Data Sheet

RICi-16

Ethernet over Bonded PDH Network Termination Unit

- Transports Ethernet traffic over 16 bonded E1 or T1 ports or two clear channel T3 ports using Ethernet over NG-PDH protocols
- MEF 9/MEF 14 certified product supporting EPL and EVPL services with flexible mapping of user traffic into Ethernet flows
- Enhanced QoS mechanism and flow-based provisioning (service multiplexing) with advanced traffic management
- Monitoring and diagnostic tools for quick fault isolation on TDM and Ethernet ports
- Complete Ethernet OAM solution based on IEEE 802.3-2005 (formerly 802.3ah), IEEE 802.1ag and ITU-T Y.1731

Connects Fast Ethernet LANs transparently over TDM infrastructure

EtherAccess

RICi-16 is a state-of-the-art Network Termination Unit (NTU) connecting Fast Ethernet LANs over up to 16 bonded E1/T1 lines or up to two clear-channel T3 circuits. Alternatively, RICi-16 can transport Ethernet over bonded and TDM T1s using a single channelized T3 as uplink.

This enables service providers to supply high-capacity Ethernet services to remote locations, and transparently connects corporate LANs over existing PDH infrastructure.

An essential part of RAD's EtherAccess™ portfolio, RICi-16 features Carrier Ethernet attributes, that include Ethernet OAM for proactive SLA monitoring, quality of service (QoS) per Ethernet flow and advanced traffic management capabilities, all starting at the service hand-off points.

MEF COMPLIANCE

Certified by the Metro Ethernet Forum (MEF) for the following services:

- MEF 9: EPL, EVPL
- MEF 14: EPL, EVPL.

RAD data communications
The Access Company

RICi-16

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ENCAPSULATION AND BONDING

RICi-16 uses the Ethernet over NG-PDH technologies such as Generic Framing Procedure (GFP G.8040), Virtual Concatenation (VCAT G.7043) and Link Capacity Adjustment Scheme (VCAT G.7042). NG-PDH solutions improve overall network availability by reducing latency and optimizing line utilization and throughput.

The unit supports up to 16 GFP VCAT groups (VCG), allowing the connection of up to 16 different customers per site.

Typical applications include:

- IP DSLAM, cellular IP, and WiMAX base station backhauling
- Interoffice or enterprise LAN connection.

FLEXIBLE TRAFFIC MAPPING

Traffic is mapped to the Ethernet flows (EVCs) using the following per-port criteria:

- Port-based (All-to-one bundling)
- CE-VLAN
- CE-VLAN priority
- DSCP
- IP precedence
- CE-VLAN + CE-VLAN priority
- CE-VLAN ID + IP precedence (user to network only)
- CE-VLAN + DSCP (user to network only)
- Non-IP
- CE-VLAN + non-IP
- Untagged.

TRAFFIC SEPARATION

VLAN stacking and stripping option at ingress and egress enables transporting user traffic transparently, keeping the user VLAN settings intact. In addition, the management traffic can be tagged with a different VLAN, fully separating user traffic from management data.

QUALITY OF SERVICE – QOS

Different service types require different levels of QoS to be provided end-to-end. QoS can be defined per subscriber as well as per service. QoS has two aspects: rate limitation and traffic prioritization.

Two policing mechanisms are applied per flow. The policing mechanisms operate according to the dual leaky bucket mechanism (CIR + CBS, EIR + EBS: two rates, three colors).

For prioritizing user traffic, RICi-16 employs up to four separate queues.

The queues handle traffic with different service demands, such as real-time traffic, premium data, or best-effort data.

MANAGEMENT

- Remote inband management via the network ports using Telnet, Web browser or RADview, RAD's SNMP based management system.
- Out-of-band management via one of the user data ports that can be configured as a management port
- Local management via an ASCII terminal connected to the RS-232.

