**	**Pin**
1	RX+	White/Orange	TX+	1
2	RX-	Orange	TX-	2
3	TX+	White/Green	RX+	3
4	TX-	Green	RX-	6

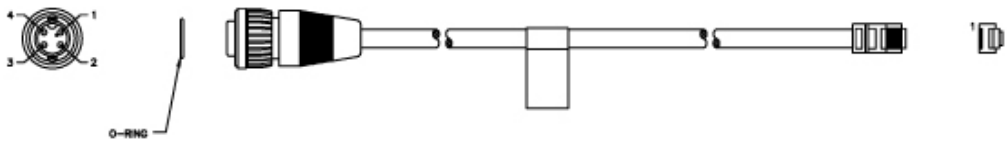


Table A.3 – DC Power Cable

To Link CX-24 POWER (4-pin Circular)		Wire Color	To DC Power Supply	
Pin	**Function**		**Function**	**Wire**
1	-V in	White/Orange	-V out	White
2	–	–	–	–
3	–	–	–	–
4	+V in	Red	+V out	Red

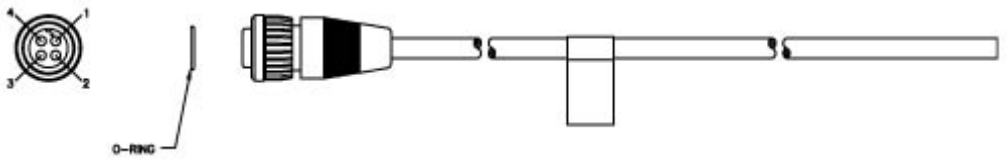


Table A.4 – 10/100 Ethernet Crossover Cable

Link CX-24 ETHERNET 1/2 Connectors		Wire Color	Link CX-24 ETHERNET 1/2 Connectors	
Pin	**Function**		**Function**	**Pin**
1	RX+	White/Orange	TX+	3
2	RX-	Orange	TX-	4
3	TX+	White/Green	RX+	1
4	TX-	Green	RX-	2

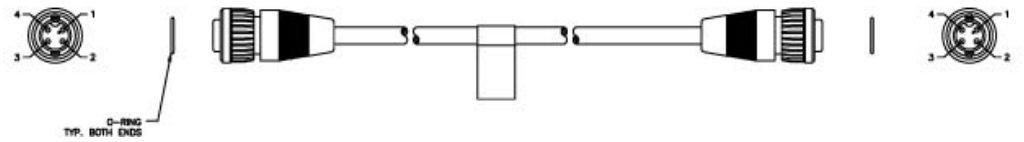


Table A.5 – RS-232 CLI Craft PC Cable

To Link CX-24 TEST (4-pin Circular)		Wire Color	To Craft PC Serial DB-9 Port	
Pin	**Function**		**Function**	**Pin**
1	N/C	–	N/C	–
2	RS-232 RX	Red	RS-232 TX	3
3	RS-232 TX	Black	RS-232 RX	2
4	RS-232 GND	Yellow	RS-232 GND	5

Appendix B - Technical Specifications

Table B.1 – Link CX-24 DS-3 or Ethernet Version (24 GHz)

General	
Frequency Range	24.05-24.250 GHz
Compliance (USA)	FCC Rules Part 15.249
Capacity	Full-duplex DS-3, per Bellcore GR-499-CORE, or 45 Mbps Ethernet, per IEEE 802.3
Emission Bandwidth	26 dB at 13.9 MHz
Channel Center Frequencies	
• Channel 1 (Tx Low/Rx High)	Transmit -- 24.072GHz/Receive -- 24.212GHz
• Channel 1 (Tx High/Rx Low)	Transmit -- 24.212GHz/Receive -- 24.072GHz
• Channel 2 (Tx Low/Rx High)	Transmit -- 24.088GHz/Receive -- 24.228GHz
• Channel 2 (Tx High/Rx Low)	Transmit -- 24.228GHz/Receive -- 24.088GHz
Modulation Type	16 QAM
Transmitter	
Maximum RMS Power Output	0 dBm
Power Output Stability	+/- 2 dB
Frequency Stability	+/- 0.24MHz
Transmit Duty Cycle	100%
Emissions Mask & Spurious and Harmonic Output	Per FCC CFR 47 Part 15.249
Channel Frequency Selection	Software-controlled
Automatic Tx Power Control (ATPC)	Maintains a constant Carrier-to-Noise Ratio at both ends of a link, operator enabled ON or OFF
Transmitter Attenuation Range	0-30 dB in 1 dB steps, and Mute 40 dB, operator controlled
Receiver	
Type	Double Heterodyne
Error Correction	FEC Reed Solomon Decoding
Sensitivity at 10-6 BER	-78 dBm state guaranteed
Typical Unfaded BER	10^{-10}
Frequency Stability	+/- 0.24MHz
Channel Frequency Selection	Software-controlled
Maximum Receive Level without Receiver Degradation	-35 dBm
Maximum Receive Level without Receiver Damage	-30 dBm

Table B.1 – Link CX-24 DS-3 or Ethernet Version (24GHz) (continued)

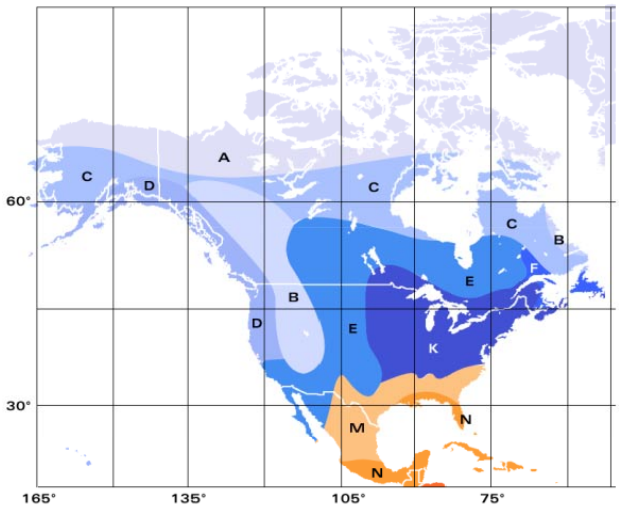
DS-3 Interface	
Type	Full-duplex DS-3, per Bellcore GR-499-CORE
Line Rate	44.736 Mbps
Line Code	B3ZS
Tx and Rx Electrical Interfaces	75 Ohm unbalanced
Tx and Rx Physical Connectors	Female TNC coaxial with grounded outer conductor
Ethernet Interfaces	
Number	Two, with independent transmit and receive pair sensing
Type	Full-duplex 10/100 Base-T per IEEE 802.3
Line Rate	45 Mbps
Max Distance between CPE and Link CX-24	100 m (328 ft.)
Electrical Interfaces	100 Ohm UTP
Physical Connectors	Female four-pin Circular
Other Interfaces	
Craft Port	Male four-pin Circular, RS-232 asynchronous data port (TXD, RXD, GND)
RSSI	Female BNC, DC voltage level proportionate to Received Signal Strength
Power Requirements	
DC Source	+/- 21 to +/- 60 VDC
Power Consumption	36 watts typical
Undervoltage Protection Circuit	> +/- 18 VDC to power up the Link CX-24
Physical Connector	Male four-pin Circular
Environmental	
Ambient Temperature Range	
• Operational	-32 to +60°C (-27 to +140°F)
• Storage	-40 to +85°C (-40 to +185°F)
Relative Humidity	
• Operational	100%, all weather protection
• Storage	95%, non-condensing
Altitude	
• Operational	15,000 ft. AMSL (4,500m)
• Storage	50,000 ft. AMSL (15,000m)
Mechanical	
Height (HxWxD)	30 x 30 x 10.6 cm (12 x 12 x 4.25 in.)
Weight	(TBD) kg (lb.); Shipping Weight: kg (lb.)

Table B.2 describes the specifications for the integral antenna on the Link CX-24. Table B.3 gives the Linx CX-24 availability figures for North America.

