

## 4



## Last Mile (Local Loop)

RAD offers an array of Last Mile product solutions for extending multiple services transparently end-to-end over copper, fiber and wireless access infrastructure from DSLAMs, SDH/SONET or packet switched networks. RAD's portfolio also includes aggregation capabilities for handing off traffic to SDH/SONET and packet switched networks.

### DSL modems

The SHDSL.bis standard enables symmetrical transmission at rates up to 5.7 Mbps over 2-wire, 11.4 Mbps over 4-wire or 22.8 Mbps over 8-wire, to a range of 2.9 km (1.825 miles). With SHDSL.bis technology, a variety of services can be deployed over high bandwidth DSL connections. This compares with SHDSL, which enables symmetrical transmission at data rates up to 2.3 Mbps and symmetrical VDSL, which enables transmission at data rates up to 6, 13 or 26 Mbps for shorter ranges.

### Baseband modems

Baseband modems, also known as short haul or short range modems, connect computers, bridges, routers, and other digital communications equipment over relatively short distances, such as inside buildings and campuses or within cities. The modems overcome limitations of digital interfaces and can provide LAN extension when connected to bridges and routers. Many of RAD's baseband modems support LAN extension using a built-in remote bridge or router, with no need for an external one.

### Intelligent modems

Intelligent modems (RAD's "i" series) are baseband modems with management capabilities. These modems include a management channel that enables the user at the central site to configure the unit at the customer premises, remotely activate diagnostics and receive real-time alerts on the system status. The management channel can operate in parallel to the data channel over the same wire or fiber link.

### Fiber optic technology

Deregulation and demands for increased bandwidth have reduced the price of fiber optic cabling and installation. Fiber is generally superior to copper wires because it provides higher bandwidth over longer distances, is immune to electrical interference and power surges, and provides data security. Fiber optic modems are usually

smaller and lighter and consume less power than copper modems.

### Fiber optic distance and bandwidth

Distance and bandwidth are determined by fiber type and light source:

**Fiber type** – There are two types of fiber optic strands: multimode and single mode. Multimode fiber allows propagation of light at various paths, resulting in high attenuation, while single mode fiber allows a single transmission path, which results in lower attenuation and higher speeds.

**Light source** – Signal attenuation in fiber optics also depends on wavelength. Low attenuation occurs at three different wavelengths: 850 nm, 1310 nm and 1550 nm.

### Point-to-point wireless links

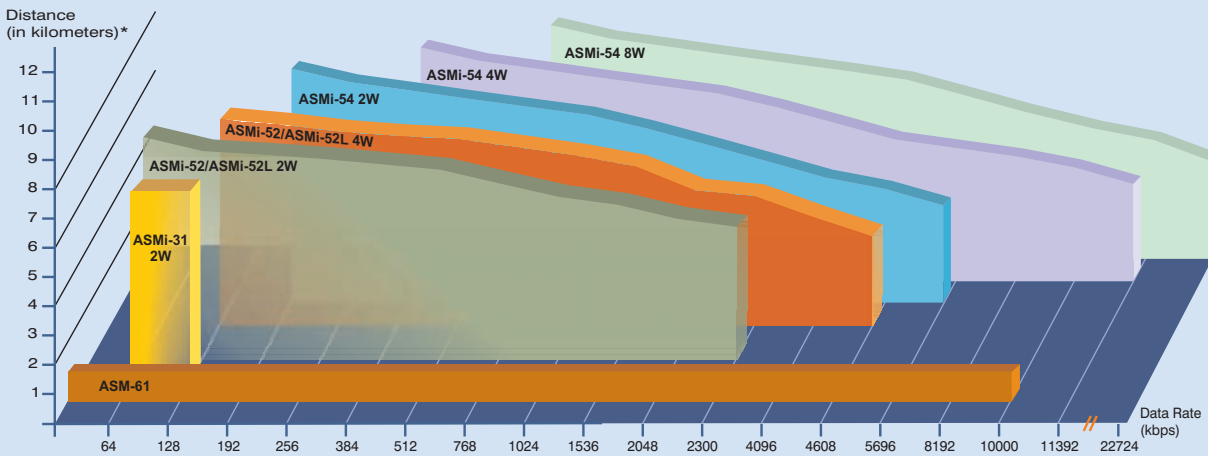
License-exempt wireless links provide high bandwidth connectivity over long distances, at a fraction of the cost and time required to deploy fiber optic cables. Businesses can also avoid the cost of leased line service by connecting remote campus locations over wireless links. The Airmux is RAD's wireless point-to-point multiplexer. It aggregates E1/T1 circuits and Ethernet traffic over wireless links, extending data/voice transmission for tens of kilometers and miles.

### Miniature fiber and short range modems

Miniature short range modems offer the same communications functions as AC-powered modems but with fewer features, such as limited diagnostics capability and no BER tests. Usually, they operate over shorter distances at lower rates (normally up to 19.2 kbps). However, certain modems can operate at data rates up to 115.2 kbps in async transmission and up to 128 kbps in sync transmission. A reference guide on pages 214-215 will help you select the most suitable modem for your application.

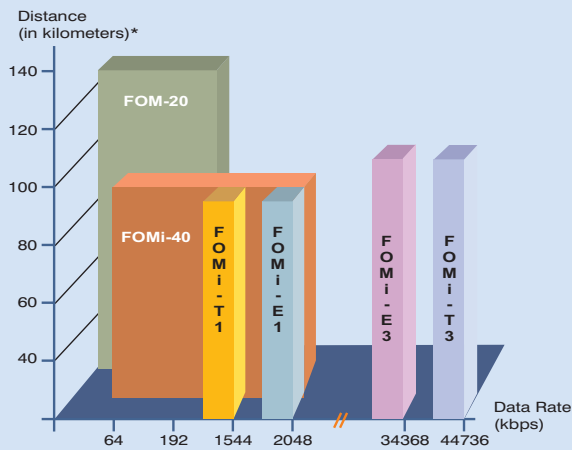


## Quick selection guide for choosing modems



### 2/4/8-wire modems

For applications using DSL line, these 2/4/8-wire copper modems offer extended distance and high data rates.



