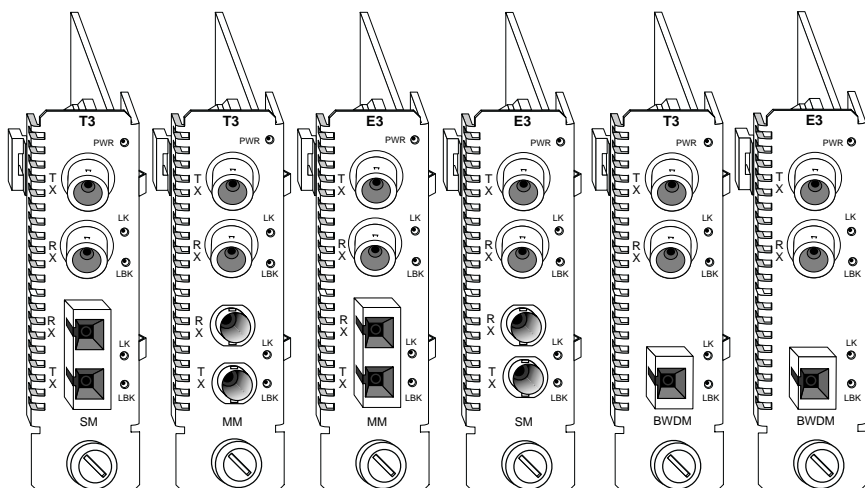


# RADIANCE

## T3/E3

### SINGLE INTERFACE LINE CARDS



### *Installation & User Guide*

Models: R115-23 / R115-24 / R115-25 / R115-26 / R115-27 /  
R115-2J / R115-2X / R115-2Y / R175-23 / R175-24 / R175-25 /  
R175-26 / R175-27 / R175-2J / R175-2X / R175-2Y

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## ***Radiance T3/E3 Single Interface Line Cards***

### **T3 Copper to T3 Fiber:**

R115-23	_____	T3 BNC to T3 multimode SC
R115-24	_____	T3 BNC to T3 singlemode SC
R115-25	_____	T3 BNC to T3 multimode ST
R115-26	_____	T3 BNC to T3 singlemode ST
R115-27	_____	T3 BNC to T3 singlemode SC (40km)
R115-2J	_____	T3 BNC to T3 singlemode SC (100km)
R115-2X	_____	T3 BNC to T3 singlemode SC 1550/1310nm bidirectional wave-length division multiplexed (BWDM)
R115-2Y	_____	T3 BNC to T3 singlemode SC 1310/1550nm BWDM

### **E3 Copper to E3 Fiber:**

R175-23	_____	E3 BNC to E3 multimode SC
R175-24	_____	E3 BNC to E3 singlemode SC
R175-25	_____	E3 BNC to E3 multimode ST
R175-26	_____	E3 BNC to E3 singlemode ST
R175-27	_____	E3 BNC to E3 singlemode SC (40km)
R175-2J	_____	E3 BNC to E3 singlemode SC (100km)
R175-2X	_____	E3 BNC to E3 singlemode SC 1550/1310nm BWDM
R175-2Y	_____	E3 BNC to E3 singlemode SC 1310/1550nm BWDM

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# Overview

**The Metrobility® Radiance T3/E3 line card provides high-speed integration** and conversion of T3 (44.736Mbps) or E3 (34.368Mbps) coaxial telco communication lines to fiber transport environments. The copper data stream is converted to optical signals for greater noise immunity and longer transmission. The T3/E3 line card supports remote fiber optic links up to 2km over multimode and up to 100km over singlemode cable.

To optimize your T3/E3 network, this hot-swappable media converter operates seamlessly with low jitter. All signal activity is completely converted ensuring accurate communication within connected segments. The Radiance T3 line card features a user-selectable line build out, and all T3 and E3 models include independent copper and fiber loopback modes to isolate problems within a specific segment of the network.

Management options supported by the Radiance line cards include terminal console commands, Metrobility's GUI-based NetBeacon® or WebBeacon software, or any standard SNMP application. This ability provides remote control over the line card's configuration and immediate notification of a problem to a management station.

The Radiance T3/E3 line card offers the following key features:

- B3ZS (T3) or HDB3 (E3) line code support on the coaxial interface.
- System and port LEDs on the front panel for easy diagnostics.
- Independent copper or fiber loopback mode that can be set with a DIP switch or through software via local management.
- Individual port enable/disable.
- Line build out switch for short- or long-haul operation on the T3 models.
- Coaxial to multimode conversion up to 2km, coaxial to singlemode conversion up to 100km, or coaxial to bidirectional wavelength division multiplexed (BWDM) conversion up to 20km.
- Surge protection on the RX and TX ports of the coaxial interface.
- Low jitter for maximum transmission quality.
- Independent clocking on the RX and TX ports.
- Hot swappable.
- High MTBF.

# Installation Guide

Follow the simple steps outlined in this section to install and start using your Radiance T3/E3 single interface line card.

