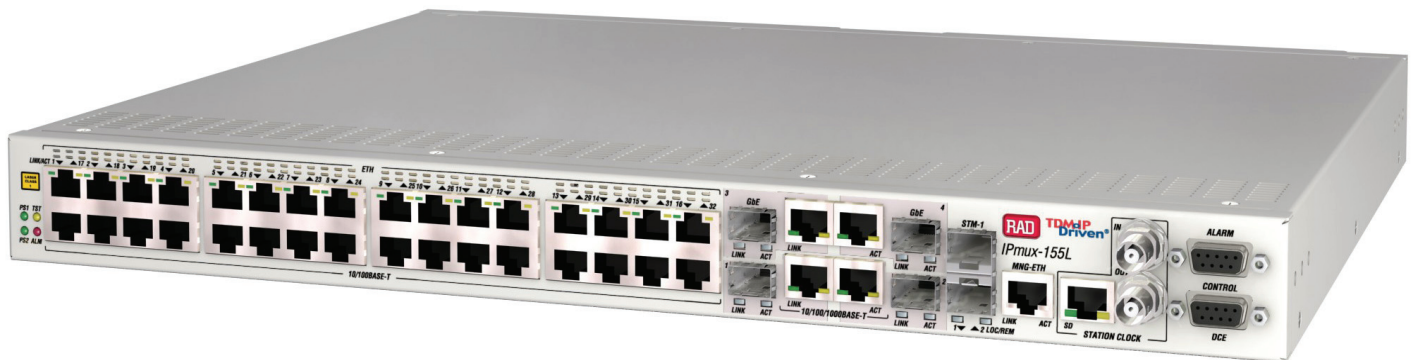


IPmux-155L

Hub-Site Pseudowire Access Gateway



Multiservice
pseudowire gateway
converging TDM voice
or data services over
packet-switched
networks

TDM IP
Driven®

- High capacity pseudowire gateway, transporting TDM traffic over packet-switched networks in a compact 1U, 19" enclosure
- Built on pseudowire technology, implementing the IETF, MFA Forum and ITU-T standards for Pseudowire Emulation Edge-to-Edge (PWE3)
- Transport of a fully populated channelized STM-1 stream over a packet-switched network
- Aggregation of 32 fiber optic or electrical Fast Ethernet interfaces into four Gigabit Ethernet links
- Redundant power supply and fan units

IPmux®-155L is a pseudowire gateway that extends the TDM traffic (originating from legacy circuit-switched networks) over packet-switched networks (PSNs). This is achieved by converting TDM data streams coming from the TDM ports into packets transported over the PSN. IPmux-155L includes the following ports:

- 1 + 1 redundant STM-1
- Four Gigabit Ethernet with traffic protection
- 32 fiber optic or electrical Fast Ethernet user ports.

The unit is used in the following applications:

- Aggregating traffic from remote pseudowire devices, such as IPmux-24 or IPmux-2L, at a small PoP or CO, while eliminating a need for additional Ethernet switch.
- Transporting STM-1 traffic over PSN, saving TDM leased line cost.

RAD

data communications
The Access Company

IPmux-155L

Hub-Site Pseudowire Access Gateway

PSEUDOWIRE FUNCTIONALITY

The ASIC-based architecture provides a robust and high performance pseudowire solution with minimal processing delay.

The unit employs SAToP pseudowire encapsulation method.

Proper balance between PSN throughput and delay is achieved via configurable packet size.

A jitter buffer compensates for packet delay variation (jitter) of up to 200 msec in the network.

PSEUDOWIRE TIMING

End-to-end synchronization between circuits is maintained by the adaptive clock recovery mechanism.

Clock recovery conforms to G.823 traffic interface using G.8261-defined scenarios.

The system clock uses master and fallback timing sources for clock redundancy.

IPmux-155L also provides system clock input and output via an external clock port.

SDH INTERFACE

The SDH interface provides direct access to the Synchronous Digital Hierarchy (SDH) transmission cores at the STM-1 level (155.520 Mbps).

An SDH interface asynchronously maps/de-maps 63 E1 streams into a single STM-1 link.