### Fiber optic modems

When the application requires immunity to electrical interference, high data security and extended distances, these fiber optic modems are recommended.

\*To calculate distance in miles, divide kilometers by 1.6.

Notes:

- 1) Ranges for 2/4/8-wire copper modems are measured over line simulators at 24 AWG.
- 2) Ranges for fiber optic modems are typical maximum ranges. Precise range is based on optical budget and fiber optic link attenuation.





## PFH-4

### Power Feeding Hub

- Remote power feeding of up to four SHDSL wire-pairs (four x 2-wire or two x 4-wire)
- Output power feeding options per line: 120 VDC @60 mA or 180 VDC @60 mA
- Terminal block connectors for each line input and output
- Current limit protection for each channel (line and earth)
- DIP switch allows for selective control for each wire-pair
- LED line status indicators
- Dry contact connectors for alarms
- All connectors on front of 1U-high, half 19-inch metal enclosure

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Although SHDSL modems provide superior reach in comparison with other DSL technologies, the maximum range of standard SHDSL modems is still not sufficient for some longer range applications, such as those along railways or pipelines. In such cases, SHDSL repeaters are employed to duplicate and retransmit the signal.

To simplify deployment and save the cost of laying power lines, repeaters can operate on a remote power feeding source. In other words, they can be powered over the same lines that carry the data traffic. RAD's PFH-4 is a remote power feeding hub designed especially to support long range SHDSL applications. It delivers power and data for up to four SHDSL wire-pairs (four x 2-wire lines or two x 4-wire lines), eliminating the need for local power sources for modems or repeaters on the line.

The hub runs on 48 VDC power and can supply an output of 120 VDC or 180 VDC to each line.

Each SHDSL wire-pair is input to the PFH-4, which then adds power to the original data signal. This power output feeds the repeaters on the line, which retransmit the data signal. Separate terminal block connectors are provided for easy connection of the input and output of each wire-pair.

All lines are protected from overload, short-circuiting and leakage to earth. At overload, a current-limiter drops the line, activates an LED alarm and initiates an auto-restart recovery.

Dry contacts relay major and minor alarm warnings via a DB-9 connector.

Front panel LEDs indicate the power feeding status for each line and provide warnings for current and temperature overload conditions. An external DIP switch allows selective power feeding for each individual line.



## ASM-40

### High Speed Short Range Modem

- Selectable data rates: 32 kbps to 2.048 Mbps
- Range up to 1.75 km (1.1 miles)
- SNMP-managed double modem card version for LRS-24
- V.54 diagnostics
- Digital interfaces: V.24, V.35, X.21, RS-530, V.36/RS-449, Ethernet (bridge) or G.703 (HDB3)
- Optional built-in router

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The ASM-40 is a high speed synchronous short range modem operating at 13 selectable data rates, from 32 kbps up to 2.048 Mbps with a range up to 1.75 km (1.1 miles).

The modem transmits data to the line at four data rates, depending upon the selected DTE rate or the PCM network. Data rates of 32, 64, 128, 256, 512, 1,024 and 2,048 kbps are transmitted at 2,048 kbps; data rates of 192, 384, 768 and 1,536 kbps are transmitted at 1,536 kbps; the 1,544 kbps data rate is transmitted at 1,544 kbps; and the 1,920 kbps data rate is transmitted at 1,920 kbps.

The modem's line interface is coded using HDB3, AMI or B8ZS (strap-selectable). On the digital side, a choice of V.35, V.36/RS-449, X.21, RS-530, built-in Ethernet bridge, router or G.703/HDB3 interfaces is available. This also enables the ASM-40 to perform as an interface converter, a rate converter or a repeater for G.703.

The ASM-40 features V.54 diagnostic capabilities to perform local analog loopbacks and local and remote digital loopbacks. An internal test pattern complying with the V.52 standard can be generated to provide end-to-end integrity testing.

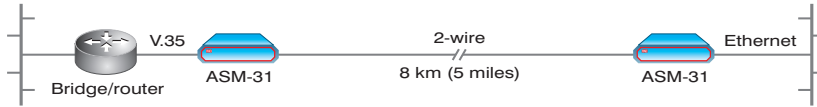
The ASM-40 is available as a standalone unit or as a card for the 19-inch ASM-MN-214 rack that holds up to 14 cards (see page 143).

An SNMP-managed double modem card – ASM-40CD – is available for the LRS-24 chassis. This chassis can hold up to 24 modems and provides management from a central or remote management station. RADview, RAD's SNMP management application, enables configuration, monitoring and diagnostics for the ASM-40CD cards, as well as for other modems in the LRS-24 modem rack.



# ASM-31

## 2-Wire Multirate Short Range Modem



- **Selectable data rates:**
  - 1.2 kbps up to 128 kbps (sync)
  - Up to 38.4 kbps (async)
- **2-wire full duplex**
- **Adaptive echo canceller**
- **Range up to 8 km (5 miles) over 24 AWG lines**
- **2B1Q line code**
- **DTE interfaces: V.24/RS-232, V.35, V.36, RS-530, X.21, Ethernet (bridge) or G.703 codirectional (64 kbps)**
- **Optional built-in router**

The ASM-31 multirate sync/async short range modem operates full duplex over a 2-wire twisted pair. The ASM-31 can operate at selectable data rates from 1.2 kbps to 128 kbps. Full duplex operation is achieved using the adaptive echo cancellation technique. This method entails setting one modem as a master and the other as a slave (switch-selectable). 2B1Q line coding provides an operating range of up to 8 km (5 miles) for all data rates, with an internal rate converter that converts all DTE data rates to a line data rate of 128 kbps. Local and remote loopbacks can be activated from either side of the line, to test both

modems and the line. Loopbacks are controlled by a manual switch or from the DTE interface. The modem includes a BER tester for complete end-to-end integrity testing. An error LED indicates each bit error detected. The ASM-31 has line protection circuits against lightning and power surges. Interface options include V.24/RS-232, V.35, V.36, X.21, RS-530, built-in Ethernet bridge, router, and G.703 codirectional 64 kbps. The analog line connectors are RJ-45 and terminal block. The ASM-31 is available as a standalone unit or as a card for the 19-inch ASM-MN-214 rack that holds up to 14 cards (see page 143).