Table B.2 – Integral Reflector Antenna

Size	30 cm diameter x 1.9 cm deep (12 in diameter x 0.75 in deep)
Mounting	Permanently attached to the Link CX-24 radio; gasketed to prevent moisture intrusion
Polarization	Horizontal or vertical, depending on Link CX-24 mounting position
Forward Gain	34.5 dBi
Front/Back Ratio	>45 dB
Beam Width	2.9°
Elevation Adjustment	± 15°
Azimuth Adjustment	360°

Table B.3 – Link CX-24 Availability – North America



	Hotspot/ISP/WISP		VOIP				*Typical Application*
			WAN			Carrier Grade	
ITU Rain Zone	*99.7%* 131	*99.9%* 44	*99.97%* 13	*99.99%* 4	*99.997%* 1	*99.999%* 0.4	**Availability** Rain Outage at Maximum Distance (minutes/month)
A (Arctic)	**5.5**	**5.0**	**4.1**	**3.5**	**2.8**	**2.2**	**Maximum Distance[1] (miles)**
B (Nevada, Idaho, Inland BC)	**5.0**	**4.6**	**3.9**	**3.0**	**2.3**	**1.8**	
C (Anchorage)	**4.2**	**4.1**	**3.4**	**2.7**	**2.0**	**1.5**	
D (San Francisco, Sacramento)	**4.3**	**3.5**	**2.9**	**2.4**	**1.9**	**1.5**	
E (Los Angeles, San Diego)	**4.9**	**3.9**	**3.0**	**2.2**	**1.5**	**1.1**	
F (Newfoundland)	**4.3**	**3.5**	**2.7**	**1.9**	**1.3**	**0.9**	
K (New York, Philadelphia)	**4.3**	**3.0**	**2.1**	**1.5**	**1.1**	**0.8**	
M (Dallas, Atlanta)	**3.1**	**2.2**	**1.5**	**1.1**	**0.8**	**0.7**	
N (New Orleans, Miami)	**2.7**	**1.7**	**1.1**	**0.8**	**0.6**	**0.5**	

1. Maximum Distance and Availability based on Line-of-Site installation and ITU average rainfall statistics. Actual performance may vary.

Appendix C - Using the Web-Based GUI User Interface

The Link CX-24 includes its own HTML-based installation, operation and test Web pages, which can be accessed locally using a Web browser on a Craft PC, or remotely using any Web browser on the same network as the Link CX-24.

C-1 Web Browser Requirements

The Web browser used to install, operate, and maintain the Link CX-24 must have an HTML-enabled interface.

C-2 Connecting A Web Browser

You must connect your Web browser to the Link CX-24; either locally using a Craft PC, or remotely using any Web browser on the same Ethernet network as the Link CX-24. The web browser platform must have an Ethernet adapter for connecting to the Link CX-24 directly, or to the Link CX-24 though other Ethernet equipment.

C-3 Accessing the Link CX-24 Web Pages

Once your Web browser is connected to the Link CX-24 as described in Section C-2, you can access and move through the configuration and maintenance pages as you would any other Web site. The rest of this paragraph will describe how to access the Link CX-24 Web pages.

C-4 Link CX-24 Web Pages

The following figures show the Link CX-24 Web pages, and Chapter Four through Chapter Seven describe how to use the Link CX-24 Web pages to configure, install, and maintain the Link CX-24.

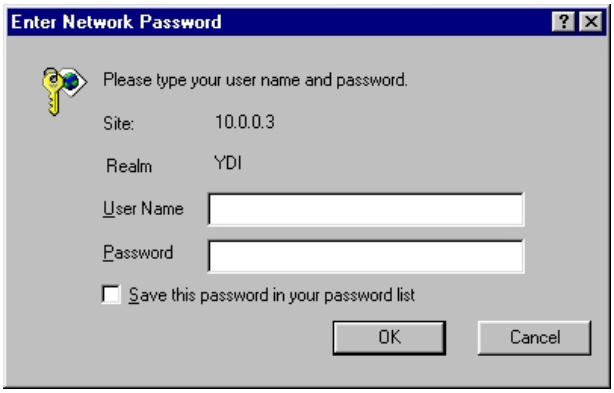
C-4.1 All Versions

To access the Link CX-24 built-in website, connect the Link CX-24 to your Craft PC using the Ethernet cable, open your Craft PC web browser, and open Ethernet address http:// 10.0.0.2/ (transmit low models) or http://10.0.0.3/ (transmit high models) in the web browser.

When the web browser Ethernet address has been changed, use the replacement Ethernet address instead of http://10.0.0.x/.

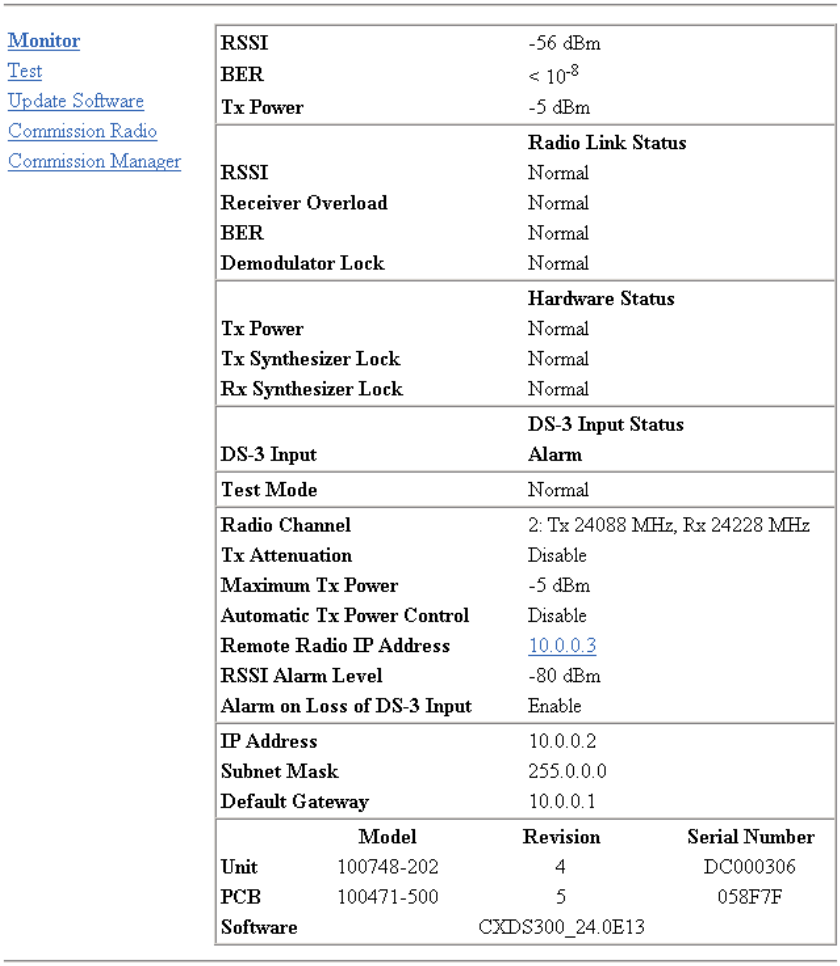
When the Link CX-24 is configured for a password, enter it in the window shown in Figure C.1, and the web browser takes you to Figure C.2 (DS-3 models). When the Link CX-24 is not configured for a password, the web browser takes you directly to Figure C.2.

Figure C.1 – Link CX-24 Login Window (all models)



C-4.2 DS-3 Versions

Figure C.2 – Link CX-24 DS-3 Monitor Web Page

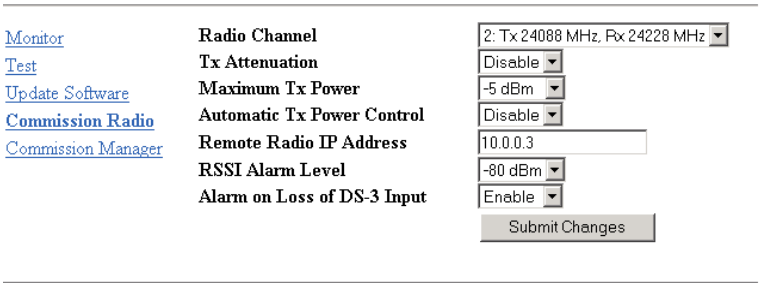


Monitor
Test
Update Software
Commission Radio
Commission Manager

RSSI	-56 dBm		
BER	$< 10^{-8}$		
Tx Power	-5 dBm		
	Radio Link Status		
RSSI	Normal		
Receiver Overload	Normal		
BER	Normal		
Demodulator Lock	Normal		
	Hardware Status		
Tx Power	Normal		
Tx Synthesizer Lock	Normal		
Rx Synthesizer Lock	Normal		
	DS-3 Input Status		
DS-3 Input	**Alarm**		
Test Mode	Normal		
Radio Channel	2: Tx 24088 MHz, Rx 24228 MHz		
Tx Attenuation	Disable		
Maximum Tx Power	-5 dBm		
Automatic Tx Power Control	Disable		
Remote Radio IP Address	10.0.0.3		
RSSI Alarm Level	-80 dBm		
Alarm on Loss of DS-3 Input	Enable		
IP Address	10.0.0.2		
Subnet Mask	255.0.0.0		
Default Gateway	10.0.0.1		
	Model	**Revision**	**Serial Number**
Unit	100748-202	4	DC000306
PCB	100471-500	5	058F7F
Software		CXDS300_24.0E13	

Note that the Monitor page has a hypertext link to the Link CX-24 on the far end of the radio link for faster troubleshooting and easy movement between the two Link CX-24s.