The physical STM-1 ports can be ordered with field-replaceable SFP transceivers with optical interfaces, for meeting a wide range of operational requirements.

The STM-1 interface features 1+1 APS line redundancy for rapid restoration of service in case of line failure.

AU4/TU12 pointer process complies with the G.783, G.707 requirements.

The interface generates and monitors trace messages with 16 bytes sequences (J1 and J2 bytes).

ETHERNET INTERFACE

IPmux-155L features the following PSN ports:

- Four Gigabit Ethernet ports with SFP-UTP combo connectors
- 32 Fast Ethernet ports with fiber optic SFP or UTP connectors.

The GbE interface operation complies with the IEEE 802.3, 802.1Q and 802.1p requirements.

Link aggregation is supported as per 802.3ad. This enables the operator to use up to four Ethernet links as a single virtual interface sharing traffic load and providing link resiliency.

Preserves investment in legacy equipment in migration to PSN

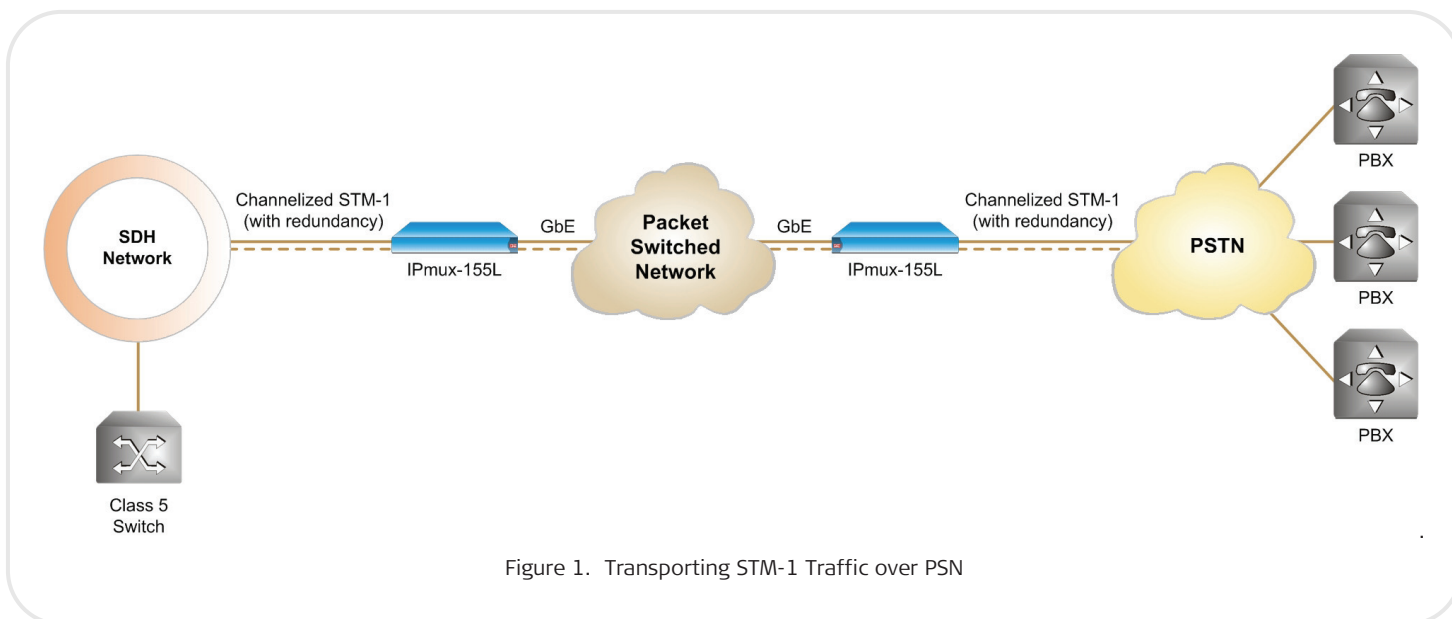


Figure 1. Transporting STM-1 Traffic over PSN

Lowers Opex of TDM service by utilizing packet infrastructure

ETHERNET CAPABILITIES

IPmux-155L includes an internal bridge, operating in VLAN-aware and VLAN-unaware modes.

