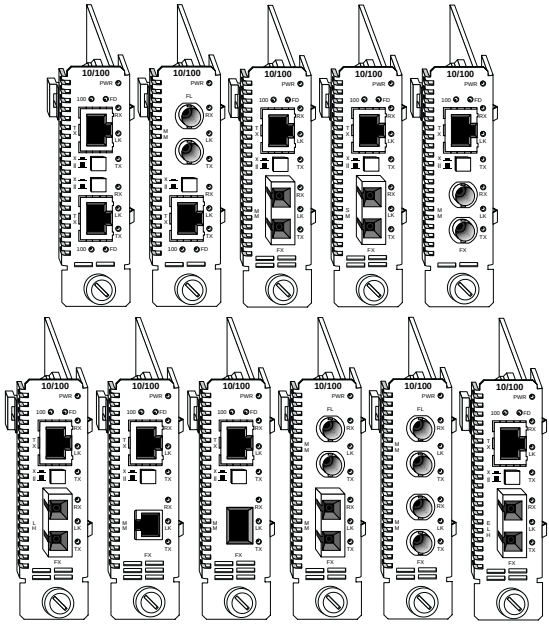
METROBILITY
optical systems

RADIANCE
10/100MBPS
INTERFACE LINE CARDS



Installation & User Guide

Models: R621-11 / R611-51 / R641-13 / R641-14 / R641-15 /
R641-17 / R641-1G / R641-1E / R641-1J / R641-53 /
R641-55 / R612-51 / R642-53 / R642-55

Radiance 10/100Mbps Interface Line Cards

Copper to Copper:

R621-11 ____ 10/100Base-TX to 10/100Base-TX

Copper to Fiber:

R641-13 ____ 10/100Base-TX to 100Base-FX multimode SC
R641-14 ____ 10/100Base-TX to 100Base-FX singlemode SC
R641-15 ____ 10/100Base-TX to 100Base-FX multimode ST
R641-17 ____ 10/100Base-TX to 100Base-FX singlemode SC (40 km)
R641-1E____ 10/100Base-TX to 100Base-FX multimode MT-RJ
R641-1G ___ 10/100Base-TX to 100Base-FX multimode VF-45
R641-1J ____ 10/100Base-TX to 100Base-FX singlemode SC (100 km)
R611-51 ____ 10Base-FL multimode ST to 10/100Base-TX

Copper to Fiber with LLCF:

R612-51 ____ 10Base-FL multimode ST to 10/100Base-TX

Fiber to Fiber:

R641-53 ____ 10Base-FL multimode ST to 100Base-FX multimode SC
R641-55 ____ 10Base-FL multimode ST to 100Base-FX multimode ST

Fiber to Fiber with LLCF:

R642-53 ____ 10Base-FL multimode ST to 100Base-FX multimode SC
R642-55 ____ 10Base-FL multimode ST to 100Base-FX multimode ST

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Radiance 10/100Mbps Interface Line Cards Installation & User Guide

Overview

The Radiance 10/100Mbps interface line card provides seamless migration between Ethernet and Fast Ethernet networks, in addition to built-in media conversion allowing high-speed integration of fiber optic and twisted-pair segments. A complete set of LEDs allows for quick status verification, and a bank of DIP switches provides added versatility on each port. To optimize your Ethernet network, each port operates independently in either half or full duplex.

The management functionality allows communication between the chassis and a management station. This ability provides remote software control over the Radiance line card configuration and notification of a failure to the management station.

The Radiance 10/100Mbps interface line cards offer the following key features:

- Auto-negotiation switches on all twisted-pair interfaces.
- Link Loss Return (LLR) functionality to aid in troubleshooting a remote network connection on all fiber optic ports.
- Link Loss Carry Forward (LLCF) functionality to aid in trouble-shooting a remote network connection. (R642-xx and R612-51 only)
- An MDI-II to MDI-X switch that eliminates the need for crossover cables on twisted-pair ports.
- Store-and-forward switching to improve overall network performance by buffering packets during times of heavy congestion and to prevent the forwarding of corrupted packets.
- A high-performance switching engine that performs forwarding and filtering at full wire speed (148,800 packets per second).
- The ability to learn up to 8,000 MAC addresses.
- 320 buffers per port with 1,536 bytes each.
- Low last-bit-in to first-bit-out delay.