Figure C.3 – Link CX-24 DS-3 Commission Radio Web Page



Monitor
Test
Update Software
Commission Radio
Commission Manager

Radio Channel	2: Tx 24088 MHz, Rx 24228 MHz
Tx Attenuation	Disable
Maximum Tx Power	-5 dBm
Automatic Tx Power Control	Disable
Remote Radio IP Address	10.0.0.3
RSSI Alarm Level	-80 dBm
Alarm on Loss of DS-3 Input	Enable

Submit Changes

Figure C.4 – Link CX-24 DS-3 Commission Manager Web Page

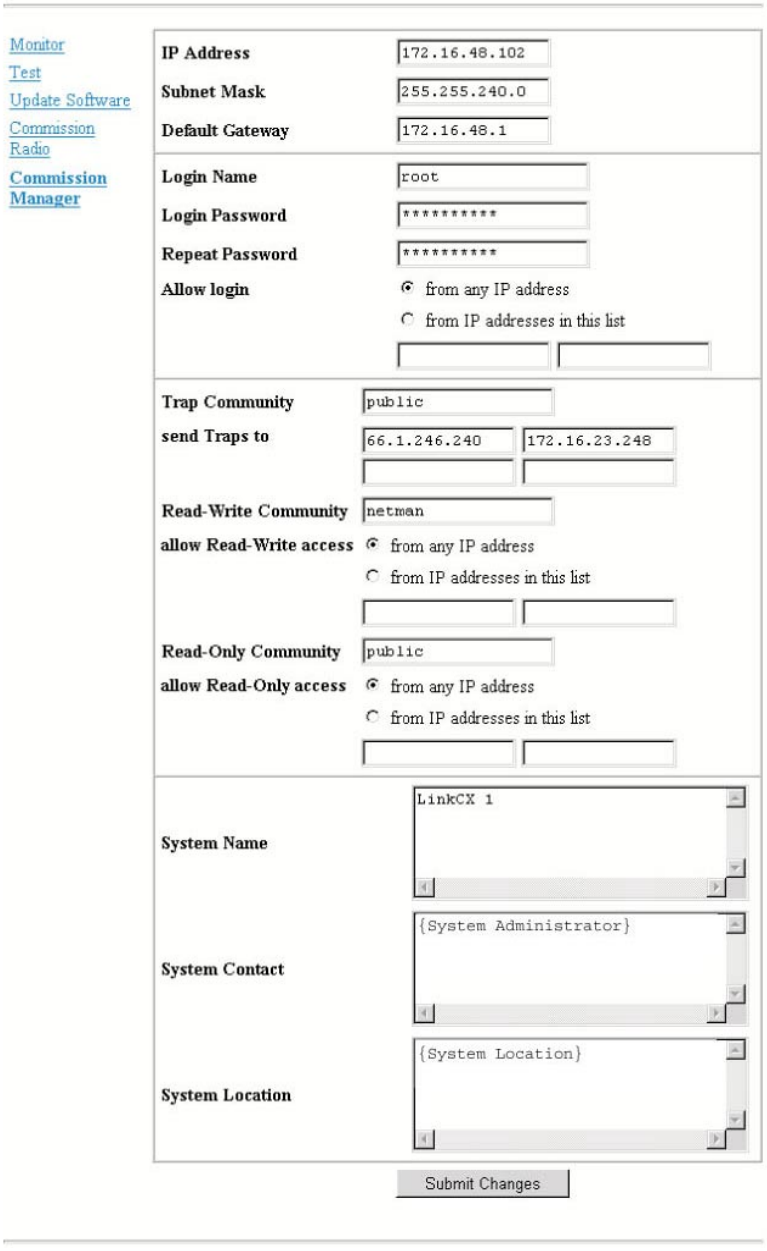


Figure C.5 – Link CX-24 DS-3 Test Web Page

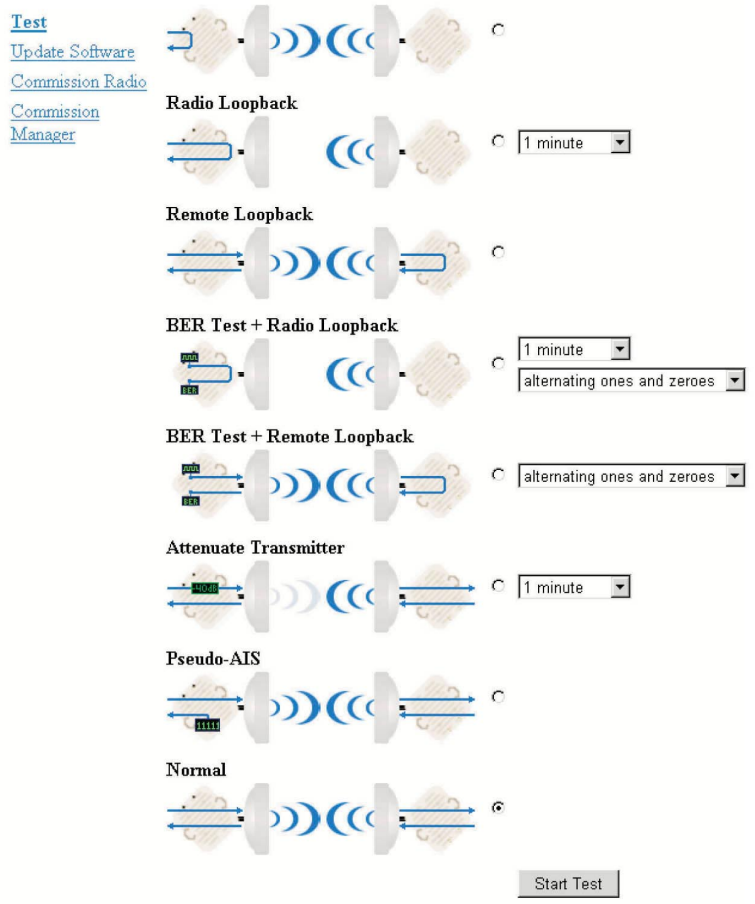
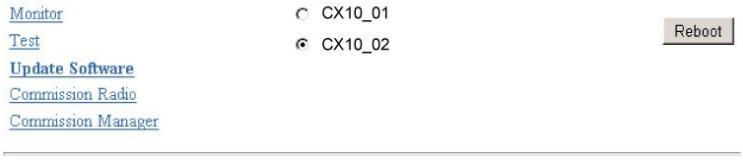
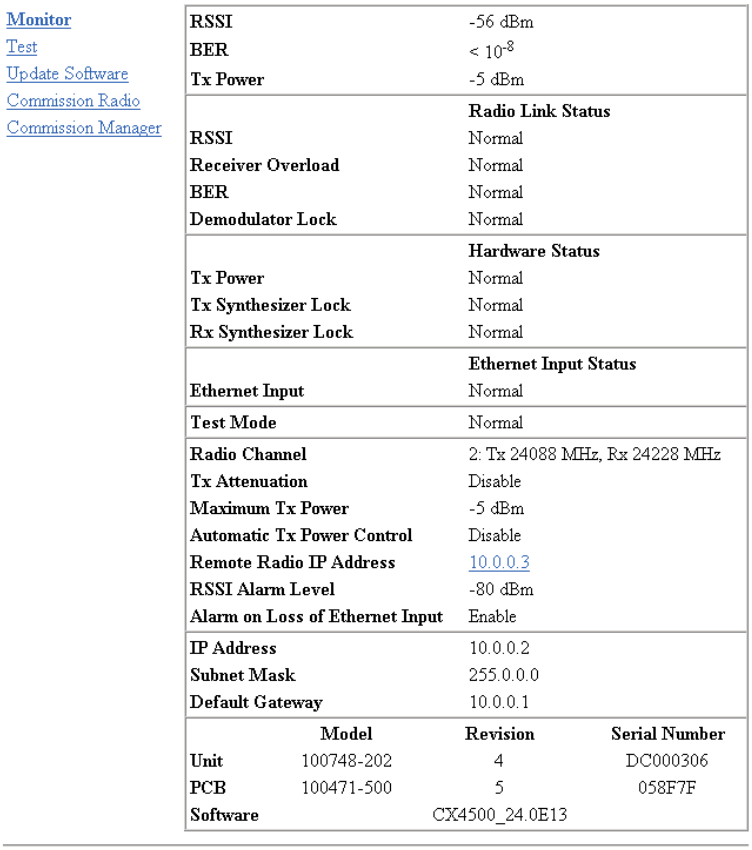