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# ASM-20

## Sync/Async Short Range Modem



The ASM-20 is a synchronous/asynchronous short range modem operating at selectable rates from 19.2 kbps to 256 kbps, full or half duplex over twisted pair, unconditioned lines. It has a range of 7.5 km (4.7 miles) at 64 kbps. The modem uses conditional diphase modulation (EUROCOM Std. D1), which provides immunity to background noise, eliminates normal line distortion and enables efficient transmission over twisted pair. Transmit timing is provided internally, derived externally from the DTE or recovered from the receive signal. The carrier may be continuous or controlled for passing control signals end-to-end.

The ASM-20 features diagnostic capabilities, complying with the V.54 standard to perform local and remote loopbacks. A built-in bit error rate tester (BERT), activated and monitored from the front panel, complies with the V.52 standard to enable complete testing of both modems and the line.

Several interface options are available: V.24/RS-232, V.35, V.36, X.21, RS-530, built-in Ethernet bridge, and G.703 codirectional (64 kbps). The ASM-20 has line protection circuits against lightning and power surges. It is available as a standalone unit or as a card for the 19-inch ASM-MN-214 rack that holds up to 14 cards (see page 143).

**Approximate Range for 24 AWG (0.5 mm)**

Data Rate (kbps)	km	miles
19.2	9.7	6.0
32	8.7	5.4
64	7.5	4.6
128	5.0	3.1
144	4.5	2.8
256	2.2	1.4

- **Selectable data rates from 19.2 kbps to 256 kbps**
- **Full or half duplex over 4-wire**
- **Range up to 7.5 km (4.6 miles) at 64 kbps**
- **Built-in BER tester**
- **V.54 diagnostics**
- **Automatic equalizer**
- **DTE interfaces: V.24/RS-232, V.35, V.36, X.21, RS-530, Ethernet (bridge) or G.703 codirectional (64 kbps)**

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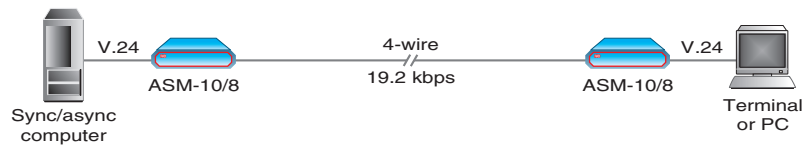
## ASM-10/8

### Sync/Async Short Range Modem

- Full or half duplex over 4-wire
- Data rates up to 19.2 kbps
- Range up to 10 km (6.2 miles) at 19.2 kbps
- Controlled or continuous carrier
- V.54 diagnostics
- Automatic equalizer

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The ASM-10/8 is a sync/async short range modem operating full or half duplex over twisted pair, unconditioned lines in point-to-point applications. It has a range of up to 10 km (6.2 miles) and operates at nine selectable rates up to 19.2 kbps. The modem uses conditional diphase modulation (EUROCOM Std. D1), which provides immunity to background noise, eliminates normal line distortion and enables efficient transmission over



twisted pair. Transmit timing is provided internally, derived externally from the DTE or recovered from the receive signal.

The ASM-10/8 features diagnostic capabilities complying with the V.54 standard to perform local and remote loopbacks.

The unit has a V.24/RS-232 interface and is available as a standalone unit or as a card for the 19-inch ASM-MN-214 rack that holds up to 14 cards (see page 143).

#### Approximate Range for 24 AWG (0.5 mm)

Data Rate (kbps)	km	miles
19.2	10.0	6.0
9.6	13.0	8.0
4.8	16.0	10.0
2.4	21.0	13.1
1.2	28.0	17.5



## FOMi-E1/T1

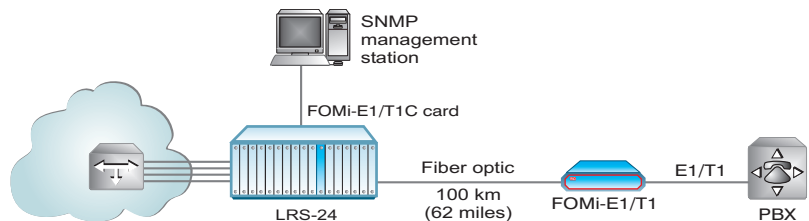
### E1/T1 Fiber Optic Modem with Remote Control

- Extends the range of equipment with electrical E1 or T1 interfaces over fiber
- Inband management of both local and remote units
- Supports balanced and unbalanced interfaces
- Transparent to framing (ITU G.704)
- Laser diode option for extended range

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The FOMi-E1/T1 extends the limited range of the electrical interface of E1 or T1 equipment over fiber optic links. Range extension is provided for the following interfaces:

- 100 ohms balanced T1 at 1.544 Mbps
  - 120 ohms balanced E1 at 2.048 Mbps
  - 75 ohms unbalanced E1 at 2.048 Mbps
- The modem is transparent to ITU G.704 framed signals.



An inband management channel enables monitoring and control of local and remote units. The management channel is transmitted over the same fiber optic link used for data transfer, with no interference between them.

The FOMi-E1/T1 is available as a standalone unit with a front panel LCD, or with a blank panel and a portable control unit (PCU) to prevent unauthorized operation. A card version of the FOMi-E1/T1 is available for the LRS-24 19-inch

rack with central SNMP management. A double modem card is also available for the LRS-24, which supports up to 24 modems in a 4U/6U-high chassis.