For updating or expanding an existing network, Metrobility offers line cards that support a wide range of configuration needs. The Radiance 10/100Mbps interface line cards support the following conversion combinations:

10/100Base-TX to 10/100 Base TX
10/100Base-TX to 100Base-FX multimode SC
10/100Base-TX to 100Base-FX singlemode SC
10/100Base-TX to 100Base-FX multimode ST
10/100Base-TX to 100Base-FX multimode MT-RJ
10/100Base-TX to 100Base-FX multimode VF-45
10Base-FL multimode ST to 10/100 Base-TX
10Base-FL multimode ST to 100Base-FX multimode SC
10Base-FL multimode ST to 100Base-FX multimode ST

Installation Guide

Follow the simple steps outlined in this section to install and start using your Radiance 10/100Mbps 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 line card 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

MDI-II to MDI-X Switch (twisted-pair ports only)

To eliminate the need for crossover cables, the Radiance 10/100Mbps interface line card includes an MDI-II to MDI-X switch on each twisted-pair port. This push-in switch is located in the center of the front panel and allows setup in either straight-through or crossover configurations. The default setting is parallel (II).

When setting the switch, observe the positioning of the following symbols:

- The parallel symbol (II) indicates a straight-through or parallel connection. The switch is up. *(default)*
- The cross symbol (X) indicates a crossover connection. The switch is down.

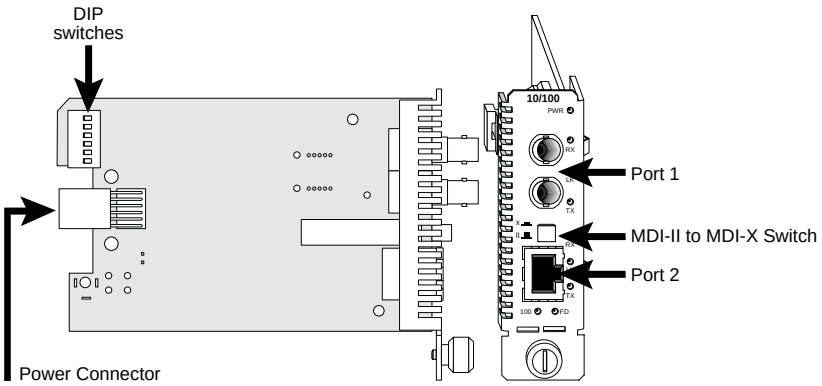
Use the tables below as a guide.

A device that is wired straight through needs one crossover connection:	
If the cable is	the MDI-II to MDI-X Switch Setting should be
straight through	**X**
crossover	**II**

A device that is wired crossover needs a parallel connection:	
If the cable is	the MDI-II to MDI-X Switch Setting should be
straight through	**II**
crossover	**X**

DIP Switches

A set of six DIP switches, located on the back of the line card, allows you to select from several modes of operation. These switches are clearly marked on the printed circuit board.



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 circuit board.

NOTE: *Not all switches are available on every model. Unmarked switches are reserved and should be left in the DOWN position. See the table below for switch locations on the four board types.*

Board Type	**DIP Switch Position** (left to right)					
	1	2	3	4	5	6
TX-TX	FD1	AN1	100M1	FD2	AN2	100M2
FL-TX	FD1	LLR1	LLCF	FD2	AN2	100M2
FL-FX	FD1	LLR1	LLCF	FD2	LLR2	—
TX-FX	FD1	AN1	100M1	FD2	LLR2	LLCF

*DIP switches also can be managed via console commands or with 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.

Auto-Negotiation Switch (AN)*

Switches AN1 and AN2 control the use of auto-negotiation on their respective copper ports. To enable auto-negotiation, push the lever UP. To disable this function, push the lever DOWN. The default setting is auto-negotiation enabled.

When a port has auto-negotiation enabled, it advertises 10/100Mbps and full/half duplex capabilities when both its speed (100M) and duplex (FD) switches are also enabled. These are the default settings on a copper port. If the 100M switch is disabled, the port advertises only 10Mbps capability. If the FD switch is disabled, the port advertises only half duplex.

When auto-negotiation is disabled, the port's duplex is determined by its FD switch setting and its speed is set by its 100M switch.

10/100Mbps Switch (100M)*

Switches 100M1 and 100M2 control the speed setting for their respective copper ports. The speed setting determines which speed is advertised when auto-negotiation is enabled. If auto-negotiation is disabled, the port speed is the same as the switch setting, where UP is 100Mbps and DOWN is 10Mbps.

