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Data Sheet

General Availability

IPmux-2L

TDM Pseudowire Gateway

- Comprehensive compliance with pseudowire/circuit emulation standards including TDMoIP, CESoPSN, SAToP and HDLCoPSN
- Built on TDMoIP technology, implementing IETF, MFA Forum, ITU T for Pseudowire Emulation Edge-to-Edge (PWE3)
- E1 and serial traffic emulation over MPLS, IP and Ethernet networks
- Transmission of both framed (full or fractional) and unframed E1 traffic

IPmux-2L is a TDM pseudowire access gateway extending TDM-based services over packet switched networks. It also serves as an Ethernet-based access device.

PSEUDOWIRE

Pseudowire Performance

The unit provides a legacy over PSN solution for transmitting E1 streams over packet switched networks (PSNs). The device converts the data stream from its user E1 and high-speed data ports into packets for transmission over the network. The addressing scheme of these packets is IP or MPLS.

These packets are transmitted via the IPmux-2L Ethernet network port to the PSN. A remote pseudowire device converts the packets back to TDM traffic.

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

The unit employs various legacy over packet protocols, including TDMoIP, CESoPSN, SAToP and HDLCoPSN.

High-performance ASIC-based buffering and forwarding techniques achieve minimal end-to-end processing delay. Configurable packet size balances PSN throughput and delay, while a jitter buffer compensates for packet delay variation (jitter) of up to 200 msec in the network.

An assigned, IANA-registered UDP port number for pseudowire simplifies flow classification through switches and routers.

TDMoIP uses constant-rate AAL1 for circuit emulation as per RFC 5087. AAL1 mode is used for structured transport of unchannelized data and circuits with relatively constant usage. In addition, AAL1 it is used when the TDM-bound IWF is required to maintain a high timing accuracy and when high reliability is required.

The ToS or Diffserv of the outgoing pseudowire packets are user-configurable. This allows assigning pseudowire packets a higher priority in IP networks.

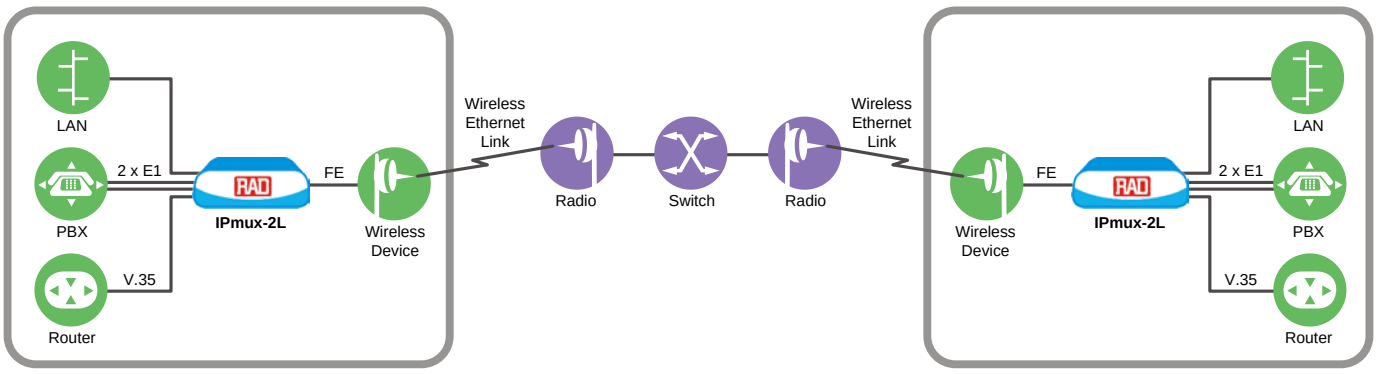

Figure 1. LAN and TDM Services over a Wireless Ethernet Link

Your Network's Edge®

IPmux-2L

TDM Pseudowire Gateway

QoS

IPmux-2L performs VLAN tagging and priority labeling according to 802.1p&Q. Pseudowire packets are assigned a dedicated VLAN ID and 802.1p bit.

ETHERNET

IPmux-2L features an internal Layer-2 Ethernet switch with three Ethernet ports. The ports can be configured to operate as network or user interfaces.

Each Ethernet port features:

- Port-based rate limiting for bandwidth control
- Four priority queues (strict or weighted) for handling traffic with different service demands. Traffic is classified according to IP Precedence, 802.1P, DSCP or port default priority.
- Port-based VLAN membership for ingress traffic restriction
- Port-based VLAN tagging
- Double VLAN tagging (VLAN stacking)
- Bridging and filtering.

The device supports standard IP features, such as ICMP (ping), ARP, next hop and default gateway.

TDM INTERFACE

One or two E1 ports provide connectivity to any standard E1 device.