Two BNC coax connectors and an RJ-45 connector are used for connection to coax or twisted pair cables. An additional DB-9 connector is used for external dry contact relay activation in case of major or minor alarms.

# FOMi-E3, FOMi-T3

## E3, T3 and HSSI Manageable Fiber Optic Modems



The FOMi-E3 and FOMi-T3 are high speed fiber optic modems that extend the transmission range of electrical E3 or T3 over fiber optic cables:

**FOMi-E3** for E3 rates (34.368 Mbps)

**FOMi-T3** for T3 rates (44.736 Mbps)

The standalone version of both modems can optionally support an HSSI DCE interface, which operates at the same rate as the modem type into which it is inserted (E3 at 34.368 Mbps and T3 at 44.736 Mbps). The HSSI option also supports bit rates of one-half and one-fourth of the main link rate. This option enables connection of high speed HSSI routers over backbones at E3 or T3 rates.

### Low cost extension and conversion of E3/T3 fiber interfaces

The FOMi-E3 and FOMi-T3 can substitute for an ACE, DXC or Optimux unit at the central office that works opposite identical devices at the customer premises, thereby enabling low cost extension and conversion of E3/T3 fiber interfaces to standard electrical interfaces. When replacing an Optimux device at the central office, the FOMi-E3 or FOMi-T3 enables the use of one E3/T3 port on the ADM rather than using many E1/T1 ports.

### Wide range of optical interfaces

The optical interface of the FOMi-E3 or FOMi-T3 is modular. The modems support the wide range of optical modules supported by the Optimux.

These modules include multimode, single mode, laser, long haul laser, WDM, and all types of optical connectors. There is an option to install two optical interfaces for full redundancy of the optical link. There is also an option of dual power supplies for additional redundancy.

FOMi-E3 and FOMi-T3 are available as cards for the LRS-24 19-inch SNMP-managed rack. The LRS-24 rack can accommodate up to seven FOMi-E3 or FOMi-T3 cards, saving cost and space at the central office.

### Management options

RADview, RAD's SNMP network management system for modem applications, enables management of multiple LRS-24 chassis and the attached remote units. These can be other FOMi-E3 or FOMi-T3 units or FOMi-E1/T1 and FOMi-40 units.

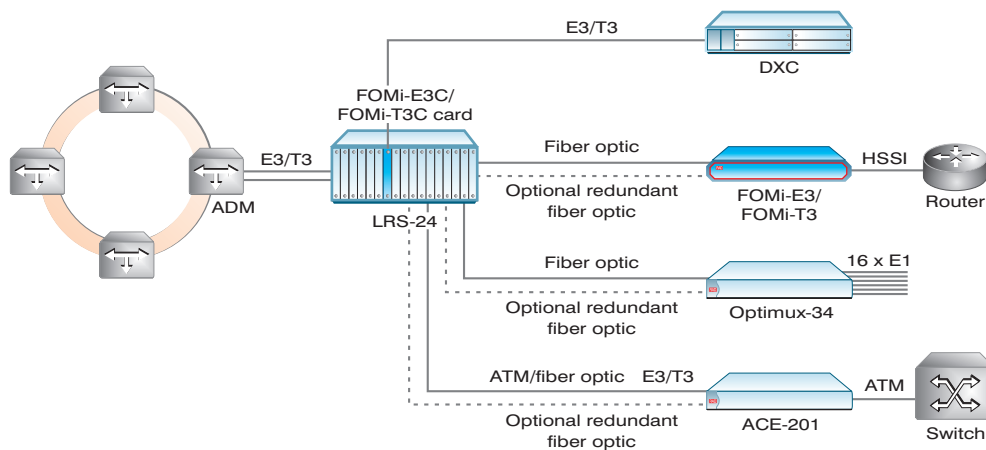
Another option for managing a pair of FOMi-E3 or FOMi-T3 modems is with an ASCII terminal connected to the RS-232 connector on the front panel of the standalone unit, or on the LRS-24 common logic card. Terminal controls can also

- Extends the range of equipment with electrical E3, T3 or HSSI interfaces
- Inband management on both local and remote units
- Redundancy on fiber optic link and power supply
- Wave Division Multiplexing (WDM) module for operation over a single-strand fiber optic link
- Works opposite Optimux, ACE and DXC
- Different clock modes including central system clock
- Wide range of modular optical interfaces

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be activated from a remote site using a dial-up modem connection.

Dry contact alarm relay for activating external alert devices in case of major or minor alarm is available in the FOMi on the rear panel of the standalone modem or on the common logic card of the LRS-24.







## FOMi-40

High Speed Fiber Optic Modem with Remote Control

- **User-selectable data rates from 56 kbps to 2.048 Mbps**
- **Extended transmission range up to 100 km (62 miles)**
- **Inband management of local and remote units**
- **Automatic rate detection in tail-end applications**
- **Digital interfaces supported: V.24 (64 kbps only), V.35, X.21, RS-530, V.36/RS-449, Ethernet bridge, Fast Ethernet bridge, G.703 E1, G.703 T1, and G.703 codirectional (64 kbps)**

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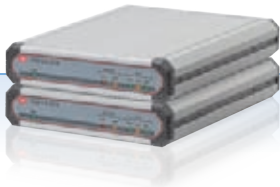
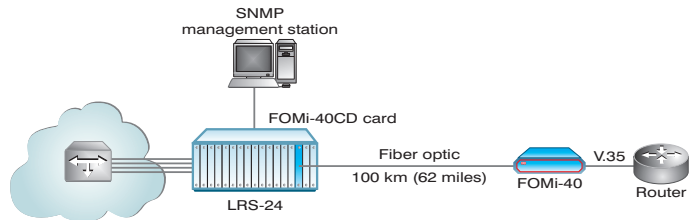
The FOMi-40 is a high speed sync fiber optic modem with remote configuration and monitoring. It supports user-selectable data rates from 56 kbps to 2.048 Mbps.