**NOTE:** Electrostatic discharge precautions should be taken when handling any line card. Proper grounding is recommended (i.e., wear a wrist strap).

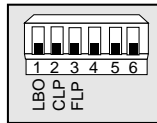
## 1 Unpack the Line Card

Your order has been provided with the safest possible packaging, but shipping damage does occasionally occur. Inspect your order carefully. If you discover any shipping damage, notify your carrier and follow their instructions for damage and claims. Save the original shipping carton if return or storage of the unit is necessary.

## 2 Set the Switches

A bank of DIP switches is located on the back of the card. On the T3 cards, three functional switches are clearly labeled and allow you to select from several modes of operation. On the E3 board, only the switches labeled CLP and FLP are functional. Unmarked switches are inoperative. Refer to the table below for the proper setting of the DIP switches.\*

When setting DIP switches, the UP position is when the lever of the DIP switch is pushed away from the circuit board. The DOWN position is when the lever is pushed toward the board.



Switch Label	Position	Function
LBO (T3 only)	UP	Long haul Line Build Out (255-1200 ft).
	DOWN ( <i>default</i> )	Short haul Line Build Out (0-255 ft).
CLP	UP	Loopback is enabled on the copper port.
	DOWN ( <i>default</i> )	Copper loopback is disabled; normal operation.
FLP	UP	Loopback is enabled on the fiber optic port.
	DOWN ( <i>default</i> )	Fiber optic loopback is disabled; normal operation.

\*DIP switches also can be managed by console commands or via Metrobility's NetBeacon or WebBeacon management software. Refer to the *Command Line Interface Reference Guide*, *NetBeacon Element Management Software Installation & User's Guide* or *WebBeacon Management Software Installation & User's Guide* for software management information.

**LBO Switch (functional only on T3 cards)**

Set the Line Build Out (LBO) switch up to support a long haul connection if the length of your coaxial cable is between 255 and 1200 feet. Set LBO down to support a short haul connection if the length of your coaxial cable is between 0 and 255 feet. The default setting is short haul.

**CLP Switch**

The Copper Loopback (CLP) switch enables/disables loopback on the copper port. When copper loopback is enabled, the incoming data and clock are looped from the RX copper port to the TX copper port, thus returning the copper input back to the sending device. At the same time, the data is transmitted to the remote T3/E3 line card. However, data from the remote card is ignored. Loopback is disabled by default. For more information, refer to [Loopback Modes](#) in the User Guide section of this manual.

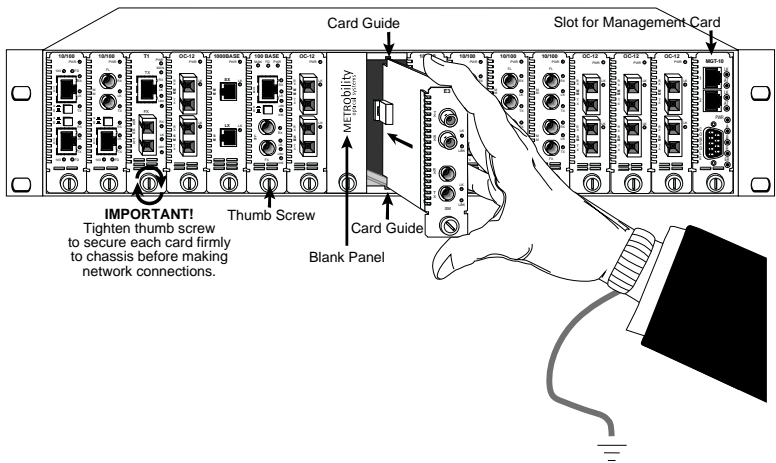
**FLP Switch**

The Fiber Loopback (FLP) switch enables/disables loopback on the fiber optic port. When fiber loopback is enabled, the incoming data and clock are looped from the RX fiber port to the TX fiber port. The data is also transmitted to the copper port, however, data from the copper port is ignored. Loopback is disabled by default. For more information, refer to [Loopback Modes](#) in the User Guide section of this manual.

## 3 **Install the Line Card**

The Radiance T3/E3 line card offers the ease of plug-and-play installation and is hot-swappable. The card must be firmly secured to the chassis before network connections are made. Follow the simple steps outlined below to install the line card.

- Grasp the card by the front panel as shown.