Figure C.6 – Link CX-24 DS-3 Update Software Web Page



C-4.3 Ethernet Versions

Figure C.7 – Link CX-24 Ethernet Monitor Web Page

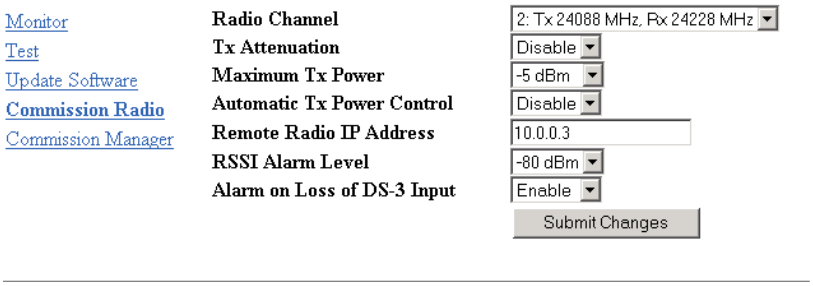


Monitor
Test
Update Software
Commission Radio
Commission Manager

RSSI	-56 dBm		
BER	$< 10^{-8}$		
Tx Power	-5 dBm		
	Radio Link Status		
RSSI	Normal		
Receiver Overload	Normal		
BER	Normal		
Demodulator Lock	Normal		
	Hardware Status		
Tx Power	Normal		
Tx Synthesizer Lock	Normal		
Rx Synthesizer Lock	Normal		
	Ethernet Input Status		
Ethernet Input	Normal		
Test Mode	Normal		
Radio Channel	2: Tx 24088 MHz, Rx 24228 MHz		
Tx Attenuation	Disable		
Maximum Tx Power	-5 dBm		
Automatic Tx Power Control	Disable		
Remote Radio IP Address	10.0.0.3		
RSSI Alarm Level	-80 dBm		
Alarm on Loss of Ethernet Input	Enable		
IP Address	10.0.0.2		
Subnet Mask	255.0.0.0		
Default Gateway	10.0.0.1		
	Model	**Revision**	**Serial Number**
Unit	100748-202	4	DC000306
PCB	100471-500	5	058F7F
Software		CX4500_24.0E13	

Note that the Monitor page has a hypertext link to the Link CX-24 on the far end of the radio link for faster troubleshooting and easy movement between the two Link CX-24s.

Figure C.8 – Link CX-24 Ethernet Commission Radio Web Page



Monitor
Test
Update Software
Commission Radio
Commission Manager

Radio Channel 2: Tx 24088 MHz, Rx 24228 MHz
Tx Attenuation Disable
Maximum Tx Power -5 dBm
Automatic Tx Power Control Disable
Remote Radio IP Address 10.0.0.3
RSSI Alarm Level -80 dBm
Alarm on Loss of DS-3 Input Enable
Submit Changes

Figure C.9 – Link CX-24 Ethernet Commission Manager Web Page

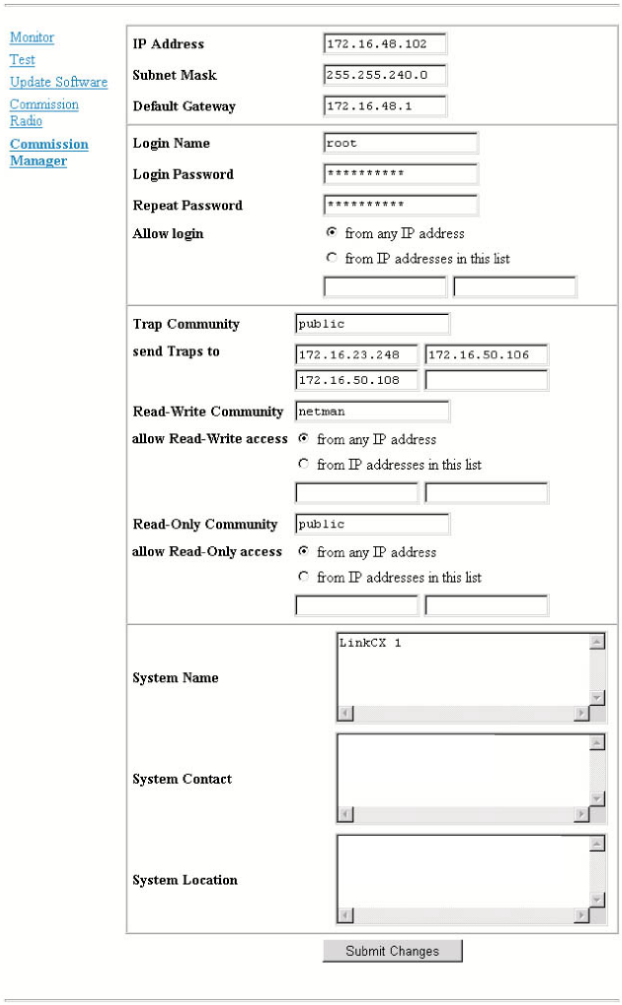


Figure C.10 – Link CX-24 Ethernet Test Web Page

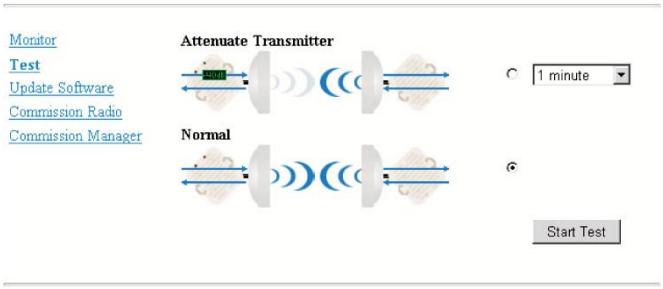
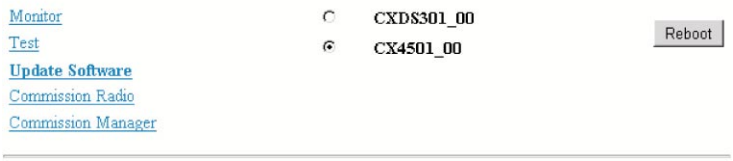


Figure C.11 – Link CX-24 Ethernet Update Software Web Page



Appendix D - Grounding and Lightning Protection

This appendix explains how to properly set up the Link CX-24 radio for grounding and lightning protection.

D-1 Overview

When used in telecommunications, good grounding practices have some direct benefits that can help users maximize system uptime as well as ensure the safety of those people working on the system. Among these benefits are:

- Protection of personnel from electric shock and fire hazards
- Reduction of radiated and conducted electromagnetic susceptibility
- Improved system tolerance to discharge of electrostatic energy and lightning interference
- Minimized service interruptions and service damage

No practice or formula can completely eliminate the above risks, but YDI believes that good grounding and bonding practices can significantly reduce the risk of many of these hazards. This appendix includes a bibliography that contains several publications that are readily available and provide detailed information on many aspects of grounding systems and their design, implementation, measurement, and maintenance.

Please note that every telecommunication site is unique and must be evaluated accordingly. The following information is provided for generic reference and educational purposes only. The grounding plans and practices for a given site should be established and implemented only by trained professionals, working in accordance with local practices and regulations.

YDI strongly recommends that you install a Transtector Lightning Arrestor or equivalent at the cable entry to the Ethernet, Power, and/or DS-3 equipment structure.

D-2 Grounding

D-2.1 Making a Grounding Plan

A grounding plan should be developed at the outset of site design to provide the best grounding procedures and to minimize ground loop currents. Grounding should be achieved by connecting the outer conductors of the cables through a large-section copper strap to a central grounding point, and the size of the conductor should be increased as each branch path is added. The final conductor should be connected directly to the grounding system. For a radio site, a single copper grounding rod is insufficient, because its impedance is likely to be too high.

D-2.2 Grounding Buildings

Ideally, a ground ring should surround the building and be connected to individual grounds associated with feeder entry, antenna support structure, the building lightning conductor, the equipment room, the main AC supply, and other facilities. Each connection should be made by the most direct route to minimize interaction between the different grounding functions.

The ground ring should consist of copper cable or tape with electrodes two meters or longer, buried to a depth of 0.6 m and at a distance from the building not to exceed 1 m.

Buildings may require lightning rods if they are not within the zone of another protected structure. To construct a good ground, ground rods should penetrate the earth to a depth of about 2 m (6 feet).

Where the ground is in rocky terrain, make sure that the ground rods penetrate into loose soil. In sandy soil, use more ground rods to make sure that the ground has sufficient contact with water-bearing material.