The FOMi-40 supports the common fiber optic wavelengths and connector types, operating over different types of fiber optic links.

An inband management channel allows the user to monitor, control and configure the remote unit using the same fiber links as for data transmission, with no interference between them.

In tail-end applications, the local FOMi-40 automatically detects the external clock rate and is locked accordingly. It also updates the remote unit's clock rate via the management channel. This enables synchronization of local and remote units to the network clock.

The FOMi-40 is available as a standalone unit or as a card version for the LRS-24 19-inch rack with central SNMP management. A double modem card is available for the LRS-24, which supports up to 24 modems in a 4U/6U-high chassis.



## FOM-E3/ETH, FOM-T3/ETH

10/100BaseT over E3/T3 Fiber Optic Modems

- **Extends the range of 10/100BaseT signals over E3/T3 services via fiber optic cable up to 110 km (68 miles)**
- **Built-in bridge and VLAN support**
- **Wave Division Multiplexing (WDM) for transmission over single fiber link**
- **User-selectable IP multicast and broadcast prevention towards the WAN**
- **Multimode or single mode fiber**

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The FOM-E3/ETH and FOM-T3/ETH fiber optic modems convert a 10/100BaseT electrical signal into an optical signal with a range of up to 110 km (68 miles).

These modems transparently connect between LANs, achieving maximum bandwidth utilization of the E3/T3 link, without the heavy overhead associated with packet- or cell-based

technologies. They provide built-in bridging and VLAN support at Ethernet/Fast Ethernet rates, enabling virtual connection of remote LANs (e.g., campus applications).

The Ethernet interface module performs frame filtering and forwarding at the Fast Ethernet maximum theoretical rate of 150,000 frames per second. The bridge causes no LAN delays.

Different optical interfaces are available:

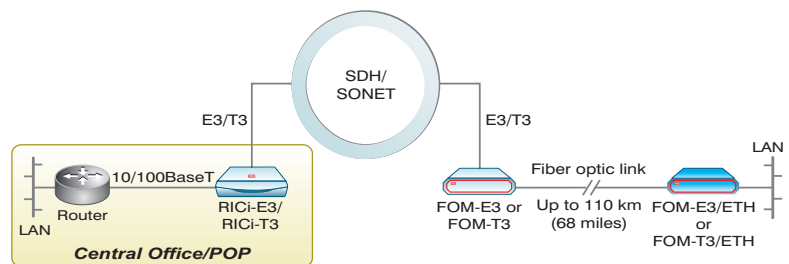
- 850 nm for multimode fiber
- 1310 nm for single or multimode fiber
- 1310 nm and 1550 nm laser diode, long haul

laser for extended range over single mode fiber

- WDM laser for transmission over a single fiber

The modems can be configured by the user to enable or prevent broadcast and IP multicasting to the WAN as required. The FOM-E3/ETH and FOM-T3/ETH can be used to connect LANs and high speed routers over E3/T3 links to the network.

The products are available as standalone units. They can be mounted in a standard 19-inch rack using special hardware, or two units can be mounted side-by-side.



## FOM-E3, FOM-T3

### E3, T3 Fiber Optic Modems



The high speed FOM-E3 and FOM-T3 fiber optic modems extend transmission range of electrical E3 or T3 signals over fiber optic cables up to 110 km (68 miles).

Two models are available:

- FOM-E3 for E3 rates (34.368 Mbps)
- FOM-T3 for T3 rates (44.736 Mbps)

The FOM-E3 and FOM-T3 support a wide range of fiber optic interfaces, including long haul laser for extended ranges and WDM laser for transmission over a single fiber.

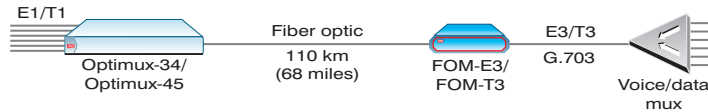
Transparent to E3/T3 framing, the FOM-E3 and FOM-T3 modems operate opposite RAD's DXC cross connect, Optimux-34 multiplexer (FOM-E3)

and Optimux-45 multiplexer (FOM-T3). Similarly, they can operate opposite an ACE ATM access device, enabling E3/T3 ATM traffic to be transported over long distances on fiber and connect to an ATM or SDH network device with an electrical E3/T3 port.

FOM-E3 and FOM-T3 operation complies with ITU G.703, G.921 and G.956 standards. In addition, the modems support activation of local and remote loopbacks in compliance with the ITU V.54 standard.

The FOM-E3 and FOM-T3 modems include a dry contact alarm port for relay of alarm conditions to external alert equipment.

- Extends the range of E3 or T3 signals over fiber optic cable up to 110 km (68 miles)
- Wave Division Multiplexing (WDM) module for operation over a single fiber strand
- Wide range of optical modules including long haul lasers for extended range
- Operates opposite Optimux, ACE and DXC
- Built-in diagnostics comply with V.54 standard
- Dry contact alarm port for external alert devices



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## FOM-E1/T1

### E1/T1 Fiber Optic Modem



The FOM-E1/T1 fiber optic modem converts an E1/T1 electrical signal into an optical signal. After the conversion, the signal is transmitted over fiber optic cable, extending the E1/T1 service range up to 144 km (89.4 miles).

The FOM-E1/T1 is transparent to E1/T1 framing (G.704), which enables it to transmit both framed or unframed E1/T1 signals.

Using the FOM-E1/T1 opposite the DXC cross connect system, Megaplex access multiplexer or FCD access unit reduces the cost of the fiber optic link when accessing the SDH/SONET network.

