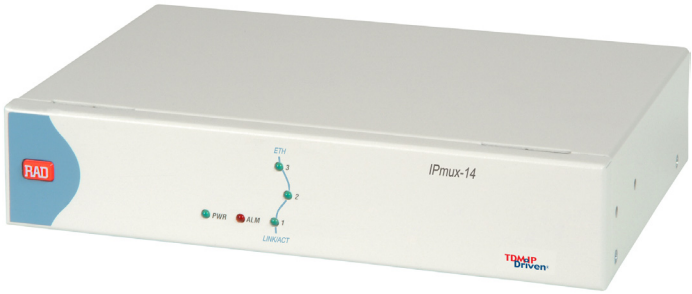
IPmux-14

TDMoIP Gateway



TDMoIP Driven®

FEATURES

- TDMoIP CPE (Customer Premises Equipment), offering TDM leased line extension over a packet switched network (PSN) and controlled Ethernet access
- TDMoIP technology, implementing the emerging IETF, MPLS/FR Alliance, ITU-T and MEF standards for Pseudo-Wire Emulation Edge-to-Edge (PWE3):
  - E1/T1 communication over IP and Ethernet networks
  - Support for both framed (full or fractional) and unframed E1/T1
  - ASIC-based architecture minimizes processing delay
  - Configurable jitter buffer compensates for network packet delay variation
  - Dedicated external clock port
  - QoS support by labeling IP level priority Type of Service (ToS) and VLAN tagging/priority labeling according to IEEE 802.1p&Q
- One Ethernet network port; two Ethernet user ports, offering:
  - Transparent Ethernet bridging
  - User data bandwidth and access control through rate limiting and VLAN filtering
  - VLAN classification through double VLAN tagging (stacking)
- Four E1 or T1 TDM ports
- Management via ASCII terminal, Telnet host, Web terminal or SNMP-based network management station
- Provisioning and monitoring of TDMoIP services using the RADview Service Center for TDMoIP applications
- Compact, 1U-high enclosures, plastic or metal

DESCRIPTION

- IPmux-14 is a TDMoIP gateway offering Ethernet-based access, as well as extension of TDM-based services over packet switched networks.

ETHERNET CAPABILITIES

- IPmux-14's internal Layer-2 Ethernet switch supports three Ethernet ports. One port serves as a network interface and the other two serve for user Ethernet traffic.
- Each Ethernet port supports:
  - Port-based rate limiting for bandwidth control
  - Port-based VLAN membership for ingress traffic restriction
  - Port-based VLAN tagging
  - Double VLAN tagging (VLAN stacking) support.
- The device supports standard IP features, such as ICMP (ping), ARP, next hop and default gateway.

TDMoIP PERFORMANCE

- IPmux-14 provides a legacy over PSN solution transmitting E1/T1 streams over packet switched networks. The device converts the data stream from its user E1/T1 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-14 Ethernet link port to the network. A remote IPmux converts the packets back to TDM traffic.

IPmux-14

TDMoIP Gateway

- High-performance ASIC-based buffering and forwarding techniques are used to achieve minimal end-to-end processing delay.
- IP packet size is configurable. A greater packet length results in greater processing delay, yet smaller bandwidth overhead is achieved.
- An enhanced buffering mechanism compensates for packet delay variation (jitter) of up to 200 msec in the network.
- Assigned, IANA-registered UDP socket number for TDMoIP simplifies flow classification through switches and routers.

TDMoIP QoS SUPPORT

- IPmux-14 supports VLAN tagging and priority labeling according to 802.1p&Q. TDMoIP frames are assigned (tagged) a dedicated VLAN ID.
- The ToS or Diffserv of the outgoing TDMoIP frames are user-configurable. This allows the TDMoIP packets to be given a higher priority by network switches and routers.

TDMoIP TIMING

- Synchronization between TDM devices is maintained, by deploying advanced clock distribution mechanisms. The clocking options are:
  - **Internal** – the master clock source for the TDM circuit is provided by IPmux-14's internal clock oscillator
  - **Loopback** – the transmit clock is derived from the E1/T1 port's receive clock
  - **Adaptive** – the clock is recovered from the Ethernet network interface
  - **External** – an external clock source to synchronize the device via its station clock port.