Use 4 to 6 AWG wire to connect each ground rod to the equipment to be grounded. The cables should be free of sharp bends. Each ground cable should be at least 2 m in length with at least 1 m separation between each. Refer to local and national electrical codes to determine acceptable grounding methods. The Link CX-24 chassis should be directly connected to ground to ensure that it functions correctly. In most cases, following the local code requirements for grounding and lightning protection will be adequate.

Many of the cables used by YDI have braided rather than solid outer conductors; this type of grounding is not appropriate. In these cases surge arrestors approved by YDI should be used. For information on surge arrestors, please contact the YDI Customer Support department.

D-3 Lightning Protection

Radio sites can be particularly prone to lightning strikes by virtue of their normally exposed locations and the presence of relatively tall antenna support structures.

Reference should also be made to various publications, some of which are listed in the bibliography.

Any site owner or user in doubt about the protection requirements for a particular location should contact the appropriate authority.

D-3.1 Purposes

The purposes of any protection arrangement should be to:

- Provide a suitable path to ground for the lightning current.
- Ensure adequate bonding between structures and all metalwork on the site and the common grounding system in order to reduce side flashing.
- Prevent the entry of flashes or surges into the building.

The resistance to ground should be kept to a minimum; a value of less than 10 Ohms is recommended. Ideally, and most important, the system should be at equal potential across the entire site.

Certain authorities and service providers have their own particular practices that have to be followed where applicable.

Protection arrangements vary considerably, from very simple sites to complicated sites with multiple buildings, antenna support structures, and associated equipment. Ensuring adequate protection may also involve integration with and upgrading of existing systems.

D-3.2 Lightning Conductors

Down conductors, bonding interconnections, ground rings, and radial tapes should be of uninsulated 000 AWG copper cable or solid copper tape with a minimum cross section of 25 mm by 3 mm, with all connections protected by non-reactive paste.

Protected test points should be included if appropriate, and sacrificial ground lugs should be clearly marked and easily accessible for periodic inspection.

D-3.3 Grounding Antenna Support Structures

A structure generally acts as its own lightning conductor and, therefore, does not require an additional conductor from the top to the base. A lightning rod may be required to extend the zone of protection to equipment mounted on the top of the structure. The lightning rod should extend 2.5 m above the highest equipment.

It is not possible to provide and guarantee complete protection from the effects of lightning; however, risks of this sort can be significantly reduced by careful attention to grounding, protection devices, and the layout of the site itself.

Ground-mounted support structures should be connected at their base to a ground ring through sacrificial ground lugs. Towers should have a connection from each leg.

A ground ring should consist of copper cable or solid copper tape, with ground rods equally spaced at 2 m intervals around the base of the structure as close to it as possible. The ground ring is buried approximately 0.6 m deep where soil conditions allow. An alternative method using radials rather than rings is detailed in The "Grounds" for Lightning and EMP Protection, published by PolyPhaser Corporation.

The ground ring should be connected to the main building ground by the most direct route, and should be buried as appropriate.

Roof-mounted structures should be connected to the main building ground by the most direct route, using sacrificial lugs and copper cable or tape as appropriate. Tower guy wires should be directly bonded at their lowest point to a suitable ground electrode or connected to the site ground by the most direct route.

Appendix E - Enterprise MIBs and Traps

This appendix contains information about the two different sets of Link CX-24 Management Information Bases (MIBs), their current listings, and where to find the most current versions.

E-1 Enterprise MIBs

E-1.1 Overview

The DS-3 and Ethernet Link CX-24 Enterprise MIBs consist of the following groups of objects:

- link_cx_identity group: Model, revision, serial numbers, and channel frequency table. Configured in the factory. Read-only by the customer.
- link_cx_configuration group: Channel number and other read-write parameters that the customer chooses. This group is the system's persistent state. It is preserved across reboots.
- link_cx_status group: Performance and alarm status, read-only. Not preserved across reboots.
- link_cx_test group: BERT, loopback, and other temporary state that the customer might use in a test procedure. Read-write. Not preserved across reboots.
- link_cx_reboot group: Identifies the software versions that are available and controls reboot.
- link_cx_trap group: There is only one trap-related variable, trapSentCounter. It is not preserved across reboots.

The following two sections contain details for the DS-3 and Ethernet Link CX-24 Enterprise MIBs.