VLAN stacking can be used for traffic separation between different users or services, by defining a service provider VLAN ID per customer or service. When VLAN stacking is used, a service provider VLAN tag is added to the user traffic and removed from network traffic. Both service provider VLAN ID and service provider VLAN priority can be defined.

User traffic can be queued and prioritized according to VLAN priority and ToS/Diffserv.

Ingress and egress rate can be limited per user and network ports.

SYSTEM REDUNDANCY

System architecture provides redundancy at different levels:

- GbE interface with 802.3ad-based link aggregation
- STM-1 1+1 line redundancy with less than 50 ms restoration of service in case of link faults
- Redundant power supply units and fans.

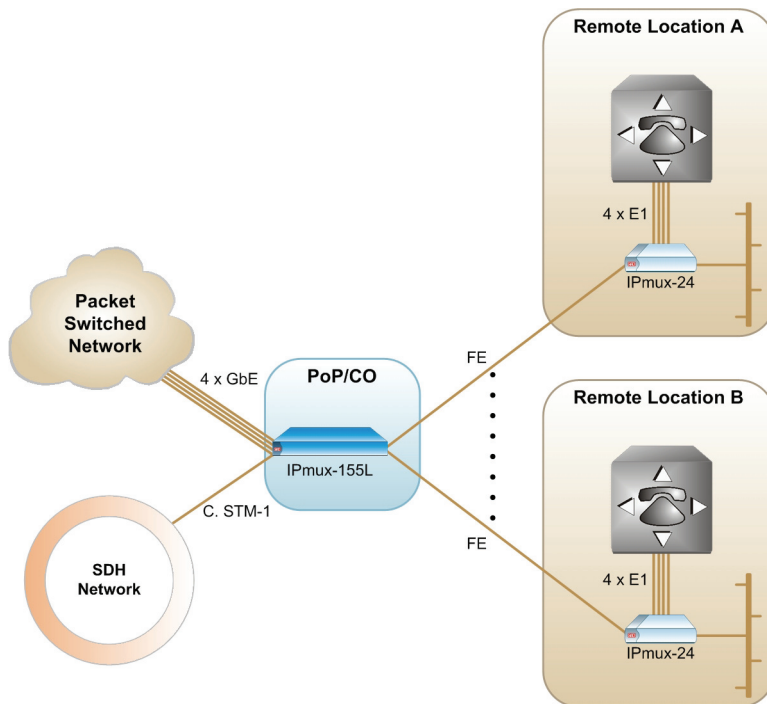


Figure 2. Aggregating Pseudowire Traffic from Remote Locations

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MANAGEMENT CAPABILITIES

The unit can be managed using different ports and applications:

- Local out-of-band management via a terminal connected to the RS-232 port
- Remote out-of-band management via the dedicated 10/100BaseT port
- Remote inband management via the GbE or FE interface. Remote management is performed using Telnet or RADview, RAD's SNMP-based EMS.

Software is downloaded via the local terminal, using XMODEM/YMODEM, or remotely, using TFTP/FTP.

OAM AND DIAGNOSTICS

Comprehensive monitoring and diagnostic capabilities include port status indication and statistic counters for Gigabit Ethernet and STM-1 interfaces.

RAD's TDM PW OAM mechanism verifies connectivity and prevents pseudowire configuration mismatch.

ALARM REPORTING

The device includes a dry-contact connector for reporting alarms to external equipment. The connector also has an external alarm input for monitoring external sensors.

TIMING

IPmux-155L features a flexible clock mechanism using external and internal timing signals coming from:

- SDH clock (8 kHz)
- 2.048 MHz clock recovered from a generated PW flow
- External station clock source via station clock port, providing out-of-band synchronization.

DIAGNOSTICS

For diagnostic purposes, IPmux-155L maintains a cyclic event log file that stores up to 2048 time-stamped events and a real-time current alarm list.

To verify the TDM link integrity, IPmux-155L provides local or remote loopbacks on the VC-4 and internal E1 interfaces.

User-activated BER tests can be generated to analyze E1 streams.

An internal built-in test (BIT) performed after power-up checks the internal circuitry of the unit. The results of the test are visible via the local terminal.