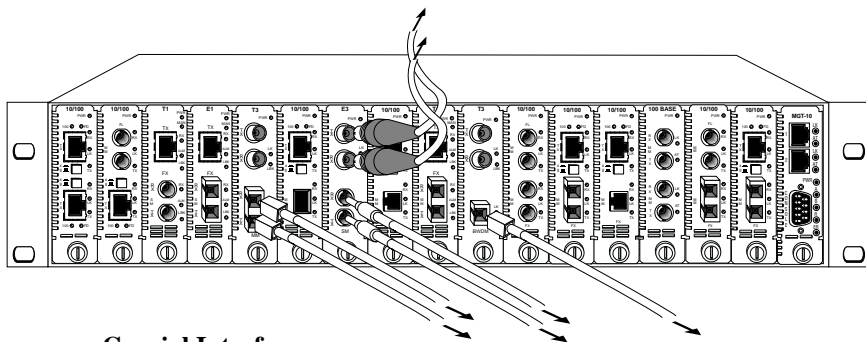


- Insert the card into a slot in the chassis making sure that the top and bottom edges of the board are aligned with the top and bottom card guides in the chassis. Do not force the card into the chassis unnecessarily. It should slide in easily and evenly.
- Slide the card in until the top and bottom edges of the front panel are flush and even with the top and bottom edges of the chassis.
- To secure the line card to the chassis, turn the thumbscrew clockwise until it is snug. The card is now properly installed and ready for connection to the network.

## 4 **Connect to the Network**

To connect the line card to the network, insert the cables into the appropriate connectors as shown in the following illustration. Make sure the card is secured to the chassis before making network connections. Once power is applied to the unit, correct connectivity can be verified via the link (LK) LED.

When making network connections, make sure that the receive (RX) port of the card connects to the transmit (TX) port of the connected device, and make sure that the receive port of the connected device connects to the transmit port of the line card.



### **Coaxial Interface**

The coaxial interface provides two BNC connectors. The transmit (TX) port is located above the receive (RX) port. Each connector supports a maximum segment length of 1200 feet. Use only RG-59 cables.

### **Fiber Optic Interface**

The line card's fiber optic receive (RX) port is located above its transmit (TX) port.

The fiber optic multimode (MM) interface supports a maximum segment length of 2km for remote links.

The standard singlemode (SM) connector supports a maximum segment length of 15km.

On the R115-27 and R175-27, the singlemode long haul interface supports a maximum segment of 40km.

On the R115-2J and R175-2J, the singlemode extended long haul interface supports a maximum segment length of 100km.

### **BWDM Connection**

The bidirectional wavelength division multiplexed (BWDM) port provides one singlemode SC connector that supports a maximum segment length of 20km. BWDM line cards must always be used in complementary pairs. That is, a -2X model must always be connected to a -2Y. The -2X cards are designed to transmit data at a wavelength of 1550nm and receive at 1310nm. Correspondingly, the -2Y cards transmit data at 1310nm and receive at 1550nm.



# User Guide

*This section contains more detailed information regarding the operating features of the Radiance T3/E3 single interface line card.*

## LED Indicators

The Radiance T3/E3 single interface line card provides several LEDs for the visible verification of unit status and proper functionality. These LEDs can aid in troubleshooting and overall network diagnosis and management.

### System LED

LED Label	Color/Status	Indication
PWR	Green	Unit is receiving power.
	OFF	Unit is not receiving power or has failed.

### Copper Port LEDs

LED Label	Color/Status	Indication
LK	Green	A signal is present on the copper receive port.
	OFF	No signal is detected at the port.
LBK	Yellow	Copper port is in loopback mode. Incoming frames on the copper port are sent back on the coaxial transmit line. Data is also sent through the fiber optic transmit line.
	OFF	Loopback is disabled on the copper port; normal operation.

### Fiber Optic Port LEDs

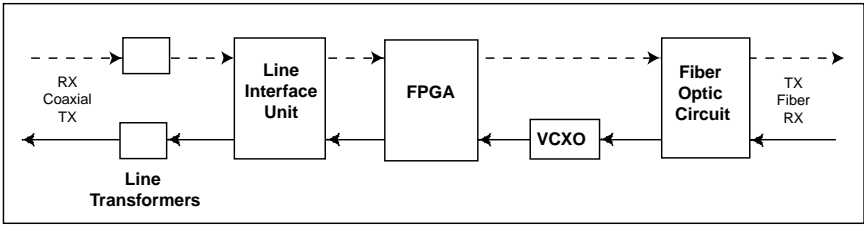
LED Label	Color/Status	Indication
LK	Green	An optical signal is present on the fiber optic receive port.
	OFF	No signal is detected at the fiber port.
LBK	Yellow	Fiber port is in loopback mode. Incoming data and clock are sent back on the transmit fiber line. Data is also transmitted out the coaxial transmit line.
	OFF	Loopback is disabled on the fiber port; normal operation.

# Theory of Operation

## Data Transparency

The Radiance T3/E3 single interface line card offers full data transparency. Any codes or commands contained within the data stream are passed through to the remote device. The only commands executed by the T3/E3 card are those set through the hardware (i.e., DIP switches) or software, which communicates with the card via the management bus on the chassis backplane.

## Functional Block Diagram



## Coaxial to Fiber Data Path

The receive (RX) port on the coaxial interface accepts an electrical signal. This signal is coupled to the line interface unit (LIU) through a line transformer. The LIU performs clock and data recovery and converts the signal into non-return to zero (NRZ) data and clock. The NRZ data and clock then pass through the field-programmable gate array (FPGA), which encodes the data for fiber optic transmission. The encoding ensures adequate transition density for reliable clock recovery at the remote T3/E3 fiber optic interface.