E1 interfaces feature:

- Integral LTU for long haul applications
- G.703 unframed and G.704 framed modes
- CAS and CRC-4 bit generation (E1).

SERIAL INTERFACE

An IPmux-2L data port is available for an n×64 kbps serial connection to legacy equipment.

Provided via 25-pin D-type connector, the serial port features the following interfaces:

- X.21
- V.24/RS-232
- RS-530/RS-422
- V.35
- V.36/RS-449.

DCE/DTE modes are selected via adapter cables and IPmux-2L clock configuration.

Note: *IPmux-2L can be ordered with serial data port only, with no E1 interfaces installed.*

TIMING AND SYNCHRONIZATION

Synchronization between TDM devices is maintained by deploying advanced clock distribution mechanisms. The clocking options are:

- Internal – The IPmux-2L internal clock oscillator provides the master clock source for the TDM circuit
- Loopback – The transmit clock is derived from the TDM or serial data receive clock
- Adaptive – The clock is recovered from the PSN
- Receive – The system timing is locked to the clock received via one of the TDM ports or the third FE port (Sync-E option).

The system clock ensures a single clock source for all TDM links and uses master and fallback timing sources for clock redundancy. The system timing also supports two different clock sources from two TDM links at the same time.

Sync-E

IPmux-2L utilizes standard Synchronous Ethernet (Sync-E) technology to ensure highly accurate clock recovery over PSN (special ordering option). The clock operation conforms to ITU-T G.8261 requirements.

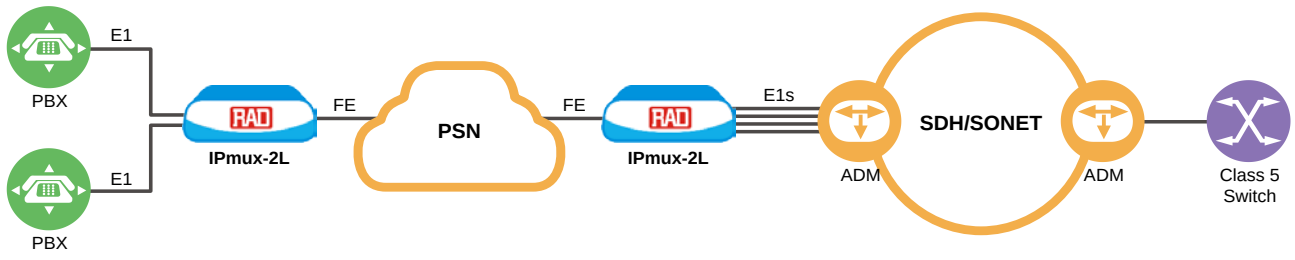

Figure 2. TDM Backhaul and Trunking over a PSN

IPmux-2L

TDM Pseudowire Gateway

MANAGEMENT AND SECURITY

IPmux-2L can be configured and monitored locally via an ASCII terminal, or remotely via Telnet or Web browser.

Management traffic can run over a dedicated VLAN.

Software can be downloaded via a local terminal using XMODEM/YMODEM, or remotely, using TFTP. After downloading a new software version, IPmux-2L automatically saves the previous version in non-volatile memory for backup purposes. Also, copies of the configuration file may be downloaded and uploaded to a remote workstation for backup and restore purposes.

Current date and time are retrieved from a dedicated server, using SNTP.

MONITORING AND DIAGNOSTICS

External and internal loopbacks check TDM and serial link connectivity.

A built-in internal and external BERT utility is used to monitor the TDM link quality. Virtual Cable Test (VCT) checks the quality of Ethernet cables, connectors and terminations, identifying a cable break or short.

The following E1 physical layer performance statistics are available: LOS, LOF, LCV, RAI, AIS, FEBE, BES, DM, ES, SES, UAS and LOMF.

LAN and IP layer network condition statistics, such as packet loss and packet delay variation (jitter), are monitored and stored by the device.

Fault isolation, statistics and event logging are also available.

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

AC-powered units report power failures to defined network management stations by sending a trap, thus enabling the devices to properly disconnect from the network with notification of the reason for the service problem.