Carrier-grade voice
quality without
compression, or
silence suppression

Specifications

CHANNELIZED STM-1 INTERFACE

Number of Ports

2 (1+1)

Payload Capacity

63 VC 12

Payload Routing

Unframed E1 stream to any VC 12 within the STM-1 payload

Fiber Optic Physical Layer

According to ITU T Rec. G.957

Nominal Bit Rate

155.520 Mbps

Standard

SDH

Framing

According to ITU T Rec. G.707

Redundancy Type

1+1 unidirectional as per G.841

Clock Source

System clock derived from:

- STM-1 (loopback)
- Adaptive
- Internal
- Station

Line Type

SFP

STM-1 SFPs

For full details, see the SFP Transceivers data sheet at 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 functional 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 data sheet.

INTERNAL E1 INTERFACE

Number of Ports

63

Framing

Unframed

Clock Source

Loopback, adaptive, system

ETHERNET INTERFACE

Number of Ports

Gigabit Ethernet: 4 ports

Fast Ethernet: 32 ports

Connector Type

Gigabit Ethernet: SFP-UTP combo

Fast Ethernet: fiber optic (via SFP) or built-in 10/100BaseT

Interface Type

Fiber optic:

Gigabit Ethernet: 1000BaseSX, 1000BaseLX

Fast Ethernet: 100BaseFX, 100BaseLX10, 100BaseBX10

Electrical:

Gigabit Ethernet: 10/100/1000BaseT

Fast Ethernet: 10/100BaseT

ETHERNET CAPABILITIES

Priority Mapping

VLAN priority, ToS/Diffserv

Redundancy

LAG (GbE ports only)

Bridging

VLAN-aware, VLAN-unaware

Filtering

MAC learning and filtering

Number of Service Host IPs

Up to 4

PSEUDOWIRE

Standard Compliance

RFC 4553

PSN Type

UDP/IP

PW Type

SAToP

Number of PW Connections

63

Jitter Buffer Size

0.5–200 msec with 0.1 msec granularity

Adaptive Clock Characteristics

According to G.823 traffic interface

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GENERAL

Management

SNMPv1, SNMPv2c

Telnet

SNTP

DHCP server/client

ASCII terminal via V.24 (RS-232) DCE port

External Clock

2.048 Mbps input/output via two BNC, unbalanced (75 Ω) connectors, G.703, HDB3/AMI code

2.048 Mbps via dedicated RJ-45 balanced 120 Ω connector, G.703, HDB3/AMI code, 2048 kHz squarewave (RS-485 electrical levels)

Diagnostics

Local and remote loopbacks on VC-4 and internal E1

External BERT on internal E1

Ping and traceroute utilities

Virtual Cable Test (VCT)

Statistics

STM-1 (SOH, HVC, LVC)

Ethernet (RFC 2819, RFC4188, RFC1213)

Jitter buffer status (overflow, underflow, sequence error, max/min jitter buffer levels)

Pseudowire connection (OAM)

Alarm Relay

Via dedicated DB-9 female connector

Indicators

LINK (green) – Ethernet link status

ACT (yellow) – Ethernet activity status

TST (yellow) – Test status

ALM (red) – Alarm status

PS1 (green) – Power supply 1 status

PS2 (green) – Power supply 2 status

LOC (red)/REM (yellow) – STM-1 signal status

SD (green/red) – External clock status

Power

AC: 100 to 240 VAC

(115/230 VAC nominal), 50/60 Hz

DC: 40 to 72 VDC (48 or 60 VDC nominal)

Power Consumption

75W max

Physical

Height: 43 mm (1.7 in)

Width: 440 mm (17.5 in)

Depth: 350 mm (13.7 in)






Weight: 5 kg (11 lb)

Environment

Temperature: 0 to 50°C (32 to 122°F)

Humidity: Up to 90%, non-condensing

Table 1. IPmux Family Product Comparison

Feature	IPmux-2L (Ver. 1.0)	IPmux-4L (Ver. 1.0)	IPmux-24 (Ver. 2.1)	IPmux-216 (Ver. 2.1)	IPmux-155L (Ver. 1.0)
					