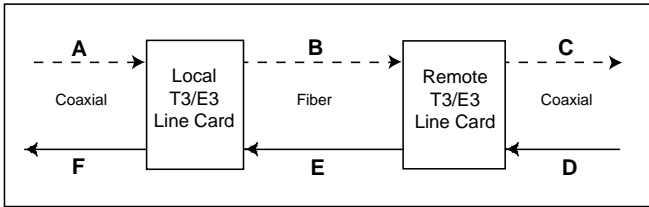
## Fiber to Coaxial Data Path

The RX port on the fiber interface accepts an optical signal from the remote T3/E3 line card and converts it back to an electrical signal. The optical signal first enters the voltage-controlled crystal oscillator (VCXO), which extracts the line rate clock and data. The recovered clock and data are then sent to the FPGA for decoding. The decoded data stream goes to the LIU for encoding into T3 or E3 signals. The transmitted signal is coupled to the BNC coaxial connector through a line transformer.

On both the RX and TX ports of the coaxial interface, surge protection is provided.

## Timing Paths

The transmit (TX) and receive (RX) paths are clocked independently and during normal operation, the Radiance T3/E3 line cards are never timing masters of the network system. In the coaxial to fiber path, timing is recovered by the card's LIU and transmitted over the fiber line to the remote T3/E3 line card. In the fiber to coaxial path, timing is derived from the incoming optical signal and sent over the coaxial TX line.



The following table describes how timing is affected if a failure occurs at various points in the network.

Line Failure Point	Result
A	The local T3/E3 line card detects loss of signal. The fiber receiver's VCXO becomes the timing source for transmission over fiber link B.
B	The remote T3/E3 line card's VCXO reverts to its reference clock input. The remote T3/E3 card becomes the system timing master.
C	If the equipment connected to the remote T3/E3 line card supports looped timing, the equipment should revert to its internal clock when it detects loss of signal. Alternatively, the equipment could fail to provide a valid signal or clock, and the system will behave as if the failure occurred at point D.
D	The remote T3/E3 card's LIU detects loss of signal. The fiber receiver's VCXO becomes the timing source for transmission over fiber link E.
E	The local T3/E3 line card's VCXO reverts to its reference clock input. The local T3/E3 card becomes the system timing master.
F	No system timing disruption occurs. The device connected to the local T3/E3 card detects loss of signal.

# Factory Settings

## Default Hardware Settings

Copper Loopback ..... Disabled  
Fiber Loopback ..... Disabled  
Line Build Out (T3 models only) ..... Short Line (0-255 ft)

The hardware DIP switches can be overridden through software. Resetting the line card via software will force the settings back to their default states and return control to the hardware.

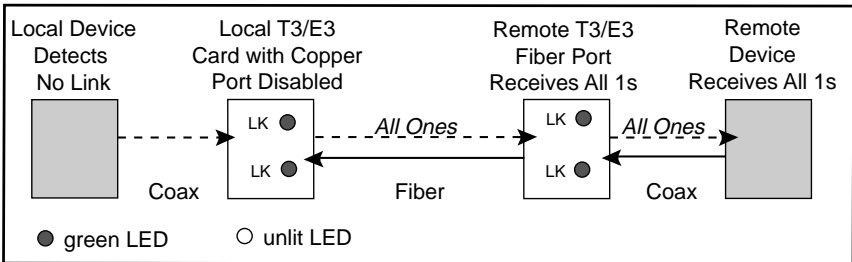
## Default Software Setting

Port Enable/Disable ..... Enabled

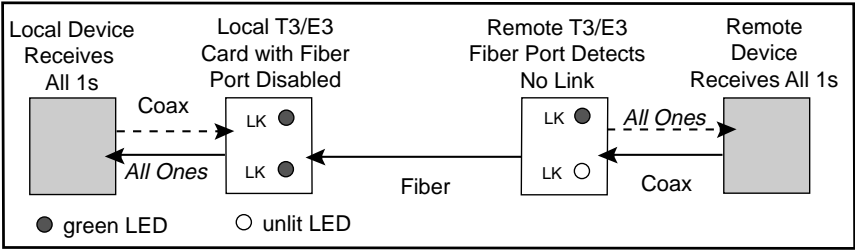
### Port Enable/Disable

Through software, either port on the T3/E3 line card can be enabled or disabled independently. Disabling a port stops the flow of data to and from that port. If the copper port is disabled, no signals will be sent from the coaxial transmitter and an unframed all-ones pattern will be transmitted over the fiber line to the remote line card.

**Note:** An all-ones pattern indicates an alarm indication signal (AIS) for the E3 line cards only. For T3 cards, the all-ones pattern is simply transmitted to the remote device; it does NOT indicate AIS.



If the fiber port is disabled, no signals will be sent from the fiber transmitter, and an unframed all-ones pattern will be passed from the copper port.