E-1.2 DS-3 Version Details

```
LINK_CX-MIB DEFINITIONS ::= BEGIN

IMPORTS
  enterprises, Counter
    FROM RFC1155-SMI
  OBJECT-TYPE
    FROM RFC-1212;

YDI_Wireless          OBJECT IDENTIFIER ::= { enterprises  792  }
link_cx               OBJECT IDENTIFIER ::= {YDI_Wireless 5   }
link_cx_identity      OBJECT IDENTIFIER ::= { link_cx 1 }
link_cx_configuration OBJECT IDENTIFIER ::= { link_cx 2 }
link_cx_status        OBJECT IDENTIFIER ::= { link_cx 3 }
link_cx_test          OBJECT IDENTIFIER ::= { link_cx 4 }
link_cx_reboot        OBJECT IDENTIFIER ::= { link_cx 5 }
link_cx_trap          OBJECT IDENTIFIER ::= { link_cx 6 }

-- link_cx_identity group

unitModelNumber OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "The model number of the unit as a whole."
  ::= { link_cx_identity 1 }

unitRevisionNumber  OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
```

```
  DESCRIPTION
     "The revision number of the unit as a whole."
  ::= { link_cx_identity 2 }

unitSerialNumber   OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "The serial number of the unit as a whole."
  ::= { link_cx_identity 3 }

boardModelNumber OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "The model number of the PCB board assembly."
  ::= { link_cx_identity 4 }

boardRevisionNumber  OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "The revision number of the PCB board assembly."
  ::= { link_cx_identity 5 }

boardSerialNumber   OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "The serial number of the PCB board assembly."
  ::= { link_cx_identity 6 }

rfFrequencyTable OBJECT-TYPE
  SYNTAX  SEQUENCE OF RfChannelFreqEntry
  ACCESS not-accessible
  STATUS mandatory
  DESCRIPTION
      "The table of 2 selectable Tx/Rx frequency channel pairs, in MHz. The
      receive frequency on a Tx-high unit is lower than the transmit frequency
      by the amount of the Tx/Rx separation. Conversely, the receive frequency
      on a Tx-low unit is higher than the transmit frequency by the amount of
      the Tx/Rx separation."
  ::= { link_cx_identity 7 }

rfFrequencyEntry OBJECT-TYPE
  SYNTAX  RfFrequencyEntry
  ACCESS  not-accessible
  STATUS  mandatory
  DESCRIPTION
     "Channel frequency entry."
  INDEX   { rfChannelIndex }
  ::= { rfFrequencyTable 1 }
```

```
RfFrequencyEntry ::=
  SEQUENCE {
    rfChannelIndex
      INTEGER,
    rfTxFrequency
      INTEGER,
    rfRxFrequency
      INTEGER
  }

rfChannelIndex OBJECT-TYPE
  SYNTAX  INTEGER (1..2)
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The RF channel number."
  ::= { rfFrequencyEntry 1 }

rfTxFrequency OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The transmit frequency in MHz."
  ::= { rfFrequencyEntry 2 }

rfRxFrequency OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The receive frequency in MHz."
  ::= { rfFrequencyEntry 3 }

-- link_cx_configuration group

rfTxAttenuateControl OBJECT-TYPE
  SYNTAX  INTEGER {
       enabled(1),
       disabled(2)
       }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "If enabled, attenuates the transmit output level by 40 dB."
  ::= { link_cx_configuration 1 }

rfAtpcControl   OBJECT-TYPE
  SYNTAX  INTEGER {
       enabled(1),
       disabled(2)
       }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
```

```
      "Automatic Tx Power Control mode can be enabled or disabled.
       If enabled, the two Link CX-24 radios at opposite ends of the
       radio link send each other feedback messages that they use
       to adjust their Tx power down to the lowest level that is
       consistent with good signal quality."
  ::= { link_cx_configuration 2 }

rfTxPowerLimit   OBJECT-TYPE
  SYNTAX  INTEGER (-30..0)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "Maximum transmit power level limit at the antenna port, in dBm.
       The Tx power limit can be set in 1 dB steps within the range
       of -30 dBm to 0 dBm. If Automatic Tx Power Control is enabled
       the measured Tx power may be lower than this limit. If Automatic
       Tx Power Control is disabled the measured Tx power should be
       exactly the same as this target value."
  ::= { link_cx_configuration 3 }

rfAtpcAddress    OBJECT-TYPE
  SYNTAX IpAddress
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "The IP Address of the peer radio with which this radio exchanges
       Automatic Tx Power Control information."
  ::= { link_cx_configuration 4 }

rfChannel     OBJECT-TYPE
  SYNTAX  INTEGER (1..2)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "The current transmit channel of the local unit. The transmit
       frequency in MHz for each channel can be read in the rfFrequencyTable."
  ::= { link_cx_configuration 5 }

rfRssiAlarmThresholdSetting   OBJECT-TYPE
  SYNTAX  INTEGER (-80..-40)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "A RSSI Alarm will be generated if the level of RSSI goes below
       the set threshold.  The threshold can be set in 1 dB steps
       within the range of -80 to -40 dBm."
  ::= { link_cx_configuration 6 }

losAlarmControl   OBJECT-TYPE
  SYNTAX  INTEGER {
        enabled(1),
        disabled(2)
        }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
```

```
      "DS3/E3 LOS alarm control. When enabled, the alarm will be generated.
       When disabled, the alarm will not be generated even if
       LOS condition is detected."
  ::= { link_cx_configuration 7 }

-- link_cx_status group

rfPowerOutputLevel OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "The measured radio Tx power level in dBm."
  ::= { link_cx_status 1 }

rfRssiLevel OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "The measured RSSI of the active channel in dBm. -110 dBm
      indicates the receive signal level is below the detection level."
  ::= { link_cx_status 2 }

bitErrorRate OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "The estimated bit error rate (BER), in errors per 10^8 bits.
      A returned value of 0 indicates zero bit errors in 10^8 bits.
      A returned value of 1 indicates an estimated BER of 1x10^-8.
      A returned value of 10 indicates an estimated BER of 1x10^-7,
      and so on."
  ::= { link_cx_status 3 }

losAlarmStatus OBJECT-TYPE    -- DS3/E3 interface alarm condition
  SYNTAX  INTEGER {
       normal(1),
       alarm(2)
       }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "A value of 1 indicates a DS3/E3 connection is present.
      A value of 2 indicates the DS3/E3 connection has been lost.
      If losAlarmControl = disabled, losAlarmStatus will
      always be normal."
  ::= { link_cx_status 4 }

txSynthLockAlarmStatus OBJECT-TYPE    -- local alarm condition
  SYNTAX  INTEGER {
       normal(1),
       alarm(2)
       }
  ACCESS  read-only
```

```
  STATUS  mandatory
  DESCRIPTION
      "The Tx synthesizer lock status.
       A value of 1 indicates the Tx synthesizer is locked.
       A value of 2 indicates the Tx synthesizer is unlocked"
  ::= { link_cx_status 5 }

rxSynthLockAlarmStatus OBJECT-TYPE  -- local alarm condition
  SYNTAX  INTEGER {
        normal(1),
        alarm(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The Rx synthesizer lock status.
       A value of 1 indicates the Rx synthesizer is locked.
       A value of 2 indicates the Rx synthesizer is unlocked"
  ::= { link_cx_status 6 }

lowTxPowerAlarmStatus OBJECT-TYPE   -- local alarm condition
  SYNTAX  INTEGER {
        normal(1),
        alarm(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "A value of 1 indicates the Tx power at the antenna port
       is greater than or equal to -30dBm. A value of 2 indicates
       the Tx power at the antenna port is less than -30 dBm."
  ::= { link_cx_status 7 }

demodLockAlarmStatus OBJECT-TYPE    -- link alarm condition
  SYNTAX  INTEGER {
        normal(1),
        alarm(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The demodulator lock status.
       A value of 1 indicates the demodulator is locked.
       A value of 2 indicates the demodulator is unlocked"
  ::= { link_cx_status 8 }

lowRssiLevelAlarmStatus OBJECT-TYPE -- link alarm condition
  SYNTAX  INTEGER {
        normal(1),
        alarm(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "A RSSI alarm will be generated if the level of RSSI goes below
       the user configured RSSI alarm level, rfRssiAlarmThresholdSetting.
```

```
      A value of 1 indicates the received signal level is above the RSSI
      alarm threshold. A value of 2 indicates the received signal level
      is at or below the user configured RSSI alarm level.
      This alarm is valid only if the Rx synthesizer is locked."
  ::= { link_cx_status 9 }

receiverOverloadAlarmStatus OBJECT-TYPE -- link alarm condition
  SYNTAX  INTEGER {
       normal(1),
       alarm(2)
       }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "A receiver overload alarm will be generated if the level
      of RSSI is at or above -40 dBm. A value of 1 indicates the
      received signal level is below -40 dBm. A value of 2 indicates
      the received signal level is at or above -40 dBm.
      This alarm is only valid if the Rx synthesizer is locked."
  ::= { link_cx_status 10 }

bitErrorRateAlarmStatus OBJECT-TYPE -- link alarm condition
  SYNTAX  INTEGER {
       normal(1),
       alarm(2)
       }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "A bit error rate alarm will be generated if the level
      of BER is at or above 10^-3, i.e. if bitErrorRate is
      equal to or greater than 100000."
  ::= { link_cx_status 11 }

-- link_cx_test group

rfTxAttenuateTimer   OBJECT-TYPE
  SYNTAX  INTEGER (0..1800)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
     "To temporarily enable Tx attenuation by 40 dB, write the number of
      seconds to this timer. When the timer counts down to 0, Tx attenuation
      will return to its normal unattenuated state. Writing to this timer
      has no effect if rfTxAttenuateControl is set to enable because in
      that case the transmitter is already attenuated."
  ::= { link_cx_test 1 }

localLoopbackControl OBJECT-TYPE
  SYNTAX  INTEGER {
       enabled(1),
       disabled(2)
       }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
```

```
      "The DS3/E3 local loopback control. When enabled, DS3/E3 data on the
       local interface is looped back through the local interface.
       When disabled, DS3/E3 data on the local interface is sent over
       the radio link to the remote unit."
  ::= { link_cx_test 2 }

rfLocalLoopbackTimer   OBJECT-TYPE
  SYNTAX  INTEGER (0..1800)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "When this value is greater than zero, the radio is in the local
       loopback mode. The RF transmit signal on the local unit is
       converted to the receive frequency of the local unit so it can
       be received by the local unit, for the chosen period of time in
       seconds. When this timer counts down to 0 the unit reverts to
       normal operation in which the RF transmit signal on the local unit
       is transmitted over the radio link to the remote unit. The duration
       is selectable in 1 second intervals from 0 seconds to a maximum of
       1800 seconds."
  ::= { link_cx_test 3 }

remoteLoopbackControl OBJECT-TYPE
  SYNTAX  INTEGER {
        enabled(1),
        disabled(2)
        }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "The DS3/E3 remote loopback control. With either setting of this
       control, DS3/E3 data on the local interface is sent to the peer radio
       and DS3/E3 data received from the peer radio goes to the local
       interface. When enabled, the peer radio loops the data back to the
       originating radio. When disabled, DS3/E3 data flow from end to end."
  ::= { link_cx_test 4 }

berTestControl   OBJECT-TYPE
  SYNTAX  INTEGER {
        alternatingOnesZeros(1),
        allOnes(2),
        allZeros(3),
        disabled(4),
        pseudorandom(5)
        }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "BER test mode control.  The BER test is enabled by selecting one of
       four different data patterns.  The patterns are:
       (1) alternating 1's and 0's, (2) all 1's, (3) all 0's, and
       (5) pseudorandom 1's and 0's. The BER test is disabled by setting
       the BER test control to 4."
  ::= { link_cx_test 5 }

pseudoAisControl   OBJECT-TYPE
```

```
  SYNTAX  INTEGER {
        enabled(1),
        disabled(2)
        }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "When enabled, pseudo-AIS (constant mark or all ones at the DS3/E3
       interface) will be generated."
  ::= { link_cx_test 6 }

-- link_cx_reboot group

softwareVersionBank1 OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The software version in bank one."
  ::= { link_cx_reboot 1 }

softwareVersionBank2 OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The software version in bank two."
  ::= { link_cx_reboot 2 }

bootedUsingBankNumber OBJECT-TYPE
  SYNTAX  INTEGER {
        bankOne(1),
        bankTwo(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The software bank from which the unit booted."
  ::= { link_cx_reboot 3 }

bootUsingBankNumber OBJECT-TYPE
  SYNTAX  INTEGER {
        bankOne(1),
        bankTwo(2)
        }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "Selects the software bank and causes reboot."
  ::= { link_cx_reboot 4 }

-- traps

trapSentCounter OBJECT-TYPE
  SYNTAX  Counter
  ACCESS  read-only
```

```
  STATUS  mandatory
  DESCRIPTION
     "Total number of enterprise traps sent since last reboot."
  ::= { link_cx_trap 1 }

link_cx_unit OBJECT IDENTIFIER ::= { link_cx 101 }

alarmTrap  TRAP-TYPE
  ENTERPRISE  link_cx_unit
  VARIABLES  { rfPowerOutputLevel,
               rfRssiLevel,
               bitErrorRate,
               losAlarmStatus,
               txSynthLockAlarmStatus,
               rxSynthLockAlarmStatus,
               lowTxPowerAlarmStatus,
               demodLockAlarmStatus,
               lowRssiLevelAlarmStatus,
               receiverOverloadAlarmStatus,
               bitErrorRateAlarmStatus,
               trapSentCounter }
  DESCRIPTION
     "A trap that indicates a change in one or more of the alarm conditions."
  ::= 1

configurationChangeTrap  TRAP-TYPE
  ENTERPRISE  link_cx_unit
  VARIABLES  { rfTxAttenuateControl,
               rfAtpcControl,
               rfTxPowerLimit,
               rfAtpcAddress,
               rfChannel,
               rfRssiAlarmThresholdSetting,
               losAlarmControl,
               trapSentCounter }
  DESCRIPTION
     "A trap that indicates a configuration change."
  ::= 2

unitTestTrap  TRAP-TYPE
  ENTERPRISE  link_cx_unit
  VARIABLES  { rfTxAttenuateTimer,
               localLoopbackControl,
               rfLocalLoopbackTimer,
               remoteLoopbackControl,
               berTestControl,
               pseudoAisControl,
               trapSentCounter }
  DESCRIPTION
     "A trap that indicates the beginning or end of a test procedure.
      An alarmTrap trap might result from this procedure."
  ::= 3

END
```