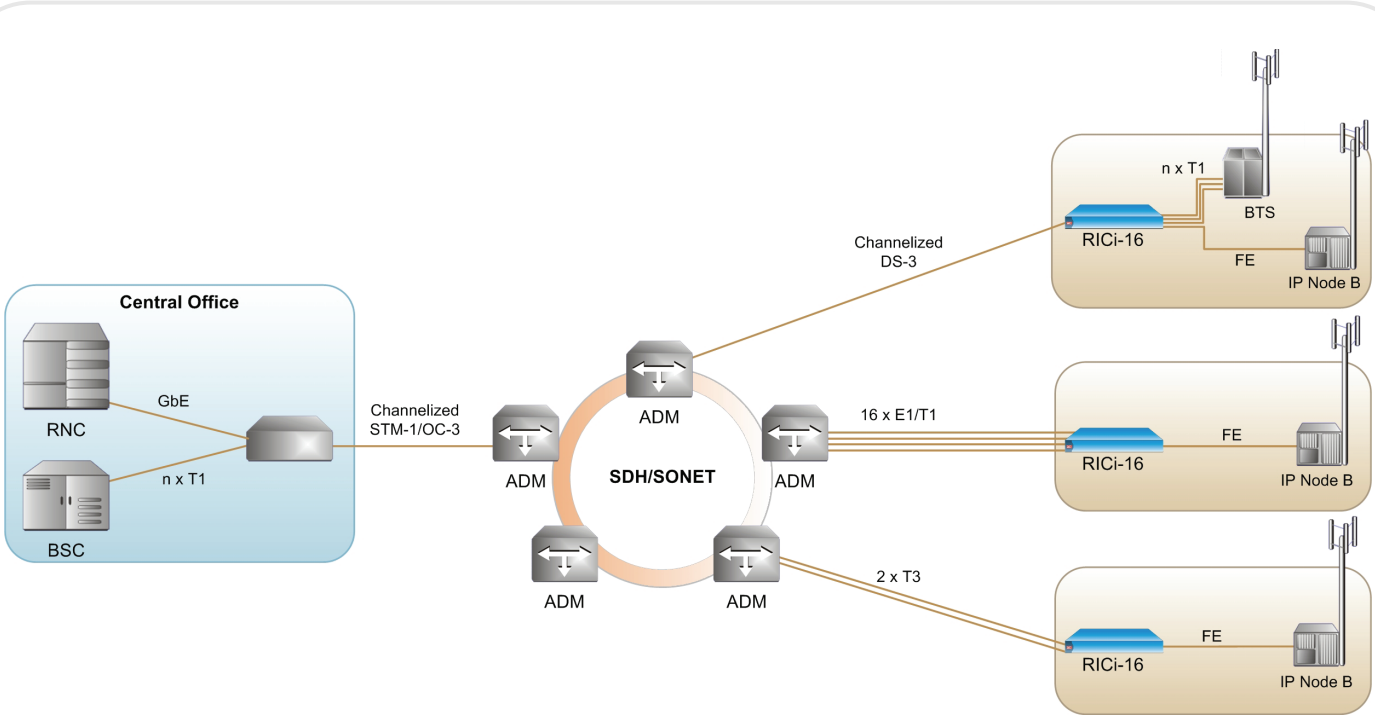

Figure 1. Ethernet Cellular Backhauling over PDH/SONET/SDH

SIMPLE NETWORK TIME PROTOCOL

RICi-16 uses Simple Network Time Protocol (SNTP) to synchronize to an accurate time from an NTP server at user-selectable intervals.

L2CP HANDLING

RICi-16 can be configured to pass through Layer-2 control frames across the network, to peer-supported protocols (OAM.ah), or to discard the L2CP frames.

SECURITY

To provide a high level of client-server communication security, the following security protocols are supported:

- SNMPv3
- RADIUS authentication
- SSL for Web-based management
- SSH for Secure Shell communication.

FAULT PROPAGATION

The unit features a user-configurable bidirectional fault propagation mechanism that notifies local and remote equipment of faulty conditions.

This enables routers and switches on both ends of the link to reroute traffic.

ETHERNET OAM

Two types of Ethernet OAM are provided:

- Single segment (link) OAM according to IEEE 802.3-2005 (formally 802.3ah) for remote management and fault indication
- OAM Connectivity Fault Management (CFM) based on IEEE 802.1ag and ITU-T Y.1731 enables Ethernet service providers to monitor their services proactively, measure end-to-end performance, and guarantee that customers receive the contracted SLA.