Once a port is disabled, the only way to enable it again is through software.

Through SNMP management, NetBeacon or WebBeacon<sup>\*</sup>, you can view the following information for the Radiance T3/E3 line card.

- Fiber and copper signal status
- Port operational status
- Port loopback mode
- Board serial identification
- FPGA firmware revision

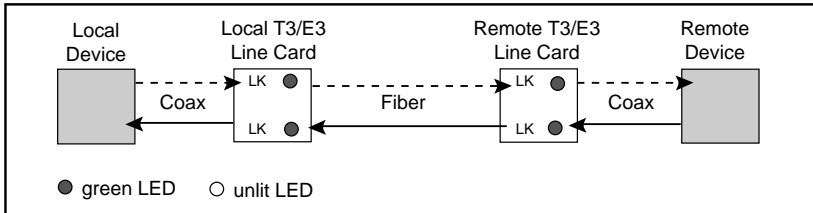
\* Refer to the *Command Line Interface Reference Guide*, *NetBeacon Element Management Software Installation & User's Guide* or *WebBeacon Management Software Installation & User's Guide* for software management information.

## Link Loss Indications

The following examples show the status of the LK LED under various link conditions and describe when unframed all ones (AIS for E3 only) are generated. (Loopback is disabled in these examples.)

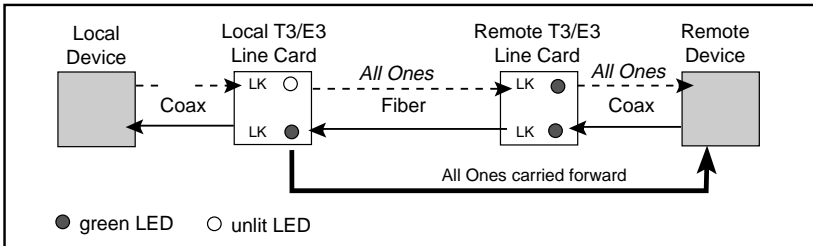
### Normal

The diagram below shows a typical configuration with good link status.



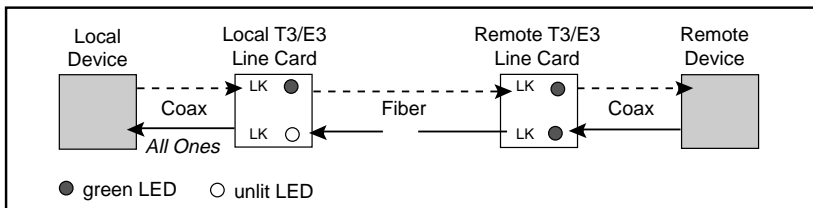
### Input Coaxial Link Loss

Loss of the copper input disables the BNC port's LK LED. It also forces the T3/E3 card to generate unframed all ones (AIS for E3 only), which are transmitted out its fiber port. For example, if the local card's inbound coaxial cable breaks, it will transmit all ones to the remote T3/E3 card via the fiber cable. The remote card then carries the pattern forward via its coaxial cable to the remote device.



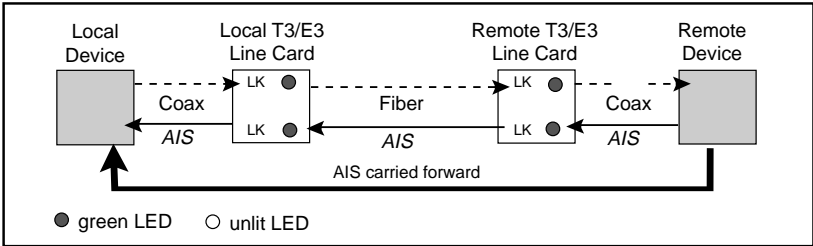
### Input Fiber Link Loss

Loss of the fiber input is indicated by the fiber port's unlit LK LED. When the fiber input is lost, an all-ones pattern is transmitted from the coaxial port, as shown in the illustration below.



**Remote Output Coaxial Link Loss**

Loss of link to the remote device produces a red alarm condition at the remote site and should force the device to revert to its internal clock. If the remote device is configured to send back a yellow alarm (AIS) under this condition, the two Radiance T3/E3 line cards will carry the alarm forward to the local device, as shown below.

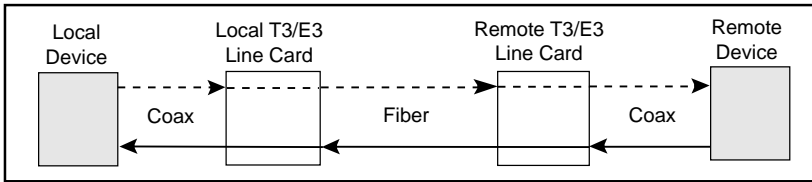


## Loopback Modes

The Radiance T3/E3 line card features two loopback modes to help verify correct installation and to diagnose system problems.