E-1.3 Ethernet Version Details

```
LINK_CX_ETHR_MIB DEFINITIONS ::= BEGIN

IMPORTS
  enterprises, Counter
    FROM RFC1155-SMI
  OBJECT-TYPE
    FROM RFC-1212;

YDI_Wireless          OBJECT IDENTIFIER ::= { enterprises 792 }
link_cx_ethr          OBJECT IDENTIFIER ::= {YDI_Wireless 6 }
link_cx_identity      OBJECT IDENTIFIER ::= { link_cx_ethr 1 }
link_cx_configuration OBJECT IDENTIFIER ::= { link_cx_ethr 2 }
link_cx_status        OBJECT IDENTIFIER ::= { link_cx_ethr 3 }
link_cx_test          OBJECT IDENTIFIER ::= { link_cx_ethr 4 }
link_cx_reboot        OBJECT IDENTIFIER ::= { link_cx_ethr 5 }
link_cx_trap          OBJECT IDENTIFIER ::= { link_cx_ethr 6 }

-- link_cx_identity group

unitModelNumber OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The model number of the unit as a whole."
  ::= { link_cx_identity 1 }

unitRevisionNumber  OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The revision number of the unit as a whole."
  ::= { link_cx_identity 2 }

unitSerialNumber   OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The serial number of the unit as a whole."
  ::= { link_cx_identity 3 }

boardModelNumber OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The model number of the PCB board assembly."
  ::= { link_cx_identity 4 }

boardRevisionNumber  OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
```

```
  STATUS  mandatory
  DESCRIPTION
     "The revision number of the PCB board assembly."
  ::= { link_cx_identity 5 }

boardSerialNumber   OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "The serial number of the PCB board assembly."
  ::= { link_cx_identity 6 }

rfFrequencyTable OBJECT-TYPE
  SYNTAX  SEQUENCE OF RfChannelFreqEntry
  ACCESS not-accessible
  STATUS mandatory
  DESCRIPTION
      "The table of 2 selectable Tx/Rx frequency channel pairs, in MHz. The
      receive frequency on a Tx-high unit is lower than the transmit frequency
      by the amount of the Tx/Rx separation. Conversely, the receive frequency
      on a Tx-low unit is higher than the transmit frequency by the amount of
      the Tx/Rx separation."
  ::= { link_cx_identity 7 }

rfFrequencyEntry OBJECT-TYPE
  SYNTAX  RfFrequencyEntry
  ACCESS  not-accessible
  STATUS  mandatory
  DESCRIPTION
     "Channel frequency entry."
  INDEX   { rfChannelIndex }
  ::= { rfFrequencyTable 1 }

RfFrequencyEntry ::=
  SEQUENCE {
    rfChannelIndex
      INTEGER,
    rfTxFrequency
      INTEGER,
    rfRxFrequency
      INTEGER
  }

rfChannelIndex OBJECT-TYPE
  SYNTAX  INTEGER (1..2)
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "The RF channel number."
  ::= { rfFrequencyEntry 1 }

rfTxFrequency OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
```

```
  DESCRIPTION
     "The transmit frequency in MHz."
  ::= { rfFrequencyEntry 2 }

rfRxFrequency OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "The receive frequency in MHz."
  ::= { rfFrequencyEntry 3 }

-- link_cx_configuration group

rfTxAttenuateControl OBJECT-TYPE
  SYNTAX  INTEGER {
       enabled(1),
       disabled(2)
       }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
     "If enabled, attenuates the transmit output level by 40 dB."
  ::= { link_cx_configuration 1 }

rfAtpcControl   OBJECT-TYPE
  SYNTAX  INTEGER {
       enabled(1),
       disabled(2)
       }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
     "Automatic Tx Power Control mode can be enabled or disabled.
      If enabled, the two Link CX-24 radios at opposite ends of the
      radio link send each other feedback messages that they use
      to adjust their Tx power down to the lowest level that is
      consistent with good signal quality."
  ::= { link_cx_configuration 2 }

rfTxPowerLimit   OBJECT-TYPE
  SYNTAX  INTEGER (-30..0)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
     "Maximum transmit power level limit at the antenna port, in dBm.
      The Tx power limit can be set in 1 dB steps within the range
      of -30 dBm to 0 dBm. If Automatic Tx Power Control is enabled
      the measured Tx power may be lower than this limit. If Automatic
      Tx Power Control is disabled the measured Tx power should be
      exactly the same as this target value."
  ::= { link_cx_configuration 3 }

rfAtpcAddress   OBJECT-TYPE
  SYNTAX IpAddress
  ACCESS  read-write
```

```
  STATUS  mandatory
  DESCRIPTION
      "The IP Address of the peer radio with which this radio exchanges
       Automatic Tx Power Control information."
  ::= { link_cx_configuration 4 }

rfChannel     OBJECT-TYPE
  SYNTAX  INTEGER (1..2)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "The current transmit channel of the local unit. The transmit
       frequency in MHz for each channel can be read in the rfFrequencyTable."
  ::= { link_cx_configuration 5 }

rfRssiAlarmThresholdSetting   OBJECT-TYPE
  SYNTAX  INTEGER (-80..-40)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "A RSSI Alarm will be generated if the level of RSSI goes below
       the set threshold.  The threshold can be set in 1 dB steps
       within the range of -80 to -40 dBm."
  ::= { link_cx_configuration 6 }

losAlarmControl   OBJECT-TYPE
  SYNTAX  INTEGER {
        enabled(1),
        disabled(2)
        }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "Ethernet Loss Of Signal alarm control. When enabled, the alarm will
       be generated. When disabled, the alarm will not be generated even if
       LOS condition is detected."
  ::= { link_cx_configuration 7 }

-- link_cx_status group

rfPowerOutputLevel OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The measured radio Tx power level in dBm."
  ::= { link_cx_status 1 }

rfRssiLevel OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The measured RSSI of the active channel in dBm. -110 dBm
       indicates the receive signal level is below the detection level."
  ::= { link_cx_status 2 }
```

```
bitErrorRate OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The estimated bit error rate (BER), in errors per 10^8 bits.
       A returned value of 0 indicates zero bit errors in 10^8 bits.
       A returned value of 1 indicates an estimated BER of 1x10^-8.
       A returned value of 10 indicates an estimated BER of 1x10^-7,
       and so on."
  ::= { link_cx_status 3 }

losAlarmStatus OBJECT-TYPE    -- interface alarm condition
  SYNTAX  INTEGER {
        normal(1),
        alarm(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "A value of 1 indicates an Ethernet connection is present.
       A value of 2 indicates the Ethernet connection has been lost.
       If losAlarmControl = disabled, losAlarmStatus will
       always be normal."
  ::= { link_cx_status 4 }

txSynthLockAlarmStatus OBJECT-TYPE    -- local alarm condition
  SYNTAX  INTEGER {
        normal(1),
        alarm(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The Tx synthesizer lock status.
       A value of 1 indicates the Tx synthesizer is locked.
       A value of 2 indicates the Tx synthesizer is unlocked"
  ::= { link_cx_status 5 }

rxSynthLockAlarmStatus OBJECT-TYPE  -- local alarm condition
  SYNTAX  INTEGER {
        normal(1),
        alarm(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The Rx synthesizer lock status.
       A value of 1 indicates the Rx synthesizer is locked.
       A value of 2 indicates the Rx synthesizer is unlocked"
  ::= { link_cx_status 6 }

lowTxPowerAlarmStatus OBJECT-TYPE   -- local alarm condition
  SYNTAX  INTEGER {
        normal(1),
```

```
        alarm(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "A value of 1 indicates the Tx power at the antenna port
       is greater than or equal to -30 dBm. A value of 2 indicates
       the Tx power at the antenna port is less than -30 dBm."
  ::= { link_cx_status 7 }

demodLockAlarmStatus OBJECT-TYPE    -- link alarm condition
  SYNTAX  INTEGER {
        normal(1),
        alarm(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The demodulator lock status.
       A value of 1 indicates the demodulator is locked.
       A value of 2 indicates the demodulator is unlocked"
  ::= { link_cx_status 8 }

lowRssiLevelAlarmStatus OBJECT-TYPE -- link alarm condition
  SYNTAX  INTEGER {
        normal(1),
        alarm(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "A RSSI alarm will be generated if the level of RSSI goes below
       the user configured RSSI alarm level, rfRssiAlarmThresholdSetting.
       A value of 1 indicates the received signal level is above the RSSI
       alarm threshold. A value of 2 indicates the received signal level
       is at or below the user configured RSSI alarm level.
       This alarm is valid only if the Rx synthesizer is locked."
  ::= { link_cx_status 9 }

receiverOverloadAlarmStatus OBJECT-TYPE -- link alarm condition
  SYNTAX  INTEGER {
        normal(1),
        alarm(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "A receiver overload alarm will be generated if the level
       of RSSI is at or above -40 dBm. A value of 1 indicates the
       received signal level is below -40 dBm. A value of 2 indicates
       the received signal level is at or above -40 dBm.
       This alarm is only valid if the Rx synthesizer is locked."
  ::= { link_cx_status 10 }

bitErrorRateAlarmStatus OBJECT-TYPE -- link alarm condition
  SYNTAX  INTEGER {
```

```
        normal(1),
        alarm(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "A bit error rate alarm will be generated if the level
       of BER is at or above 10^-3, i.e. if bitErrorRate is
       equal to or greater than 100000."
  ::= { link_cx_status 11 }

-- link_cx_test group

rfTxAttenuateTimer   OBJECT-TYPE
  SYNTAX  INTEGER (0..1800)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "To temporarily enable Tx attenuation by 40 dB, write the number of
       seconds to this timer. When the timer counts down to 0, Tx attenuation
       will return to its normal unattenuated state. Writing to this timer
       has no effect if rfTxAttenuateControl is set to enable because in
       that case the transmitter is already attenuated."
  ::= { link_cx_test 1 }

-- link_cx_reboot group

softwareVersionBank1 OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The software version in bank one."
  ::= { link_cx_reboot 1 }

softwareVersionBank2 OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The software version in bank two."
  ::= { link_cx_reboot 2 }

bootedUsingBankNumber OBJECT-TYPE
  SYNTAX  INTEGER {
        bankOne(1),
        bankTwo(2)
        }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The software bank from which the unit booted."
  ::= { link_cx_reboot 3 }

bootUsingBankNumber OBJECT-TYPE
  SYNTAX  INTEGER {
```

```
      bankOne(1),
      bankTwo(2)
      }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
     "Selects the software bank and causes reboot."
  ::= { link_cx_reboot 4 }

-- traps

trapSentCounter OBJECT-TYPE
  SYNTAX  Counter
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
     "Total number of enterprise traps sent since last reboot."
  ::= { link_cx_trap 1 }

link_cx_unit OBJECT IDENTIFIER ::= { link_cx_ethr 101 }

alarmTrap  TRAP-TYPE
  ENTERPRISE  link_cx_unit
  VARIABLES  { rfPowerOutputLevel,
               rfRssiLevel,
               bitErrorRate,
               losAlarmStatus,
               txSynthLockAlarmStatus,
               rxSynthLockAlarmStatus,
               lowTxPowerAlarmStatus,
               demodLockAlarmStatus,
               lowRssiLevelAlarmStatus,
               receiverOverloadAlarmStatus,
               bitErrorRateAlarmStatus,
               trapSentCounter }
  DESCRIPTION
     "A trap that indicates a change in one or more of the alarm conditions."
  ::= 1

configurationChangeTrap  TRAP-TYPE
  ENTERPRISE  link_cx_unit
  VARIABLES  { rfTxAttenuateControl,
               rfAtpcControl,
               rfTxPowerLimit,
               rfAtpcAddress,
               rfChannel,
               rfRssiAlarmThresholdSetting,
               losAlarmControl,
               trapSentCounter }
  DESCRIPTION
     "A trap that indicates a configuration change."
  ::= 2

unitTestTrap  TRAP-TYPE
  ENTERPRISE  link_cx_unit
  VARIABLES  { rfTxAttenuateTimer,
```

```
            trapSentCounter }
  DESCRIPTION
      "A trap that indicates the beginning or end of a test procedure.
       An alarmTrap trap might result from this procedure."
  ::= 3

END
```