When the 100M switch is UP, the port advertises 10/100Mbps capability if auto-negotiation is enabled. This is the default setting. If auto-negotiation is disabled, the port's speed is set to 100Mbps.

When the 100M switch is DOWN, the port advertises only 10Mbps capability if auto-negotiation is enabled. If auto-negotiation is disabled, the port's speed is set to 10Mbps.

Half/Full Duplex Switch (FD)*

For copper ports with auto-negotiation disabled and all fiber optic ports, switches FD1 and FD2 determine the duplex mode of their respective ports. A port operates at full duplex when its FD switch is UP. It operates at half duplex when its FD switch is DOWN. The default is full duplex enabled (UP).

With auto-negotiation enabled on a copper port, the port advertises full/half duplex capability when its FD switch is UP. The port advertises only half duplex when its FD switch is DOWN.

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*Changes to the AN, 100M and FD switch settings only come into effect after the power-cycle initialization.

Link Loss Return Switch (LLR)

The 10/100Mbps interface line card incorporates Link Loss Return (LLR) functionality as an aid in troubleshooting remote connections on its fiber optic ports. When LLR is enabled, the loss of inbound link pulses on a port stops the transmission of outbound link pulses on the *same* port. For example, if LLR is enabled on port 2 and its receiver (RX) stops detecting link pulses, then port 2's transmitter (TX) will stop sending link pulses. LLR is enabled on each fiber port independently. LLR is not applicable to copper ports.

Link Loss Return is enabled on Port 1 when switch LLR1 is UP, and it is enabled on Port 2 when switch LLR2 is UP. The unit is shipped with LLR disabled on both ports. Refer to Link Loss Return in the User Guide section of this manual for more detailed information.

Link Loss Carry Forward Switch (LLCF)

In addition to LLR, the R612-51 and R642-xx units support Link Loss Carry Forward functionality to help with troubleshooting remote connections.

Unlike LLR, which only applies to fiber ports, LLCF affects both ports on the card. When LLCF is enabled, the loss of inbound link pulses on a port stops the transmission of outbound link pulses on the *opposite* port. For example, if LLCF is enabled, the loss of incoming link pulses at *Port 1* stops the transmission of link pulses out of *Port 2*. Conversely, if *Port 2* stops receiving link pulses, *Port 1* will not transmit link pulses.

Link Loss Carry Forward is enabled on both ports when switch LLCF is UP. The unit is shipped with LLCF disabled. Refer to Link Loss Carry Forward in the User Guide section of this manual for further details.

Use the following tables to help you set the DIP switches to obtain specific modes of operation on the four board types. The configuration column lists the speed and duplex options for Port 1 on the left and Port 2 on the right. “Auto” denotes that auto-negotiation is enabled. The default settings are highlighted.

Table 1. TX to TX

Configuration	Port 1			Port 2		
	FD1	AN1	100M1	FD2	AN2	100M2
Auto - Auto	UP	UP	UP	UP	UP	UP
10 Half - 10 Half						
10 Half - 10 Full				UP		
10 Half - 100 Half						UP
10 Half - 100 Full				UP		UP
10 Full - 10 Half	UP					
10 Full - 10 Full	UP			UP		
10 Full - 100 Half	UP					UP
10 Full - 100 Full	UP			UP		UP
100 Half - 10 Half			UP			
100 Half - 10 Full			UP	UP		
100 Half - 100 Half			UP			UP
100 Half - 100 Full			UP	UP		UP
100 Full - 10 Half	UP		UP			
100 Full - 10 Full	UP		UP	UP		
100 Full - 100 Half	UP		UP			UP
100 Full - 100 Full	UP		UP	UP		UP

Table 2. FL to FX

Configuration	Port 1	Port 2
	FD1	FD2
10 Half - 10 Half		
10 Half - 10 Full		UP
10 Full - 100 Half	UP	
10 Full - 100 Full	UP	UP

Table 3. FL to TX

Configuration	Port 1	Port 2		
	FD1	FD2	AN2	100M2
10 Full - Auto	UP	UP	UP	UP
10 Half - Auto		UP	UP	UP
10 Half - 10 Half				
10 Half - 10 Full		UP		
10 Half - 100 Half				UP
10 Half - 100 Full		UP		UP
10 Full - 10 Half	UP			
10 Full - 10 Full	UP	UP		
10 Full - 100 Half	UP			UP
10 Full - 100 Full	UP	UP		UP