ETHERNET INTERFACE

- IPmux-14 supports the following Ethernet ports:
  - One network port (copper or fiber optic)
  - Two user ports (both copper or one copper + one fiber optic).
- The network and user ports feature autonegotiation, VLAN tagging and rate limiting.

APPLICATIONS

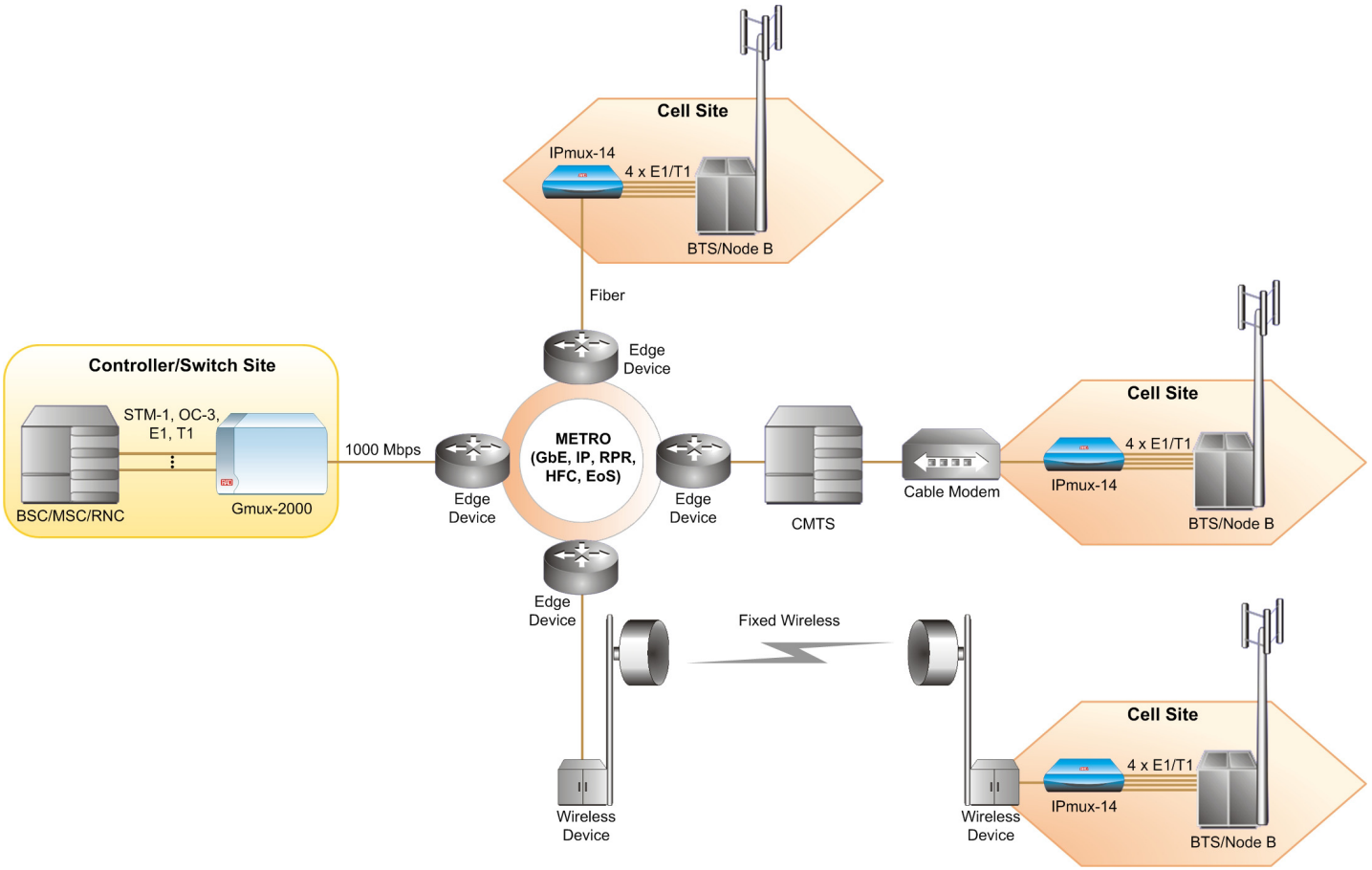


Figure 1. 2G/3G Cellular Backhaul over IP/Ethernet-Based Fiber Optic, Cable HFC and Wireless Links

TDM INTERFACE

- Four standard E1 or T1 ports provide connectivity to any standard E1 or T1 device.
- E1 and T1 interfaces support the following:
  - Integral LTU/CSU for long haul applications
  - G.703 unframed and G.704 framed modes
  - CAS and CRC-4 bit generation (E1)
  - D4/SF and ESF framing (T1).