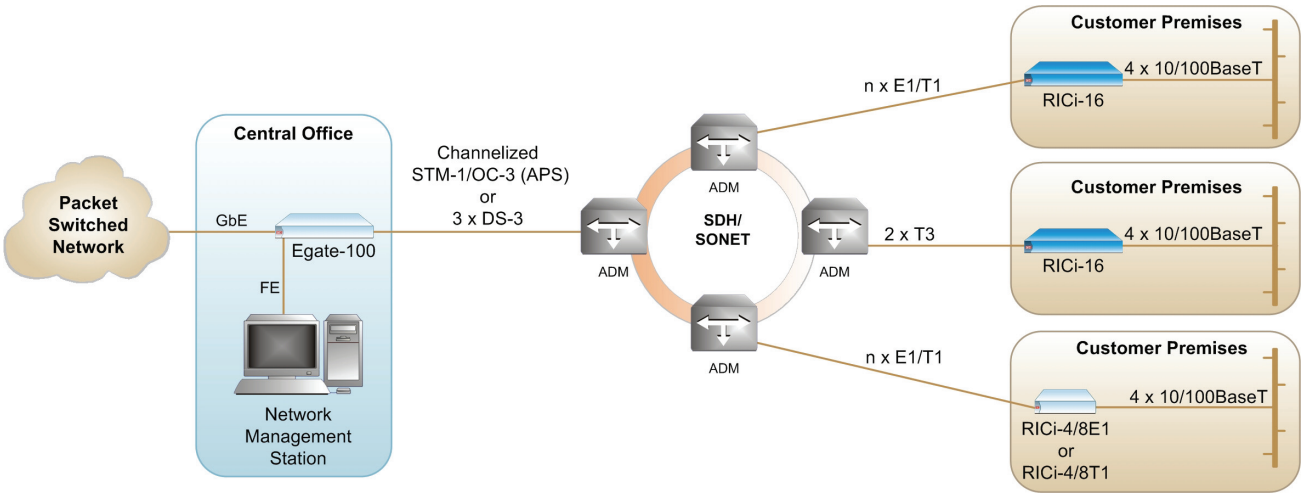

Figure 2 Ethernet Services over PDH/SONET/SDH Using Egate-100

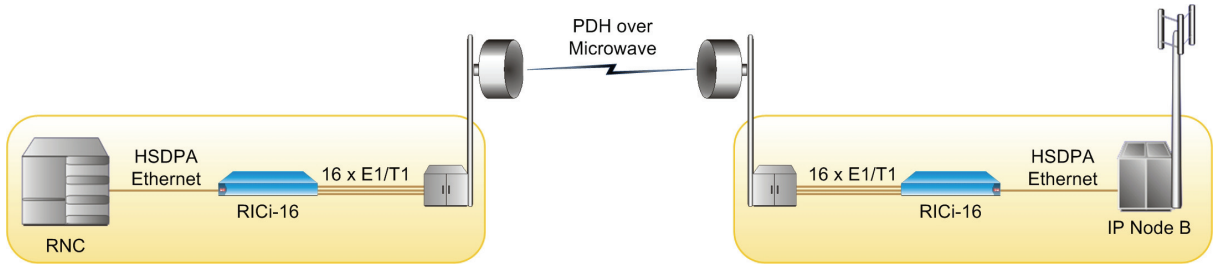

Figure 3. Next-Generation Mobile Connectivity over PDH Microwave Links

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Specifications

E1 INTERFACE

Number of Ports
4, 8, or 16

Compliance
G.703
G.704

Data Rate
2.048 Mbps

Line Code
HDB3, AMI

Framing
Framed (G732N with CRC)

Line Impedance
120Ω, balanced
75Ω, unbalanced (via adapter cable)

Connector
RJ-45, balanced

System Clock
Internal or loopback timing

T1 INTERFACE

Number of Ports
4, 8, or 16

Compliance
T1.403

Data Rate
1.544 Mbps

Line Code
B8ZS, AMI

Framing
ESF

Line Impedance
100Ω, balanced

System Clock
Internal or loopback timing

Connector
RJ-45

T3 INTERFACE

Number of Ports
1 (channelized)
2 (clear channel)

Compliance
T1.102, T1.107

Data Rate
44.736 Mbps

Line Code
B3ZS

Framing
M23 or C-bit parity

Line Impedance
75Ω, unbalanced

System Clock
Internal or loopback timing

Connector
BNC

WAN PROTOCOL

Encapsulation
GFP (G.7041)
GFPoPDH (G.8040)

Bonding
VCAT (G.7043) – Up to 16 VCAT groups
LCAS (G.7042)

Delay Compensation
Up to 250 ms (E1/T1 ports)
Up to 217 ms (clear channel T3 ports)