Specifications

E1 INTERFACES

Number of Ports

1 or 2

Compliance

ITU-T Rec. G.703, G.704, G.706, G.732, G.823

Data Rate

2.048 Mbps

Line Code

HDB3, AMI

Framing

Unframed, framed, multiframe; with or without CRC-4

Signaling

CAS, CCS (transparent)

Line Impedance

120Ω, balanced
75Ω, unbalanced

Signal Levels

Receive:
0 to -36 dB with LTU (long haul)
0 to -10 dB without LTU (short haul)
Transmit balanced: ±3V ±10%
Transmit unbalanced: ±2.37V ±10%

Jitter and Wander Performance

Per ITU-T G.823

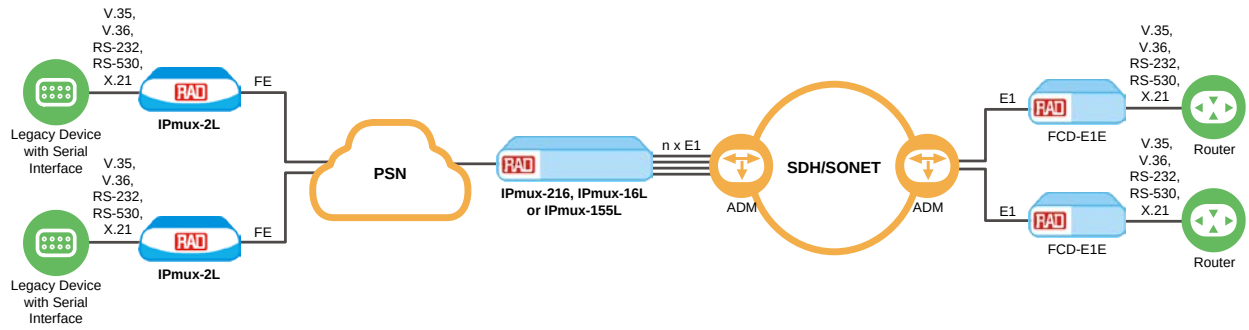

Figure 3. Gradual Migration from Serial Data Services to a PSN

Connector

Balanced: RJ-45
Unbalanced: coax BNC

SERIAL INTERFACES

Number of Ports

1

Interface Type

X.21, V.24/RS-232, RS-530/RS 422, V.35, V.36/RS 449

Timing

DCE – IPmux-2L provides both Tx and Rx clock to the user equipment. Optionally, the incoming data can be sampled with an inverted clock.

DTE1 – IPmux-2L provides the Rx clock. The attached user equipment provides the Tx clock.

DTE2 – The attached user equipment provides both Tx and Rx clocks.

Note: *The X.21 interface supports DCE mode only. The V.24 interface supports synchronous DCE mode. The V.24 interface supports asynchronous DCE mode with oversampling.*

Control Signals

CTS – constantly ON or follows RTS, user-selectable

DCD – constantly ON, unless a fault is detected in the PSN network

Data Rate

n×64 kbps (N = 1, 2, ... 32)

Connector

25-pin, D-type, female

ETHERNET INTERFACES

Number of Ports

3 (1 network, up to 2 user)

Port Combinations

3 UTP or 2 UTP and 1 SFP

Type

Electrical: 10/100BaseT
Fiber optic: 100BaseFx, 100BaseLX10, 100BaseBx10

Fast Ethernet SFPs

For full details, see the SFP/XFP/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, refer to the SFP/XFP/SFP+ Transceivers data sheet.

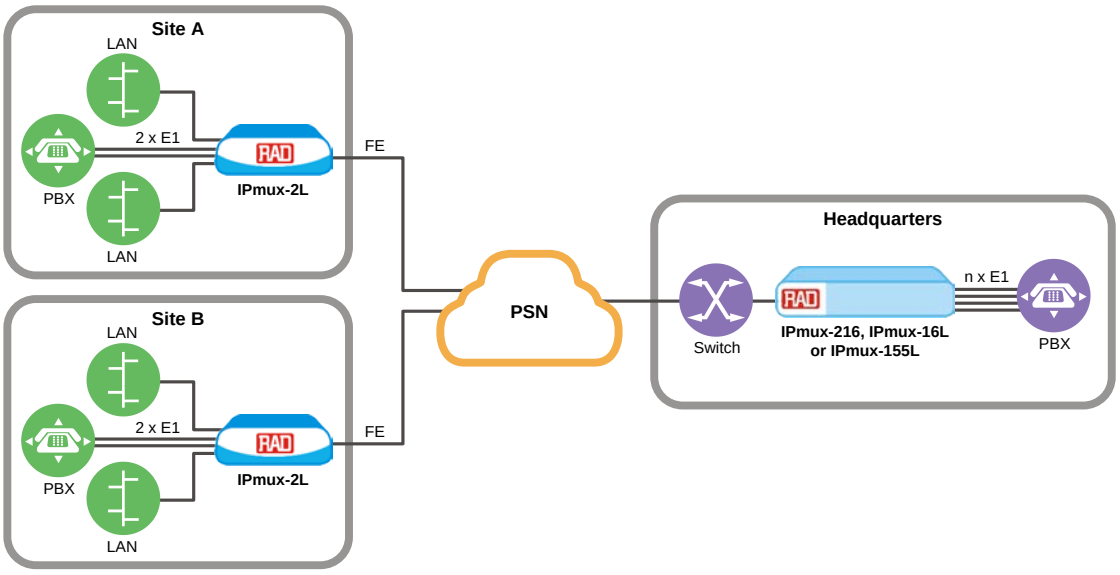

Figure 4. Corporate Multisite Communication over a PSN

Connector

LC

PSEUDOWIRE

Compliance

IETF: RFC 4553 (SAToP), RFC 5087 (TDMoIP), RFC 5086 (CESoPSN) and RFC 4618 (HDLCoPSN)