DIAGNOSTICS

- External and internal loopbacks can be used to check TDM link connectivity.
- The following E1/T1 physical layer performance statistics are available: LOS, LOF, LCV, RAI, AIS, FEBE, BES, DM, ES, SES, UAS and LOMF.
- IPmux-14 performs an internal built-in test (BIT) after power-up. The results of the test are visible via the local terminal.
- IPmux-14 monitors LAN and IP layer network condition statistics, such as packet loss and packet delay variation (jitter). The events are stored in log files.
- Fault isolation, statistics and event logging are available.
- The minor and major alarms can be relayed to a remote alarm device via dedicated pins of the external clock RJ-45 connector.

MANAGEMENT

- IPmux-14 can be configured and monitored locally via an ASCII terminal, or remotely via Telnet, Web browser or RADview.
- Management traffic can run over a dedicated VLAN, allowing L2 VPN utilization for management purposes.
- The RADview Service Center and Element Manager packages control and monitor TDM over IP (TDMoIP) devices and circuits. The Service Center's intuitive GUI, "point-and-click" functionality and easy-to-follow wizards increase the efficiency and accuracy of the service provisioning process.
- Software download is supported via the local terminal, using XMODEM, or remotely, using TFTP. After downloading a new software version, IPmux-14 automatically saves the previous version in non-volatile memory for backup purposes. Similarly, copies of the configuration file may be downloaded and uploaded to a remote workstation for backup and restore purposes.

ENVIRONMENT

- IPmux-14H is a special version capable of withstanding extreme temperatures.

Note: *The environmentally hardened version is available with the UTP Ethernet ports only.*

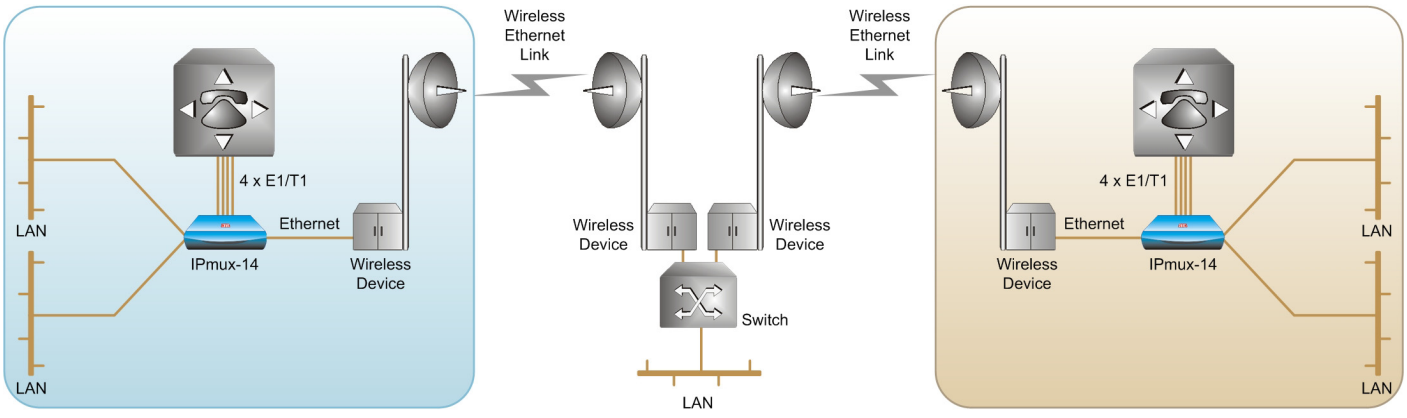


Figure 2. LAN and TDM Services over a Wireless Ethernet Link

SPECIFICATIONS

E1 INTERFACE

- **Number of Ports**
  4
- **Compliance**
  ITU-T Rec. G.703, G.704, G.706, G.732, G.823
- **Data Rate**
  2.048 Mbps
- **Line Code**
  HDB3
- **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 (for internal, loopback and external clocks)
- **Connector**
  - Balanced: RJ-45
  - Unbalanced: RJ-45 (RJ-45 to BNC adapter cable is supplied)