ETHERNET INTERFACE

Standard Compliance
IEEE 802.3 and 802.3u, relevant sections

Number of Ports
3 or 4

Type
10/100 Mbps, autonegotiation, full/half duplex, flow control

Port Combinations
4 built-in electrical
2 built-in electrical + 1 fiber optic SFP (for transceivers, see *Ordering*)

Max Frame Size
1700 bytes

SFP Transceivers
For full details, see the SFP Transceivers data sheet at http://www.rad.com

Note: *It is strongly recommended to order this device with* ***original*** *RAD SFPs* ***installed****. This will ensure that prior to shipping. RAD has performed comprehensive functionality quality tests on the entire assembled unit, including the SFP devices. RAD cannot guarantee full compliance to product specifications for units using non-RAD SFPs. For detailed specifications of the SFP transceivers, see the SFP transceivers, see the SFP Transceivers data sheet.*

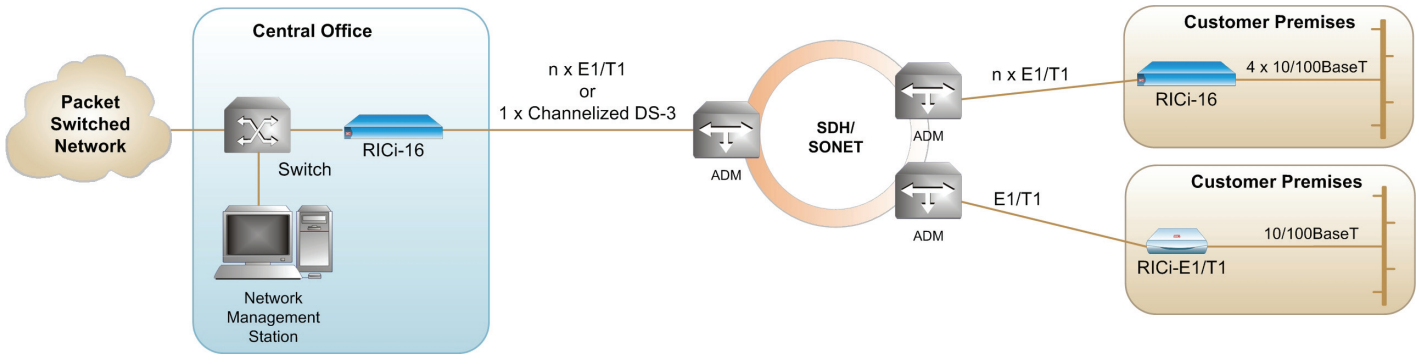


Figure 4. Ethernet Services over PDH/SONET/SDH Using RICi-16 as Aggregator

INTERNAL BRIDGE

LAN Table
Up to 2018 MAC addresses (learned) and 30 static addresses

Operation Mode
VLAN-aware, VLAN-unaware

Filtering and Forwarding
Transparent or filtered

TERMINAL CONTROL PORT

Type
RS-232/V.24 (DCE asynchronous)

Data Rate
9.6, 19.2, 115.2 kbps

Connector
9-pin, D-type, female

GENERAL

Diagnostics
Remote loopbacks on E1, T1, T3 interfaces

Indicators
PWR (green, per power supply) – Power status
TST (yellow) – Self test status
ALM (red) – Alarm status

Power
Wide-range AC/DC:
100–240 VAC, 50/60 Hz or
48/60 VDC nominal (40–72 VDC)

Power Consumption
13W max

Physical
Height: 43.7 mm (1.7 in) 1U
Width: 440.0 mm (17.3 in)
Depth: 240.0 mm (9.4 in)
Weight: 3.0 kg (6.6 lb)

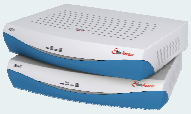
Environment
Temperature:

Standard enclosure:
0 to 50°C (32 to 122°F)

Temperature-hardened enclosure:
-22° to 65°C (-7.6° to 149°F)