Table 4. TX to FX

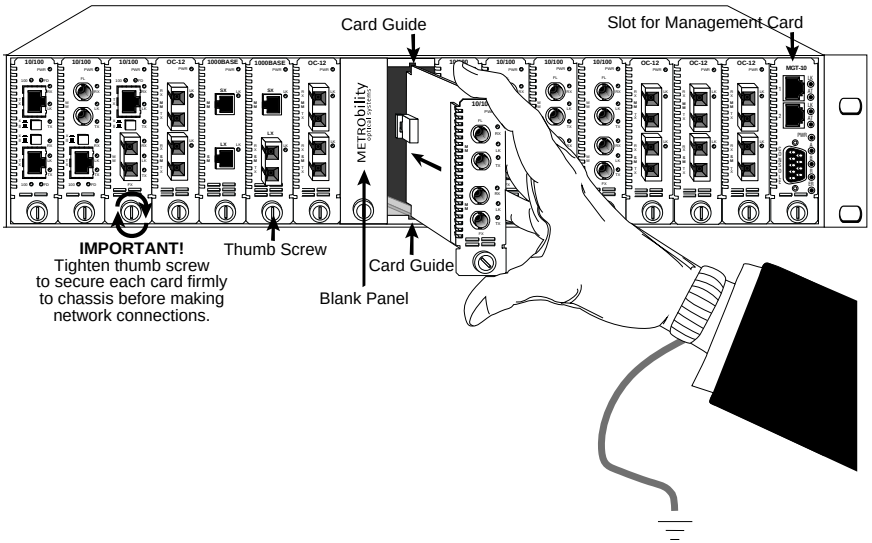
Configuration	Port 1			Port 2
	FD1	AN1	100M1	FD2
Auto - 100 Full	UP	UP	UP	UP
Auto - 100 Half	UP	UP	UP	
10 Half - 100 Half				
10 Half - 100 Full				UP
10 Full - 100 Half	UP			
10 Full - 100 Full	UP			UP
100 Half - 100 Half			UP	
100 Half - 100 Full			UP	UP
100 Full - 100 Half	UP		UP	
100 Full - 100 Full	UP		UP	UP

Set the switches UP where indicated.
Set the switches DOWN for the blank positions.

3 Install the Line Card

The Radiance 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 your line card.

- Grasp the card by the front panel as shown.



- Insert the card into a slot on 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 Radiance line card to the network, insert the fiber optic or twisted-pair cables into the appropriate connectors. Port 1 is on the top and Port 2 is on the bottom. Be sure the card is secured to the chassis before making network connections. The table below shows the correct connectors for Ports 1 and 2.

Model	Port 1 Connector	Port 2 Connector
R621-11	RJ-45	RJ-45
R641-13	RJ-45	FX multimode SC
R641-14 R641-17 R641-1J	RJ-45	FX singlemode SC
R641-15	RJ-45	FX multimode ST
R641-1E	RJ-45	FX multimode MT-RJ
R641-1G	RJ-45	FX multimode VF-45
R611-51 R612-51	FL multimode ST	RJ-45
R641-53 R642-53	FL multimode ST	FX multimode SC
R641-55 R642-55	FL multimode ST	FX multimode ST

Fiber Optic Connections

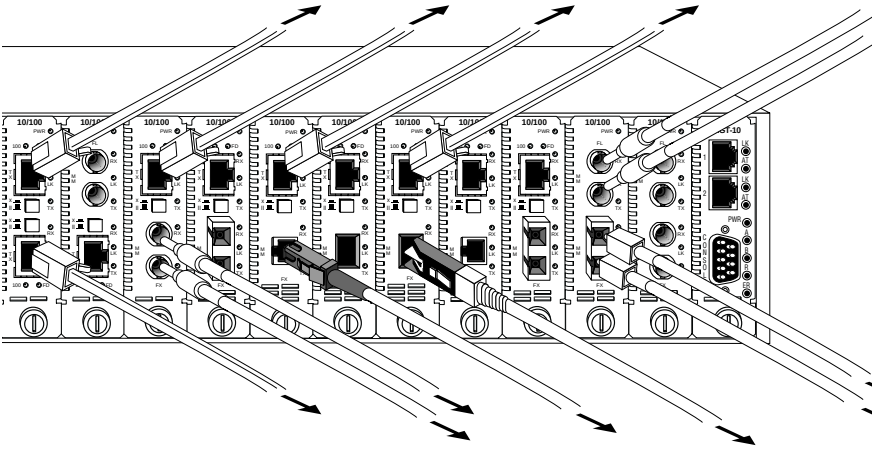
All models, except the R621-11, provide one or two fiber optic multimode or singlemode connectors. 10Base-FL segments are assigned to Port 1, and 100Base-FX segments are assigned to Port 2.