ITU-T: Y.1413

MFA: IA 4.1, IA 8.0.0

Number of PW Connections

63

Jitter Buffer Size

0.5–200 msec (unframed) with 0.1 msec granularity
1.5–200 msec (framed) with 0.5 msec granularity

MANAGEMENT

SNMPv1v2c
Telnet
ASCII terminal via V.24 (RS-232) DCE port
Web browser
Entity MIB (RFC 4133)

TIMING

Internal
Receive
Loopback
Adaptive

Adaptive Clock Characteristics

According to G.823 traffic interface

Sync-E

Per G.8261 (no ESSM/CSM), via Ethernet port 3 (ordering option)

DIAGNOSTICS

Indicators

PWR (green) – Power status
TST (yellow) – Test status
ALM (red) – Alarm status
LOC/REM (red/red) – E1 local/remote sync loss
LINK/ACT (green/yellow) – Ethernet link/activity status on RJ-45 or SFP

Loopbacks: E1 port local/remote, serial port local/remote

BERT: E1 port internal/external

VCT: Ethernet ports

Statistics

E1 (per G.826 and RFC 2495)

Ethernet (per RFC 2819)

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

Dying Gasp

AC-powered units only (ordering option)

GENERAL

Physical

Height: 43 mm (1.7 in)
Width: 220 mm (8.6 in)
Depth: 170 mm (6.7 in)
Weight: 0.5 kg (1.1 lb)

Power

AC/DC: 100–240 VAC or 48/60 VDC nominal (40 to 72 VDC)

Power Consumption

8W max

Environment

Temperature: 0° to 50°C (32° to 122°F)
Humidity: Up to 90%, non-condensing

IPmux-2L

TDM Pseudowire Gateway

Data Sheet

Ordering

RECOMMENDED CONFIGURATIONS

IPMUX-2L/1E1

1 balanced E1

IPMUX-2L/1E1/N

1 balanced E1, SFP-ready slot

IPMUX-2L/1E1/RS232/N

1 balanced E1, RS-232 interface, SFP-ready slot

IPMUX-2L/1E1/V35

1 balanced E1, V.35 interface

IPMUX-2L/1E1CX

1 unbalanced E1

IPMUX-2L/1E1CX/N

1 unbalanced E1, SFP-ready slot

IPMUX-2L/2E1

2 balanced E1

IPMUX-2L/2E1/N

2 balanced E1, SFP-ready slot

SPECIAL CONFIGURATIONS

Please contact your local RAD partner for additional configuration options

SUPPLIED ACCESSORIES

Power cord

AC/DC adapter plug

Matching adapter cable if a serial interface has been ordered:

- CBL-HS2/V/1/F for V.35
- CBL-HS2/R/1/M for V.36/RS-449
- CBL-HS2/X/1/F for X.21

Note: The above options are automatically supplied when the corresponding interface is ordered. Other options (/M for V.35 or X.21, /F for V.36/RS-449) can be ordered separately if needed.

OPTIONAL ACCESSORIES

The following cables convert the IPmux-2L 25-pin serial data port connector into the respective interface. Cable length is 2m (6 ft).

CBL-HS2/V/1/$
Adapter cable for connecting a data port in DCE timing mode to V.35 port

CBL-HS2/V/2/M
Adapter cable for connecting a data port in DTE1 timing mode to V.35 port, male cable connector

CBL-HS2/V/3/M
Adapter cable for connecting a data port in DTE2 timing mode to V.35 port, male cable connector

CBL-HS2/R/1/$
Adapter cable for connecting a data port in DCE timing mode to V.36/RS-449 port

CBL-HS2/R/2/$
Adapter cable for connecting a data port in DTE1 timing mode to V.36/RS-449 equipment

CBL-HS2/R/3/$
Adapter cable for connecting a data port in DTE2 timing mode to V.36/RS-449 port

CBL-HS2/X/1/$
Adapter cable for connecting a data port in DCE timing mode to X.21 port

Legend

$ Cable connector:
- **F** Female
- **M** Male

CBL-DB9F-DB9M-STR
Control port cable

RM-33-2
Hardware kit for mounting one or two IPmux-2L units into a 19-inch rack

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