TDM service ports	1, 2 (E1 only)	4 (E1 only)	1, 2, 4	8, 16	1 (channelized STM-1)
Ethernet network ports	1 × FE	1 × FE	1 × GbE/FE network, 1 × GbE/FE network/user	1 × GbE/FE network, 1 × GbE/FE network/user	4 × GbE
Ethernet subscriber ports	1 or 2 × FE	1 or 2 × FE	1 × GbE/FE	1 × GbE/FE	32 × FE
Number of PWs	63	64	64	256	63
Advanced clock recovery (OCXO)	-	-	✓	✓	-
Redundant power supply	-	-	-	✓	✓
External clock port	-	-	Optional	✓	✓
Serial data port	Optional	-	-	-	-
SSH, SSL, RADIUS	-	-	✓	✓	-
NMS	RV-EMS/NGN	RV-EMS/NGN	RV-SC/TDMoIP	RV-SC/TDMoIP	RV-EMS/NGN

IPmux-155L

Hub-Site Pseudowire Access Gateway

Ordering

IPmux-155L/!/#/C/\$/+1/+3

! Power supply:

- ACR** Dual 100 to 240 VAC
- 48R** Dual -48 VDC

STM-1 interface:

- NULL** SFP-ready slot
- 1** Fast Ethernet/STM-1, 1310 nm, multimode, LED, 2 km (1.2 mi)
- 2** Fast Ethernet/STM-1, 1310 nm, single mode, laser, 15 km (9.3 mi)
- 2H** Fast Ethernet/STM-1, industrially hardened, 1310 nm, single mode, laser, 15 km (9.3 mi)
- 3** Fast Ethernet/STM-1, 1310 nm, single mode, laser, 40 km (24.8 mi)
- 3H** Fast Ethernet/STM-1, industrially hardened, 1310 nm, single mode, laser, 40 km (24.8 mi)
- 4** Fast Ethernet/STM-1, 1550 nm, single mode, laser, 80 km (49.7 mi)
- 10A** Fast Ethernet/STM-1, Tx - 1310 nm, Rx - 1550 nm, single mode (single fiber), laser (WDM) , 20 km (12.4 mi)
- 10B** Fast Ethernet/STM-1, Tx - 1550 nm, Rx - 1310 nm, single mode (single fiber), laser (WDM) , 20 km (12.4 mi)
- 18A** Fast Ethernet/STM-1, Tx - 1310 nm, Rx - 1550 nm, 9/25 single mode (single fiber), laser (WDM), 40 km (24.8 mi)

- 18B** Fast Ethernet/STM-1, Tx - 1550 nm, Rx - 1310 nm, 9/25 single mode (single fiber), laser (WDM), 40 km (24.8 mi)
- 19A** Fast Ethernet/STM-1, Tx - 1490 nm, Rx - 1570 nm, 9/25 single mode (single fiber), laser (WDM) , 80 km (49.7 mi)
- 19B** Fast Ethernet/STM-1, Tx - 1570 nm, Rx - 1490 nm, 9/25 single mode (single fiber), laser (WDM) , 80 km (49.7 mi)

C VC-12 type:

- UNFR** Unframed

\$ E1 interface:

- NULL** No E1 interfaces

+1 Gigabit Ethernet network interface:

- 4N** Four SFP-ready slots

+3 Fast Ethernet user interface (Default=no FE user interface):

- 32N** 32 SFP-ready slots
- 32UTP** 32 built-in 10/100BaseT

SUPPLIED ACCESSORIES

- Power cord
- DC power connection kit

OPTIONAL ACCESSORIES

- RM-34** Hardware kit for mounting one IPmux-155L unit into a 19-inch rack
- CBL-DB9F-DB9M-STR** Control port cable

International Headquarters
 24 Raoul Wallenberg Street
 Tel Aviv 69719, Israel
 Tel. 972-3-6458181
 Fax 972-3-6498250, 6474436
 E-mail market@rad.com



12 avenue des prés
 78059 St Quentin en Yvelines
 Tel: 33 (0)1 77 55 03 00
 Fax: 33 (0)1 30 44 11 95
 E-mail: sales@cbnetworks.fr



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