T1 INTERFACE

- **Number of Ports**
  4
- **Compliance**
  ANSI T1.403, ITU-T Rec. G.703, G.704
- **Data Rate**
  1.544 Mbps
- **Line Code**
  B8ZS, B7ZS, AMI
- **Framing**
  Unframed, SF, ESF
- **Signaling**
  CAS (bit robbing), CCS (transparent)
- **Line Impedance**
  100Ω, balanced
- **Signal Levels**
  Receive: 0 to -36 dB
  Transmit pulse amplitude:
  ±3V ±20%; 0 dB, -7.5 dB, -15 dB, 22.5 dB (CSU), user-selectable
  ±2.7V ±10%, 0 to 655 feet, (DSU), user-selectable
- **Jitter and Wander Performance**
  Per AT&T TR-62411, ITU-T G.824 (for internal, loopback and external clocks)
- **Connector**
  RJ-45

ETHERNET INTERFACE

- **Compliance**
  IEEE 802.3, 802.3u, 802.1p&Q
- **Number of Ports**
  - Network: 1 (copper or fiber)
  - User: up to 2 (copper only)
- **Data Rate**
  - UTP: 10 Mbps or 100 Mbps, full or half duplex
  - Fiber: 100 Mbps, full duplex

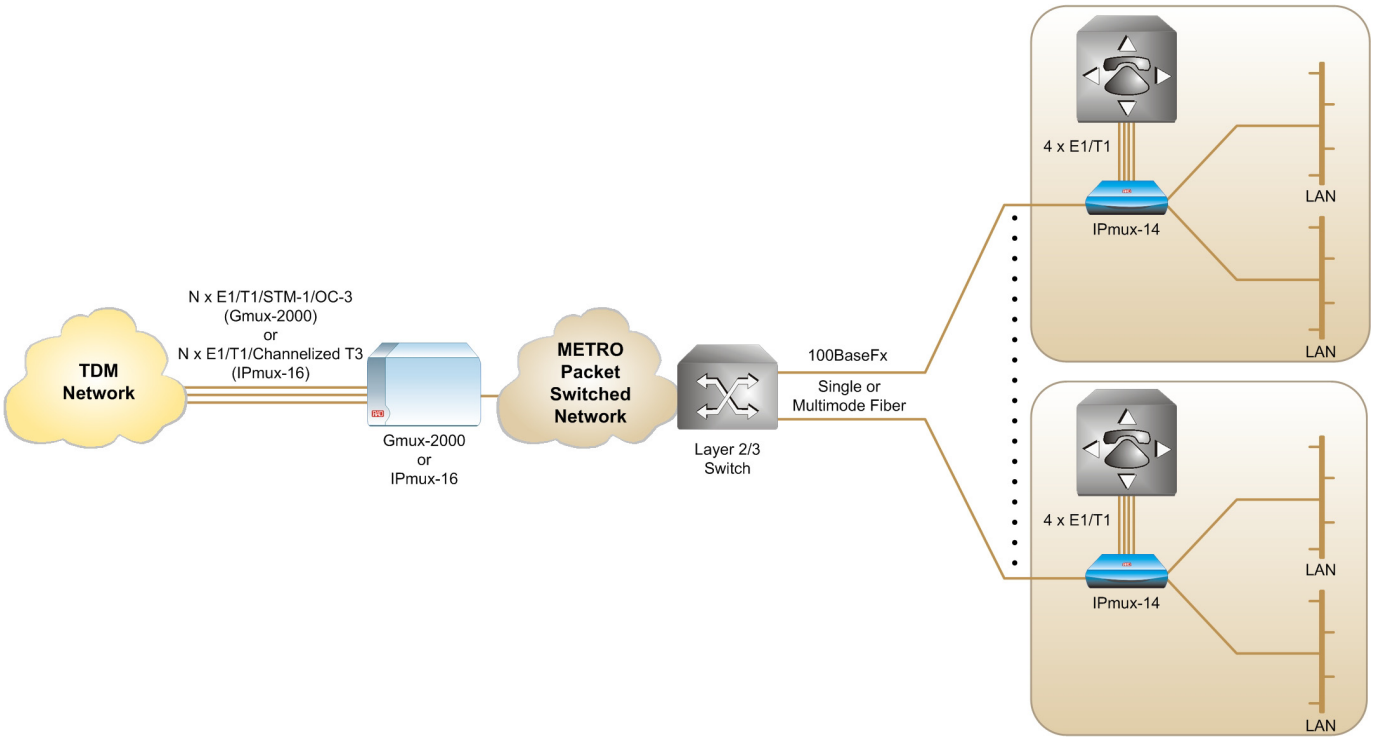


Figure 3. IPmux-14 Providing Ethernet in the First Mile

Table 1. Fiber Optic Interface Characteristics

Wavelength [nm]	Fiber Type [µm]	Transmitter Type	Power [dBm]		Receiver Sensitivity [dBm]	Loss [dB/km]		Typical Budget [dBm]	Connector Type
			Min	Max		Min	Max		
1310	62.5/125 multimode	LED	-19	-14	-32	1	4	10	LC
1310	9/125 single mode	Laser	-15	-8	-34	0.5	0.8	13	LC
1550	9/125 single mode	Laser	-5	0	-37	0.5	0.8	29	LC