### Normal

During normal operation, without loopback, data from a local device (CSU, PBX, etc.) enters the local T3/E3 line card's coaxial receiver, passes through the fiber line between the two cards, then exits the remote card's coaxial transmitter to enter the remote equipment, and vice versa.



### Loopback

Loopback helps to isolate and identify traffic problems within a specific segment. During loopback, the yellow LBK LED is lit. Loopback can be enabled/disabled in two ways: (1) by setting a DIP switch, or (2) through software by enabling loopback on Port 1 (copper) or Port 2 (fiber). Once loopback is enabled, the card will remain in this mode until either the DIP switch is reset or the software setting is changed.

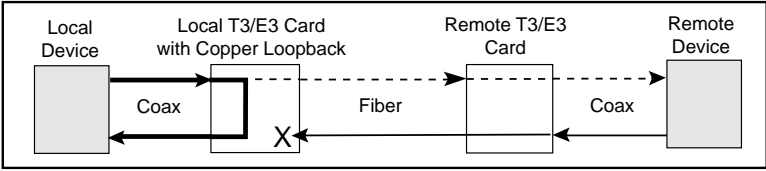
Copper and fiber loopback cannot be enabled at the same time. If both DIP switches are enabled, only the first one set will be in effect until it is disabled.

#### Copper Loopback

During copper loopback, timing and data received on the coaxial line are looped back to the sending device. The loop occurs in the FPGA. The data is also transmitted to the remote card, but the data from the remote unit is ignored by the card in loopback mode.

In the example shown below, the local T3/E3 line card has copper loopback enabled. Data received at the BNC port is simultaneously returned to the local device and sent to the remote T3/E3 card and on to the remote device. Data from the remote device is transmitted by the remote card, however, it is ignored by the local card at its fiber optic interface.

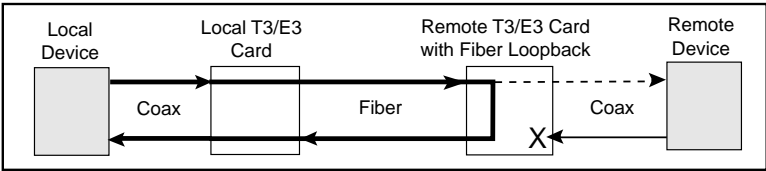




**Fiber Loopback**

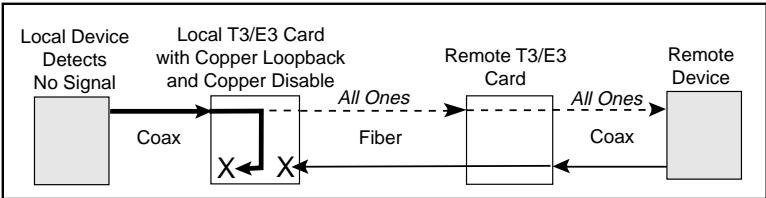
In this mode, the incoming data and clock on the fiber line are looped back. The loop occurs in the FPGA. The data is still sent out the coaxial transmitter. However, the data received at the BNC interface is ignored.

In the diagram below, the remote T3/E3 line card has fiber loopback enabled. Data received at the fiber optic port is simultaneously returned to the local device and sent to the remote device. However, data from the remote device is ignored by the remote T3/E3 line card at its coaxial interface.