Multimode fiber optic connectors support a maximum segment length of 2 km for remote links.

The R641-14, -17, and -1J provide one set of FX singlemode SC connectors. The R641-14 supports a maximum length of 20 km. The R641-17 supports a maximum length of 40 km. The R641-1J supports a maximum length of 100 km for remote links.

Insert the fiber optic connectors as shown below.

Once power is applied to the unit, verify correct connectivity via the LK (link) LED.



Twisted-Pair Connections

All models, excluding the R641-53, R641-55, R642-53 and R642-55, provide one or two shielded RJ-45 connectors which support a maximum segment length of 100 meters. Use Category 3, 4 or 5 cables for 10Mbps segments; only use Category 5 cables for 100Mbps segments.

NOTE: *Be sure to properly set the MDI-II to MDI-X switch located between the two port connectors. Refer back to Step 2 if necessary.*

Once power is applied to the line card, correct connectivity can be verified via the LK (link) LED, if a device is connected to the remote end of the cable.

This section contains information regarding the operating features of the Radiance 10/100Mbps interface line card.

LED Indicators

The Radiance 10/100Mbps interface line card provides several LEDs for the visible verification of unit status and proper functionality. These LEDs can assist with troubleshooting and overall network diagnosis and management. There are separate TX, RX and LK indicators for each port. Each twisted-pair port also has a 100 LED and an FD LED.

After power is applied to the card, verify correct connectivity via the LK LED.

LED Label	LED Name	Color (Status)	Function
PWR	power	Green (steady)	The unit is ON and functioning normally.
LK	link	Green (steady)	Verifies that the port has a valid link.
TX	transmit	Green (blinking)	The port is sending data.
RX	receive	Green (blinking)	The port is receiving data.
FD	duplex	Green (steady)	The port is in full-duplex mode when lit. It is in half-duplex mode when unlit. (Only available for twisted-pair ports.)
100	speed	Green (steady)	The speed setting of the port is 100Mbps when lit. It is 10Mbps when unlit. (Only available for twisted-pair ports.)

Factory Settings

Two functional settings on the Radiance 10/100Mbps interface line card are preset and cannot be changed. Another setting, which controls the backpressure function, can be modified via management software after the card is installed and connected to the network. Refer to the *Command Line Interface Reference Guide, NetBeacon Element Management Software Installation and User's Guide* or *WebBeacon Management Software Installation and User's Guide* for detailed software instructions.

Backpressure

For ports operating at half duplex, you have the option of enabling the backpressure function. When backpressure is activated, the line card generates a jamming pattern to force a collision on a port if the line card cannot allocate a buffer for the port's incoming packets. Activating backpressure enables it for both ports. Backpressure is ignored in full duplex because collisions are not generated in this mode. The default setting is disabled.

1522 Enable

The line card is preset to pass up to 1522-byte packets, which are used as VLAN tags, through both ports. Packets that are too small (less than 64 bytes) or too large (more than 1522 bytes) are discarded. This setting cannot be modified.

Back-Off

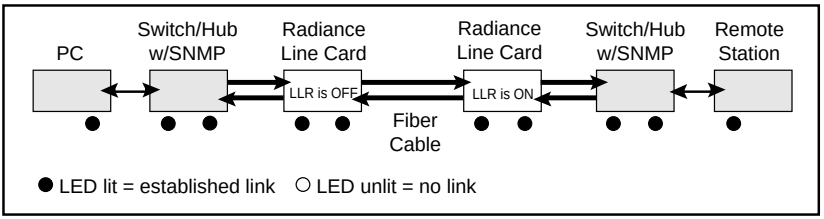
Packet transmission is attempted 16 consecutive times before the 10/100Mbps interface line card restarts its back-off algorithm. After the back-off period ends, the card again tries to send the packet up to 16 consecutive times. A packet which endlessly fails to be sent will continue to be retransmitted forever, only changing back-off intervals.