Humidity: Up to 90%, non-condensing

RICi Family Product Comparison Table

Feature	 RICi-E1, RICi-T1 (Ver. 2.1)	 RICi-E3, RICi-T3 (Ver. 1.1)	 RICi-4E1, RICi-4T1 RICi-8E1, RICi-8T1 (Ver. 2.0)	 RICi-16 (Ver. 2.5)
Protocol Type	RAD HDLC HDLC IS GFP (G.8040, G.7041/Y.1303)	RAD HDLC X.86 (LAPS)	MLPPP (BCP)	GFP (G.7041), GFPoPDH (G.8040) VCAT (G.7043) LCAS (G.7042)
Fault Propagation	Yes	Yes	Yes	Yes
MAC Address Table	512	512	2048	2048
QoS	VLAN Priority (802.1p) IP Precedence	VLAN Priority (802.1p)	VLAN Priority (802.1p) DSCP Per port	VLAN Priority (802.1p) IP Precedence DSCP Per port
QoS Mechanism	Strict	Strict	Strict	Strict
Host VLAN	Yes	Yes	Yes	Yes
VLAN Stacking	Yes	Yes	Yes	Yes

Data Sheet

RICi-16

Ethernet over Bonded PDH Network Termination Unit

Ordering

RICi-16/B/*/#/!/|/$/?
RICi-16T3/!/|/?

Note: *If RICi-16T3 is ordered, the unit is supplied with 2 T3 ports (no T1 ports) and 4 Ethernet ports (unless SFP is ordered).*

Legend

B Number of PDH ports:

16E1	16 E1 ports
16T1	16 T1 ports
8E1	8 E1 ports
8T1	8T1 ports
4E1	4 E1 ports
4T1	4 T1 ports
2T3	2 T3 ports

Note: *When RICi-16 is ordered with 16 E1/T1 or 2T3, the device is supplied with 16 E1/T1 ports, out of which only four ports are activated by default. Additional E1/T1 ports can be activated using a software license.*
For 4-E1/T1 and 8-E1/T1 versions, the device is supplied with all PDH ports operational.

***** License pack for PDH link activation:

Pack 1	8 E1/T1 links
Pack 2	12 E1/T1 links
Pack 3	16 E1/T1 links

Note: *Applicable only for units 16 E1/T1 and 2 T3 ports.*

Operation mode (Default=bridge mode):

EVPL	Enable Ethernet Virtual Private Line services using Ethernet flows

! Ethernet SFP port (Default=4 × Ethernet UTP ports)

NULL	SFP-ready slot
SFP-1	Fast Ethernet/STM-1, 1310 nm, multimode, LED, 2 km (1.2 mi)
SFP-2	Fast Ethernet/STM-1, 1310 nm, single mode, laser, 15 km (9.3 mi)
SFP-3	Fast Ethernet/STM-1, 1310 nm, single mode, laser, 40 km (24.8 mi)
SFP-4	Fast Ethernet/STM-1, 1550 nm, single mode, laser, 80 km (49.7 mi)
SFP-9F	Fast Ethernet, RJ-45 connector, 100m (238 ft)
SFP-10A	Fast Ethernet/STM-1, Tx 1310 nm, Rx 1550 nm, single mode (single fiber), laser (WDM), 20 km (12.4 mi)
SFP-10B	Fast Ethernet/STM-1, Tx 1550 nm, Rx 1310 nm, single mode (single fiber), laser (WDM), 20 km (12.4 mi)

Note: *When SFP is ordered, the device is supplied with a single SFP port and 2 Ethernet UTP ports.*

| Number of power supplies (Default=single power supply):

R	Dual power supply

$ E1 Interface type (Default=balanced):

U	Unbalanced E1 interface via RJ-45 to BNC adapter cable

? Temperature range (Default=normal temperature range, not NEBS compliant):

H	Temperature-hardened, compliant with NEBS level 3, types 2, 3, and 4

LICENSE PACKAGES

Software packages for activating additional operation modes and E1/T1 ports

Legend

RICi-16-EVPL	Ethernet Virtual Private Line services using Ethernet flows
RICi-16-Pack 1	8 E1/T1 links
RICi-16-Pack 2	12 E1/T1 links
RICi-16-Pack 3	16 E1/T1 links

SUPPLIED ACCESSORIES

AC power cord
DC power connection kit

CBL-RJ45/2BNC/E1
RJ-45 to BNC adapter cable (if unbalanced E1 interface is ordered)

OPTIONAL ACCESSORIES

CBL-DB9F-DB9M-STR
Control port cable

RM-34
Hardware kit for mounting one RICi-16 unit in a 19-inch rack

WM-34
Hardware kit for mounting one RICi-16 unit on a wall

RICi-16-PS
Spare wide-range power supply module (100–240 VAC/–48 VDC)

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