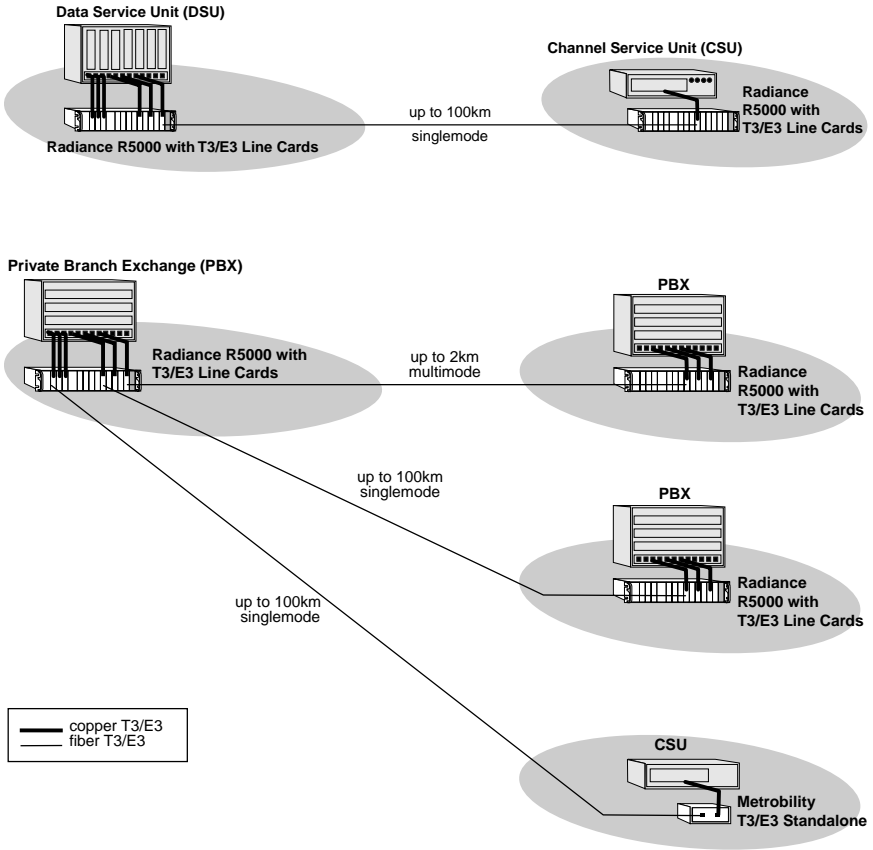
**Loopback with Port Disabled**

If loopback is enabled on a port that has been disabled, the loop will still occur and the loopback LED will be lit. However, only an unframed all-ones pattern (AIS for E3) will be sent from the opposite transmitter. No signal will be sent from the disabled transmit port, as shown in the example below.



# Topology Solutions

The Radiance T3/E3 single interface line card is a point-to-point media converter designed to extend the reach of copper T3/E3 links and to provide protection from power surges and electromagnetic interference. Each T3/E3 line card supports a single remote T3/E3 card.



# Technical Specifications

## Network Connections

### Coaxial Interface

Connector \_\_\_\_\_ BNC receptacle  
Impedance \_\_\_\_\_ 75 ohms  
Signal Structure \_\_\_\_\_ ANSI T1.404, T1404a (T3)  
\_\_\_\_\_ ITU G.703 (E3)  
Supported Link Length \_\_\_\_\_ up to 1200 ft  
Cable Type \_\_\_\_\_ RG-59 coaxial cable

### Multimode Fiber Optic Interface

Connector \_\_\_\_\_ ST or SC  
Wavelength \_\_\_\_\_ 1310 nm  
RX Input Sensitivity \_\_\_\_\_ -31 dBm peak minimum  
Output Power \_\_\_\_\_ -20 dBm to -14 dBm (62.5/125  $\mu$ m)  
Supported Link Length \_\_\_\_\_ up to 2 km full duplex  
Cable Type \_\_\_\_\_ 50/125, 62.5/125  $\mu$ m F/O

### Singlemode Fiber Optic Interface

Connector \_\_\_\_\_ ST or SC  
Wavelength \_\_\_\_\_ 1310 nm  
RX Input Sensitivity \_\_\_\_\_ -31 dBm peak minimum  
Output Power \_\_\_\_\_ -15 dBm to -8 dBm (9/125  $\mu$ m)  
Supported Link Length \_\_\_\_\_ up to 15 km full duplex  
Cable Type \_\_\_\_\_ 8.3/125, 8.7/125, 9/125, 10/125  $\mu$ m F/O

### Singlemode Fiber Optic Interface — long haul distance support

Connector \_\_\_\_\_ SC  
Wavelength \_\_\_\_\_ 1310 nm  
RX Input Sensitivity \_\_\_\_\_ -35 dBm minimum  
Output Power \_\_\_\_\_ -5 dBm to 0 dBm (9/125  $\mu$ m)  
Supported Link Length \_\_\_\_\_ up to 40 km full duplex  
Cable Type \_\_\_\_\_ 8.3/125, 8.7/125, 9/125, 10/125  $\mu$ m F/O

*Singlemode Fiber Optic Interface — extended long haul distance support*

Connector \_\_\_\_\_ SC  
Wavelength \_\_\_\_\_ 1550 nm  
RX Input Sensitivity \_\_\_\_\_ -37 dBm minimum  
Output Power \_\_\_\_\_ -3.0 dBm to 0 dBm (9/125  $\mu$ m)  
Supported Link Length \_\_\_\_\_ up to 100 km full duplex  
Cable Type \_\_\_\_\_ 8.3/125, 8.7/125, 9/125, 10/125  $\mu$ m F/O

*Singlemode BWDM Fiber Optic Interface*

Connector \_\_\_\_\_ SC  
Supported Link Length \_\_\_\_\_ up to 20 km full duplex  
Cable Type \_\_\_\_\_ 9/125  $\mu$ m F/O  
RX Input Sensitivity \_\_\_\_\_ -32 dBm minimum  
Output Power \_\_\_\_\_ -8 dBm to -15 dBm (9/125  $\mu$ m)  
(R115-2X, R175-2X)  
TX Wavelength \_\_\_\_\_ 1550 nm  
RX Wavelength \_\_\_\_\_ 1310 nm  
(R115-2Y, R175-2Y)  
TX Wavelength \_\_\_\_\_ 1310 nm  
RX Wavelength \_\_\_\_\_ 1550 nm

**Data Rate**

Data Rate \_\_\_\_\_ 44.736 Mbps (T3); 34.368 Mbps (E3)

**Power**

Input \_\_\_\_\_ +5.0 VDC @ 0.4 A, 2 W average

**Environmental**

Operating Temperature \_\_\_\_\_ 0° to 55° C  
Storage Temperature \_\_\_\_\_ -30° to 70° C  
Relative Humidity \_\_\_\_\_ 5% to 95% non-condensing  
Weight \_\_\_\_\_ 5 oz (0.14 kg)

## ***Acronyms and Abbreviations***

This list defines the acronyms and abbreviations used in this guide.