E-2 Enterprise Traps

Link CX-24 supports three enterpriseSpecific traps - alarmTrap, configurationChangeTrap, and unitTest-Trap. Each of these traps contains all the relevant variables for that particular trap, in order to minimize polling. One variable that is in each of the traps is a counter, so that the network management application can detect loss of traps.

E-2.1 alarmTrap

Link CX-24 sends this trap when any of the alarm variables changes, either going into or out of an alarm condition. All of the relevant alarm conditions and performance data are contained in the trap PDU, along with a counter of enterprise traps sent. The variables include:

- trap counter
- DS3 LOS status (DS3 input absent/present)
- Tx Power status (under/over minimum power)
- Tx Synthesizer lock status (unlocked/locked)
- Rx Synthesizer lock status (unlocked/locked)
- RSSI level status (under minimum level)
- Rx overload status (over maximum level)
- BER status (over threshold)
- demodulator lock status (unlocked/locked)
- BER
- RSSI
- Tx Power

E-2.2 configurationChangeTrap

Link CX-24 sends this trap when the persistent state of the Link CX-24 changes. This trap alerts the network management application that it must refresh its database. If all management is through SNMP exclusively, this trap is redundant. If on the other hand, management is a mixture of HTTP and SNMP this will keep the SNMP side completely consistent. All the relevant persistent state variables are contained in the trap PDU, along with the trap counter. The variables include:

- trap counter
- Tx control (attenuated/unattenuated)
- ATPC control (ATPC enabled/disabled)
- Tx power setting

- ATPC peer IP address (IP address of the CX at the other end of the radio link)
- channel number
- RSSI alarm threshold
- DS3 LOS control (enable/disable alarm for LOS)

E-2.3 unitTestTrap

Link CX-24 sends this trap when any of the test variables change, either at the start or at completion of a test. All the test state variables are contained in the trap PDU, along with the trap counter. This trap alerts the management application that a change has taken place that will probably result in an alarmTrap before too long (in case it doesn't already know, and in case it wants to distinguish between this case and spontaneous alarmTraps). The state variables in the trap PDU include:

- trap counter
- DS3 local loopback
- DS3 remote loopback
- radio loopback
- pseudoAIS
- BERT
- temporary Tx attenuation

Bibliography

ITU - T K.40	Protection against LEMP(Lightning ElectroMagnetic Pulse) in telecommunications centers
ITU - T K.27	Bonding configurations and earthing inside a telecommunication building
ITU - T K.35	Bonding configurations and earthing at remote electronic sites
ITU - T K.39	Risk assessment of damages to telecommunications sites due to lightning discharges
ITU - T Lightning Handbook	The protection of telecommunication lines and equipment against lightning discharges

IEEE Emerald Book Powering and Grounding

The "Grounds" for Lightning and EMP (Electromagnetic Pulse) Protection, second edition
Published by PolyPhaser Corporation

YDI WIRELESS

UNI-POP

EX-1

Amps & Antennas

WIPOP-In-A-Box

Bandwidth Control Unit

EtherAnt II, EtherAnt II-LR

Diamond Card

Lightning Protectors

Your One **STOP** Shop For Complete High-Speed Wireless Internet Systems!!!

View YDI's Complete Line of High-Speed License Free Wireless Data Products, Antennas and Accessories at:

www.ydi.com

Contact Our Sales Department

Main Office

8000 Lee Highway
Falls Church VA 22042
Tel: (703) 205-0600 Fax: (703) 205-0610
Sales: 1-888-297-9090

www.ydi.com

West Coast Office

990 Almanor Avenue
Sunnyvale, CA 94085
Tel: (408) 617-8150 Fax: (408) 617-8151
Sales: 1-800-664-7060