Link Loss Return (LLR)

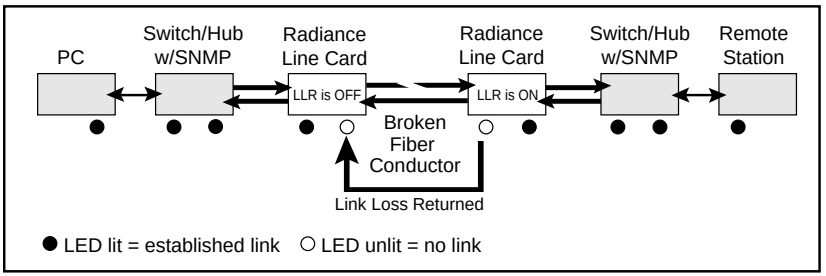
The fiber optic ports of the Radiance line cards have been designed with LLR* for troubleshooting a remote connection.

When LLR is enabled, the fiber port's transmitter shuts down if its receiver fails to detect a valid receive link. LLR should only be enabled on one end of the link and is typically enabled on either the unmanaged or remote device.

The diagram below shows a typical network configuration with a good link status using Radiance line cards for remote connectivity.



If one of the optical conductors is bad (as shown in the diagram box below), the line card with LLR enabled will return a no link condition to its link partner. This aids the administrator in determining the source of the loss.



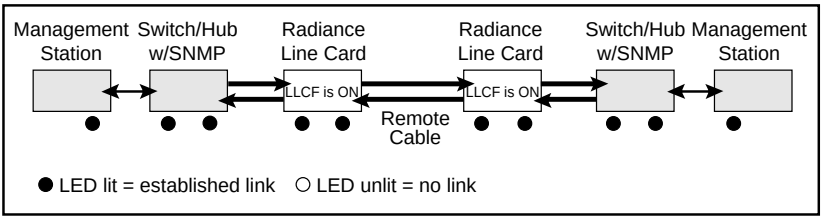
IMPORTANT: *LLR must not be active on both ends of a configuration. If it is, the link can never be established.*

*Units are shipped with the LLR function disabled (DOWN).

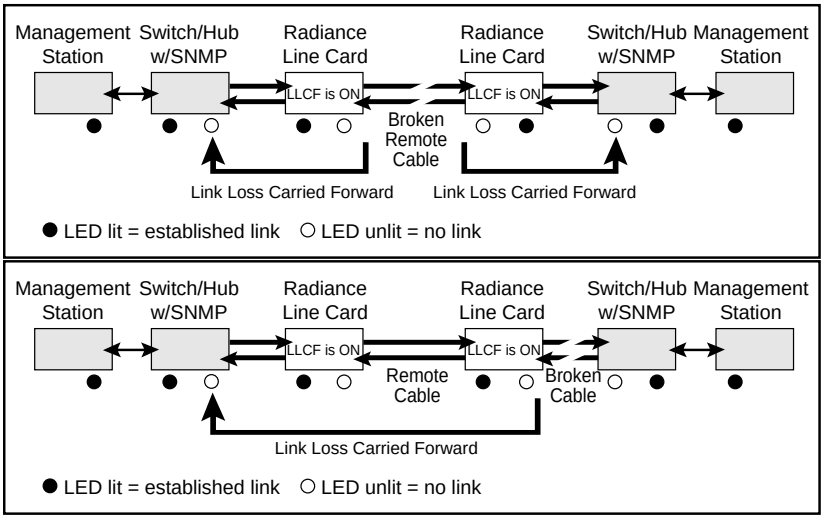
*Link Loss Carry Forward (LLCF)**

The R642-xx and R612-51 line cards incorporate LLCF for troubleshooting a remote connection. When LLCF is enabled, the ports do not transmit a link signal until they receive a link signal from the opposite port.

The diagram below shows a typical network configuration with a good link status using Radiance line cards for remote connectivity. Note that LLCF is enabled as indicated in the diagram.



If a connection breaks, the line cards carry that link loss forward to the switch/ hubs which generate a trap to the management stations. A network administrator can then determine the source of the problem.