<b>AIS</b>	Alarm Indication Signal
<b>B3ZS</b>	Bipolar Three Zeroes Substitution T3 line coding
<b>BNC</b>	Bayonet-Neill-Concelman connector
<b>BWDM</b>	Bidirectional Wavelength Division Multiplexed
<b>CLP</b>	Copper Loopback
<b>CSU</b>	Channel Service Unit
<b>DSU</b>	Data Service Unit
<b>E3</b>	34.368 Mbps communications standard
<b>F/O</b>	Fiber Optic
<b>FLP</b>	Fiber Loopback
<b>FPGA</b>	Field-Programmable Gate Array
<b>HDB3</b>	High Density Bipolar Three Zeroes Substitution E3 line coding
<b>LBK</b>	Loopback
<b>LBO</b>	Line Build Out
<b>LIU</b>	Line Interface Unit
<b>LK</b>	Link
<b>Mbps</b>	Megabits per second
<b>MM</b>	Multimode
<b>MTBF</b>	Mean Time Between Failures
<b>NRZ</b>	Non-Return to Zero line coding
<b>PBX</b>	Private Branch Exchange
<b>PWR</b>	Power
<b>RX</b>	Receive
<b>SM</b>	Singlemode
<b>SNMP</b>	Simple Network Management Protocol
<b>T3</b>	44.736 Mbps communications standard
<b>TX</b>	Transmit
<b>VCXO</b>	Voltage-controlled crystal oscillator

## ***Product Safety, EMC and Compliance Statements***

This equipment complies with the following requirements:

- UL
- CSA
- EN60950 (safety)
- FCC Part 15, Class A
- EN55022 Class A (emissions)
- EN55024: 1998 (immunity)
- DOC Class A (emissions)
- ITU-G.703
- G.704
- G.706
- ANSI T1.403-1999
- ANSI T1.408
- Class 1 Laser Product
- IEC 825-1 Classification

This product shall be handled, stored and disposed of in accordance with all governing and applicable safety and environmental regulatory agency requirements.

The following *FCC* and *Industry Canada* compliance information is applicable to North American customers only.

### ***USA FCC Radio Frequency Interference Statement***

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

***Caution:*** *Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.*

### ***Canadian Radio Frequency Interference Statement***

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

## ***Warranty and Servicing***

### **Three-Year Warranty for Radiance T3/E3 Single Interface Line Card**

Metrobility Optical Systems, Inc. warrants that every Radiance T3/E3 single interface line card will be free from defects in material and workmanship for a period of THREE YEARS from the date of Metrobility shipment. This warranty covers the original user only and is not transferable. Should the unit fail at any time during this warranty period, Metrobility will, at its sole discretion, replace, repair, or refund the purchase price of the product. This warranty is limited to defects in workmanship and materials and does not cover damage from accident, acts of God, neglect, contamination, misuse or abnormal conditions of operation or handling, including overvoltage failures caused by use outside of the product's specified rating, or normal wear and tear of mechanical components.

To establish original ownership and provide date of purchase, complete and return the registration card or register the product online at [www.metrobility.com](http://www.metrobility.com). If product was not purchased directly from Metrobility, please provide source, invoice number and date of purchase.

To return a defective product for warranty coverage, contact Metrobility Customer Service for a return materials authorization (RMA) number. Send the defective product postage and insurance prepaid to the address provided to you by the Metrobility Technical Support Representative. Failure to properly protect the product during shipping may void this warranty. The Metrobility RMA number must be clearly on the outside of the carton to ensure its acceptance.

Metrobility will pay return transportation for product repaired or replaced in-warranty. Before making any repair not covered by the warranty, Metrobility will estimate cost and obtain authorization, then invoice for repair and return transportation. Metrobility reserves the right to charge for all testing and shipping costs incurred, if test results determine that the unit is without defect.

This warranty constitutes the buyer's sole remedy. No other warranties, such as fitness for a particular purpose, are expressed or implied. Under no circumstances will Metrobility be liable for any damages incurred by the use of this product including, but not limited to, lost profits, lost savings, and incidental or consequential damages arising from the use of, or inability to use, this product. Authorized resellers are not authorized to extend any other warranty on Metrobility's behalf.

### **Product Manuals**

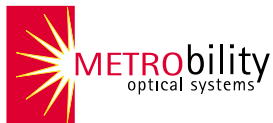
The most recent version of this manual is available online at

<http://www.metrobility.com/support/manuals.htm>

### **Product Registration**

To register your product, go to

<http://www.metrobility.com/support/registration.asp>



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