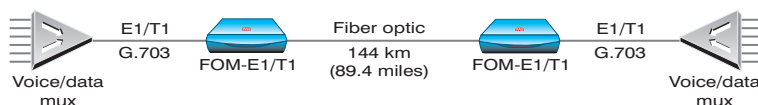
The FOM-E1/T1 supports various optical interfaces:

- 850 nm for multimode fiber
- 1310 nm for single mode or multimode fiber
- 1550 nm laser diode for extended range over single mode fiber
- WDM for single fiber extension

FOM-E1/T1 operation complies with ITU G.703, G.921 and G.956 standards. The modem supports activation of local and remote loopbacks in compliance with the ITU V.54 standard.

Front panel LEDs indicate system faults in the electrical and fiber optic circuits.

- Extends the range of E1/T1 services over fiber optic cables up to 144 km (89.4 miles)
- Transparent to E1/T1 framing
- Operates opposite RAD's DXC cross connect system, Megaplex access multiplexers and FCD access units
- Conforms to all relevant ITU series standards, including V.54 diagnostics support



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## FOM-40

### High Speed Fiber Optic Modem

- **Selectable data rates: 56, 64, 112, 128, 256, 384, 512, 768, 1,024, 1,536, 1,544 and 2,048 kbps**
- **Range up to:**
  - 5 km (3 miles) for 850 nm multimode
  - 20 km (12.5 miles) for 1310 nm single mode
  - 50 km (31 miles) for 1310 nm laser diode
  - 100 km (62 miles) for 1550 nm laser diode
- **V.54 diagnostics and built-in BER tester**
- **Digital interfaces: V.24 (up to 64 kbps), V.35, X.21, RS-530, G.703 codirectional, Fast Ethernet/Ethernet (bridge)**

The FOM-40 is a high speed, synchronous fiber optic modem operating full or half duplex over fiber optic cable. It has selectable data rates from 56 kbps up to 2.048 Mbps, and a range up to 100 km (62 miles) using single mode 1550 nm laser diode. The FOM-40 can operate over single mode or multimode fiber using 850 nm or 1310 nm LEDs, 1310 nm laser diode or 1550 nm laser diode.

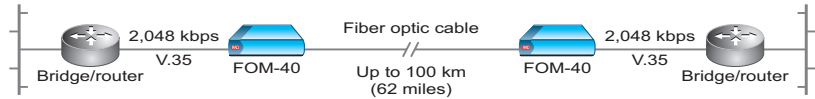
The large variety of interfaces supported by the FOM-40 facilitates the connection of distant routers to data services. The Ethernet/Fast Ethernet bridge modules enable the connection of remote LANs and VLANs. The FOM-40 extends

these services and connections over fiber optic cables and performs the hand-off to the SDH/SONET or IP network.

The FOM-40 features V.54 diagnostics to perform local analog/digital and remote digital loopbacks. Loopback commands are controlled either manually by a front panel switch or via the DTE interface signals. The front panel switch generates an internal pseudo-random test pattern (511) according to the V.52 standard, for testing end-to-end connectivity.

The FOM-40 is available as a standalone unit or as a card for the ASM-MN-214 19-inch rack.

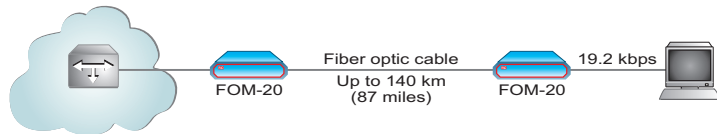
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## FOM-20

### Sync/Async Fiber Optic Modem

- **Wide range of selectable data rates - 19.2 kbps up to 256 kbps**
- **Synchronous or asynchronous data transmission**
- **Range up to:**
  - 8 km (5 miles) for 850 nm multimode
  - 25 km (15.5 miles) for 1310 nm single mode
  - 60 km (37.5 miles) for 1310 nm laser diode
  - 140 km (87 miles) for 1550 nm laser diode
- **Digital interfaces: V.24 (up to 64 kbps), V.35, X.21, RS-530, V.36/RS-449, Ethernet (bridge), and G.703 codirectional**
- **V.54 diagnostics and built-in BER tester**



The FOM-20 is a sync/async fiber optic modem operating full or half duplex over fiber optic cable. It has 16 selectable data rates from 19.2 kbps up to 256 kbps. Four rates are for asynchronous transmission and 11 rates are for synchronous transmission (19.2 kbps is for both sync and async).

The FOM-20 can operate over single mode or multimode fiber using 850 nm or 1310 nm LEDs and 1310 nm or 1550 nm laser diodes.

The main application for the FOM-20 is point-to-point fiber links at ranges longer than any copper modem can achieve, in noisy environments or when security is a primary concern.

The FOM-20 features V.54 diagnostics to perform local analog/digital and remote digital loopbacks. Loopback commands are controlled either by a manual switch or via the DTE interface signals. The FOM-20 includes a built-in BER tester, which is activated by a front panel switch and generates a 511 pseudo-random test pattern according to the V.52 standard.

The FOM-20 is available as a standalone unit or as a card for the ASM-MN-214 19-inch rack. An optional kit is available for mounting one or two standalone units in a 19-inch rack.

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# ASMi-52, ASMi-52L

## 2/4-Wire SHDSL Modems/Multiplexer



The ASMi-52 and ASMi-52L modems use TC-PAM 16 line coding SHDSL technology to extend the range of digital interfaces. These devices offer longer distances and variable data rates up to 2.3 Mbps over 2-wire and 4.6 Mbps over 4-wire.

### ASMi-52 multiplexer version

The ASMi-52 multiplexer model is equipped with one or two user ports. It can transmit combinations of V.35/X.21/RS-530 data, 10/100BaseT LAN, and E1 traffic over a single SHDSL link at a maximum data rate of 2.3 Mbps.

### ASMi-52L version

The economically priced ASMi-52L model is offered for applications requiring a single service, available with a port for E1, V.35, X.21 or Ethernet, or four 10/100BaseT ports with integral switch.

The ASMi SHDSL modems extend the range of 2 Mbps data transmission up to 4 km (2.5 miles) over 2-wire cable and even farther over 4-wire cable, reaching a maximum of 10 km (6.2 miles) for 64 kbps data. All models are compatible with 2/4-wire repeaters, such as RAD's S-RPT, for supporting even longer-range applications.