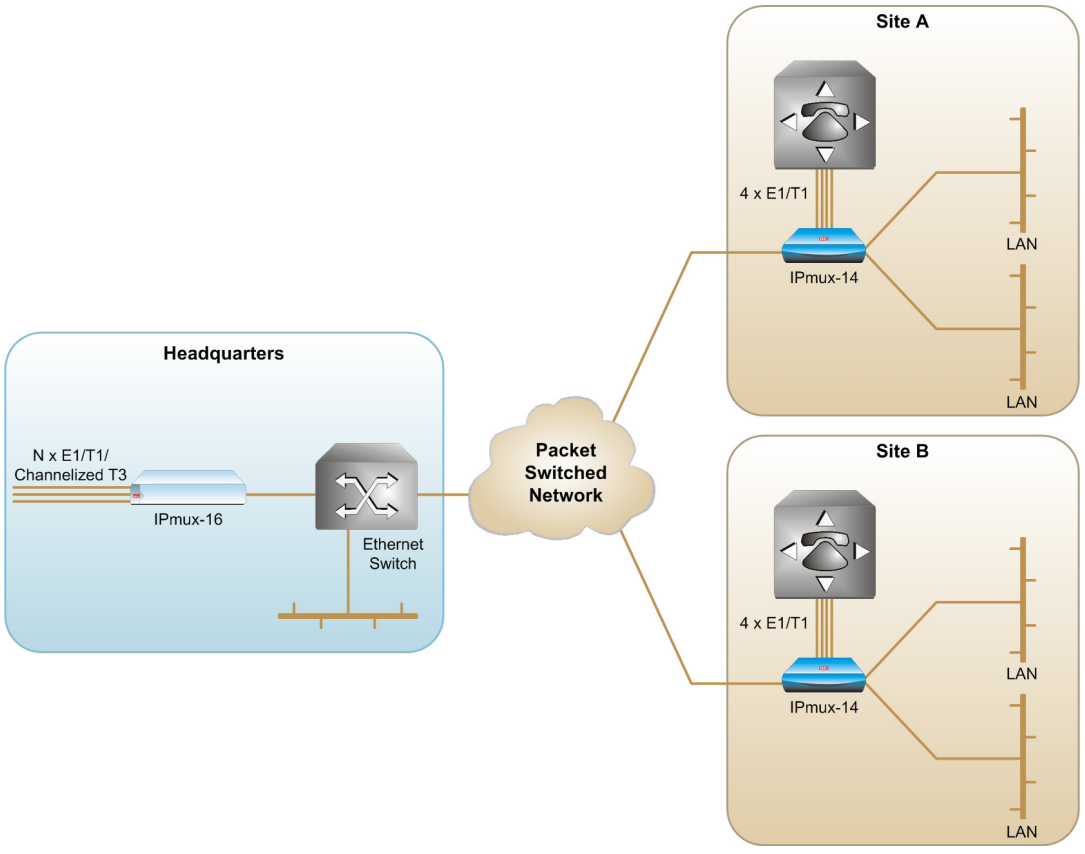


Figure 4. Corporate Multisite Communication over a Packet-Switched Network

IPmux-14

TDMoIP Gateway

BUNDLES

- **Number of Bundles**
  64 (16 bundles per link)
- **Number of TDM Bytes**
  48–1440 TDM bytes per Ethernet frame
- **Destination IP Address**
  User-configurable
- **Jitter Buffer Size**
  Up to 200 msec

MANAGEMENT PORT

- **Interface**
  V.24 (RS-232), DCE
- **Data Rate**
  9.6, 19.2, 38.4, 57.6, or 115.2 kbps
- **Connector**
  9-pin, D-type, female

GENERAL

- **Timing**
  - Internal
  - External (E1 or T1, via dedicated port)
  - Loopback
  - Adaptive
- **Diagnostics**
  - E1/T1 local loopback
  - E1/T1 remote loopback
- **Statistics**
  - E1/T1 (per G.826 and RFC 2495)
  - Ethernet (per RFC 2819)
  - Receive buffer indication (overflow, underflow, sequence error)
- **Alarm Relay**
  Dry contact via pin 6, pin 7 and pin 8 of the EXT CLK RJ-45 connector.
  Operates as Normally Open and Normally Closed, using different pins.
- **Indicators**
  PWR (green) – Power
  ALM (red) – Alarm
  TST (red) – Test is in progress
  E1/T1 SYNC (green) – E1/T1 synchronization
  LINK/ACT (green) – Ethernet link/activity status
- **Power**
  AC/DC: 100–240 VAC or -40 to -72 VDC
  DC: 24 VDC
- **Power Consumption**
  10W max
- **Physical**
  IPmux-14:
  Height: 43 mm (1.7 in)
  Width: 217 mm (8.5 in)
  Depth: 170 mm (6.7 in)
  Weight: 0.5 kg (1.1 lb)

  IPmux-14H:
  Height: 47 mm (1.8 in)