Important: *When connecting a line card with LLCF enabled to an auto-negotiating device, force both sides of the configuration to 10Mbps and either full or half duplex. This allows the line card to immediately see link pulses and start passing data.*

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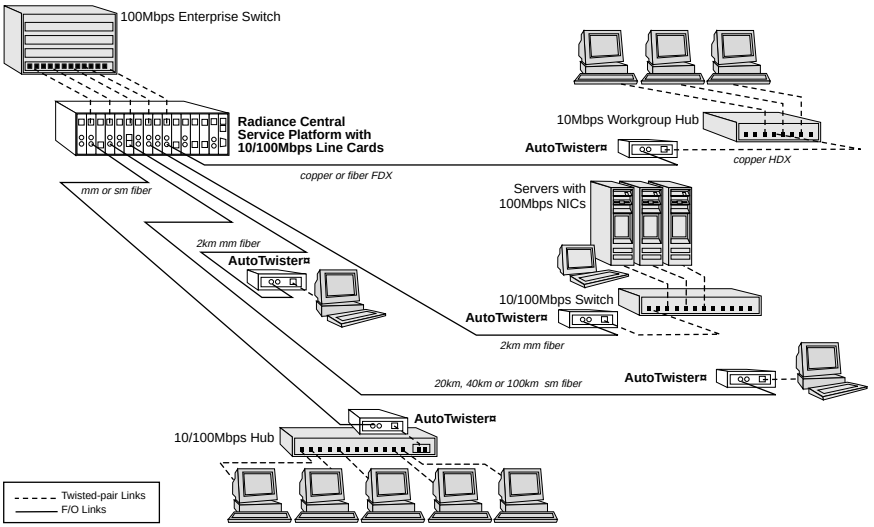
* Units are shipped with LLCF disabled (OFF).

Topology Solutions



Technical Specifications

Network Connections

Twisted-Pair Interface

Connector _____ Shielded RJ-45, 8-pin jack
Impedance _____ 100 ohms nominal
Signal Level Output (differential) _____ .95 to 1.05 V
Signal Level Input _____ 350 mV minimum
Supported Link Length _____ 100 m
Cable Type (10Mbps segments) _____ Category 3, 4 or 5 UTP
(100Mbps segments) _____ Category 5 UTP
(For NEBS Level III and EN55024:1998 compliance, use only Category 5 STP cables.)

Multimode Fiber Optic Interface

Connector _____ ST, SC, MT-RJ or VF-45
Wavelength _____ 1310 nm
RX Input Sensitivity _____ -31 dBm minimum
Output Power _____ -14 dBm to -23.5 dBm (50/125 µm)
_____ -14 dBm to -20 dBm (62.5/125 µm)
Supported Link Length _____ up to 2 km full duplex
Cable Type _____ 50/125 or 62.5/125 µm F/O

Singlemode Fiber Optic Interface

Connector _____ SC
Wavelength _____ 1310 nm
RX Input Sensitivity _____ -35 dBm minimum
Output Power _____ -8 dBm to -15 dBm
Supported Link Length _____ 20 km full duplex
Cable Type _____ 9/125 µm F/O

Singlemode Fiber Optic Interface — long haul distance support

Connector _____ SC
Wavelength _____ 1310 nm
RX Input Sensitivity _____ -35 dBm minimum
Output Power _____ 0 dBm to -5 dBm
Supported Link Length _____ 40 km full duplex
Cable Type _____ 9/125 µm F/O

Singlemode Fiber Optic Interface — extended long haul distance support

Connector	SC
Wavelength	1550 nm
RX Input Sensitivity	-37 dBm minimum
Output Power	0 dBm to -3 dBm
Supported Link Length	100 km full duplex
Cable Type	9/125 µm F/O

Data Rate

Data Rate	100 Mbps half duplex; 200 Mbps full duplex (Fast Ethernet)
	10 Mbps half duplex; 20 Mbps full duplex (Ethernet)
Latency	<9 µs (100 Mbps input)*
	<159 µs (10 Mbps input)*

Power

R621-11	5 V @ 0.7 A, 3.5 W
R641-53, -55, -1J; R642-53, -55	5 V @ 1.1 A, 5.5 W
R611-51; R612-51; R641-13, -14, -15, -17, -1E, -1G	5 V @ 0.9 A, 4.5 W

Environmental

Operating Temperature	0° to 50° C
Storage Temperature	-30° to 70° C
Operating Humidity	5% to 95% non-condensing
Weight	5 oz (0.14 kg)

*Only applicable to speeds less than 100% full duplex line rate.

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)
- IEC 825-1 Classification
- Class 1 Laser Product
- DOC Class A (emissions)

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 Réglement sur le matériel brouilleur du Canada.

Warranty and Servicing

Three-Year Warranty for Radiance 10/100Mbps Interface Line Cards
Metrobility Optical Systems, Inc. warrants that every Radiance 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. 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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