The products comply with ITU-T G.991.2 and ETSI 101524 standards for SHDSL.

They also work opposite RAD's DXC, and Megaplex SHDSL modules. Monitoring, control and diagnostics of local and remote units are available via a supervisory port. Standards compliance enables the ASMi modems to work opposite third-party TDM equipment that support the SHDSL standard.

### Card version

The ASMi-52 is available as a standalone unit or as a card for the LRS-24 19-inch rack with central SNMP management.

The ASMi-52 is also available in a half 19-inch metal enclosure or a rugged metal enclosure designed for easy installation on standard cabinet rail mounts that meet the EN 50121-4 industry standard (also for ASMi-52L with four Ethernet ports).

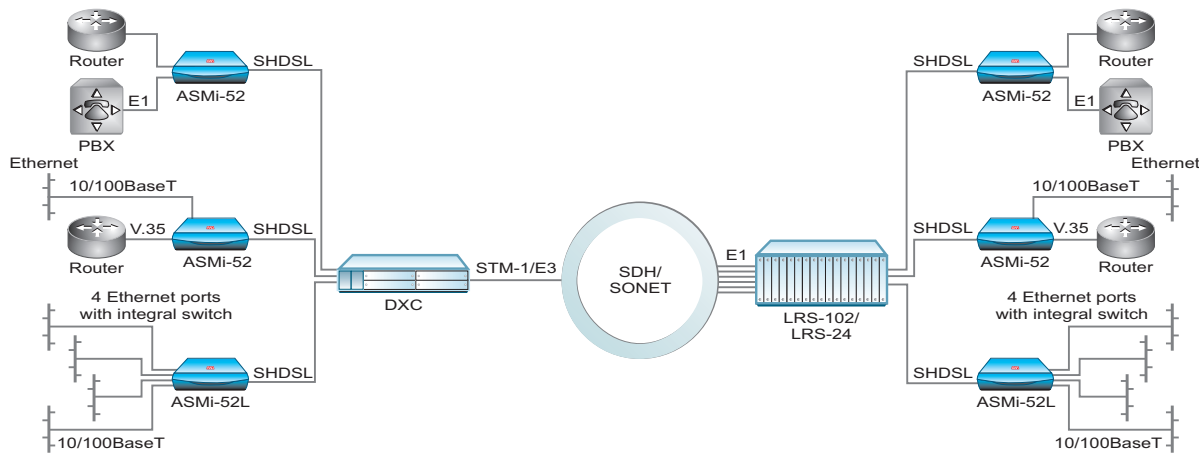
### Management options

The management connection to the standalone unit is via:

- V.24/RS-232 port using SLIP protocol
- Out-of-band Ethernet port (ASMi-52 only)
- Dedicated timeslot using E1/T1 port (ASMi-52 only)

- Data rates up to 2.3 Mbps over 2-wire and 4.6 Mbps over 4-wire
- Extended range up to 10 km (6.2 miles)
- Reliable performance over poor quality or noisy lines
- Works opposite LRS-24, DXC, Megaplex, and third-party equipment
- ASMi-52 user port options: E1, T1, V.35, X.21, RS-530, and 10/100BaseT with bridge or router
- ASMi-52 multiplexer version with two user ports integrates V.35/X.21/RS-530 data, 10/100BaseT LAN, and E1 traffic over SHDSL link
- ASMi-52L: single V.35, X.21, E1, 10/100BaseT user port, or four 10/100BaseT ports with integral switch
- Automatic configuration for fast and easy installation
- Available as a dual/quad modem card for the LRS-24 19-inch rack

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Varied services over SHDSL





# ASMi-54, ASMi-54C, ASMi-54L, ASMi-54L/RT

SHDSL.bis Modems with Integrated  
Router or Multiplexer

- Point-to-point E1 and Fast Ethernet extension over multiple SHDSL.bis lines
- Standards-compliant SHDSL (ITU-T G.991.2 and ETSI 101524)
- TC-PAM 16 or TC-PAM 32 line coding
- EFM (Ethernet in the First Mile) bonding per IEEE 802.3-2005; M-Pair bonding for HDLC per G.991.2
- Ethernet switching and bridging
- Built-in router (ASMi-54L/RT)
- VLAN prioritization and Ethernet QoS support
- Daisy-chain or ring topology with STP support per IEEE 802.1D
- Managed via SNMP, Telnet and ASCII terminal
- Optional rail mountable metal enclosure for extreme temperatures (ASMi-54)

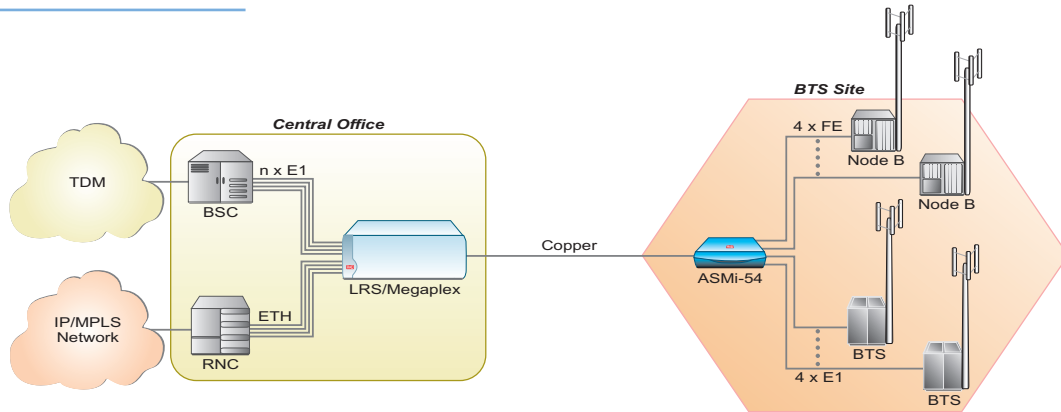
The ASMi-54 line includes a range of cost-effective, managed devices for extending E1 and mid-band Ethernet services over multi-pair bonded copper links. Ensuring reliable performance over poor quality or noisy lines, the ASMi-54 SHDSL.bis modem and ASMi-54C module operate in full duplex mode over 2-wire, 4-wire or 8-wire lines, achieving variable data rates of up to 22.8 Mbps. The ASMi-54L and ASMi-54L/RT provide access rates of up to 11.4 Mbps over 4-wire connections. The devices can achieve an extended service range of up to 2.6 km (1.825 miles) for each 5.7 Mbps pair at 26 AWG.