  Width: 215 mm (8.4 in)
  Depth: 147 mm (5.8 in)
  Weight: 0.7 kg (1.5 lb)
- **Environment**
  Temperature:
  IPmux-14:
  0 to 50°C (32 to 122°F)
  IPmux-14H: -30 to 65°C (-22 to 149°F)
  Humidity: Up to 90%, non-condensing

ORDERING

IPmux-14/@/#/+/&/%
TDMoIP gateway

@ Specify **H** for environmentally hardened unit

Note: *The environmentally hardened version is available with the UTP Ethernet ports only.*

Specify **24** for 24 VDC power supply

\+ Specify TDM interface type:
4E1 for 4 balanced E1 interfaces
4E1CX for 4 unbalanced E1 interfaces
4T1 for 4 balanced T1 interfaces

Note: *Unbalanced E1 interfaces are provided via RJ-45 to BNC adapter cables supplied with the product.*

& Specify the network Ethernet interface type:
UTP for 10/100BaseT interface, RJ-45 connector
MM13LC for multimode 1310 nm LED, LC connector
SM13LC for single mode 1310 nm laser, LC connector
SM15LC for single mode 1550 nm laser, LC connector

% Specify **UTP** for the 10/100BaseT user Ethernet interface, RJ-45 connector

SUPPLIED ACCESSORIES

Power cord

AC/DC adapter plug

DC connection kit (if a 24 VDC option has been ordered)

CBL-RJ45/2BNC/E1/X
RJ-45 to BNC adapter cable (if an unbalanced E1 interface has been ordered)

OPTIONAL ACCESSORIES

RM-33-2
Hardware kit for mounting one or two IPmux-14 units into a 19-inch rack

RM-35
Hardware kit for mounting one or two IPmux-14H units into a 19-inch rack

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