The ASMi-54 modems are ideal for carriers, service providers and mobile operators, as well as corporate, utilities and transportation companies looking for economical delivery of voice and broadband data traffic in point-to-point or hub and spoke communications. In addition, ASMi-54's ruggedized design ensures reliable operation in industrial applications and harsh environments.

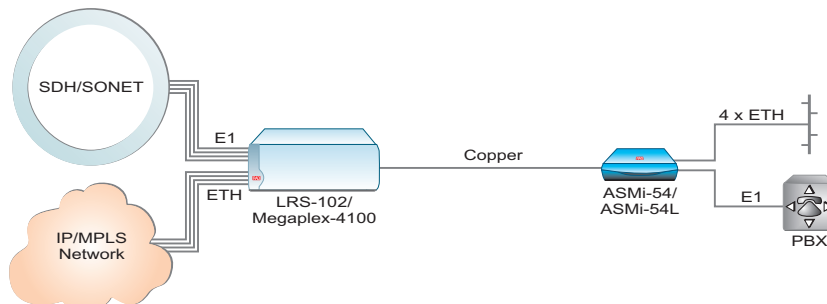
### Ethernet capabilities and QoS support

Featuring a built-in Ethernet switch, the ASMi-54 SHDSL.bis modems include up to four 10/100BaseT user ports and support VLAN-aware and VLAN-unaware bridging. VLAN stacking (Q-in-Q) and stripping functionalities

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Base stations over DSL infrastructure



Deploying Ethernet and E1 services over SHDSL.bis



ASMi-54, rail-mount enclosure



enable transparent traffic delivery over packet switched networks with optimal efficiency.

QoS (quality of service) levels are defined according to VLAN priority (802.1p), IP Precedence, DSCP, or per port, offering users flexibility in differentiating traffic handling depending on application requirements. Up to four priority queues are supported using Strict Priority (SP) scheduling.

Fault propagation enables the units to shut down the Ethernet user port when an SHDSL line failure is detected. EFM bonding capabilities ensure that a failure or addition of a link does not drop the traffic being transmitted over the other wires in the group. Capacity is also

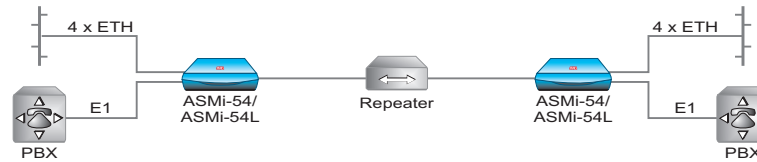
maintained when a new link is added at a lower rate during Ethernet transmission.

**IP routing functionalities**

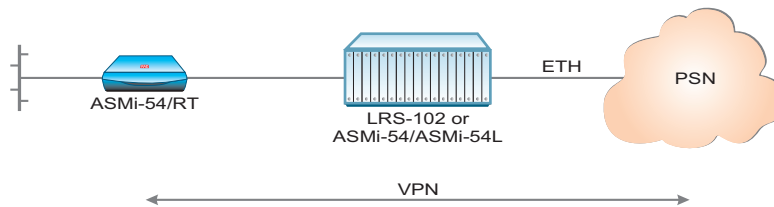
In addition to its Ethernet bridging attributes, the ASMi-54L/RT incorporates a built-in router to allow secure and efficient Layer 3 IP connectivity over packet switched networks. The device enables port forwarding whereby packets are delivered according to a static NAT/PAT (network address translation/port address translation) table. This allows multiple LAN devices to share a single public IP address, so that outgoing traffic appears to originate from a single device – the ASMi-54L/RT.

A Solid Firewall™ protection for the LAN and WAN interfaces, as well as for the DMZ sub-network, provides security against unauthorized network access, including malicious denial of service (DoS) and distributed denial of service (DDoS) attacks. Protective measures include rate limiting for ingress packets of vulnerable types, stateful packet inspection (SPI) and service authorization, among others.

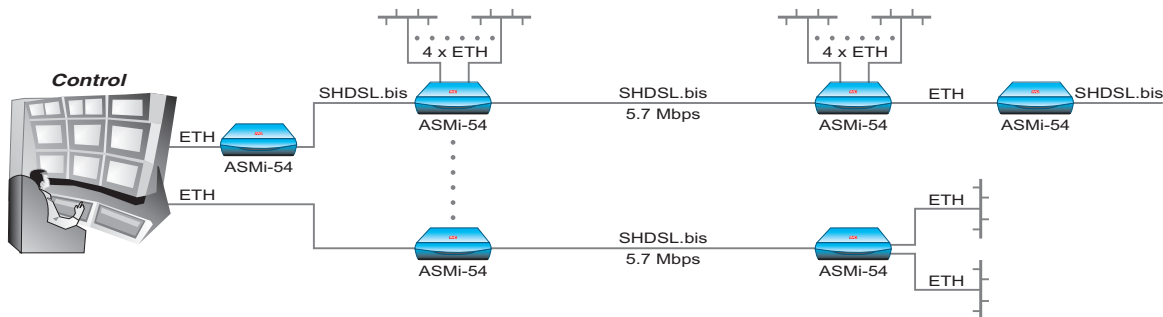
The ASMi-54L/RT supports QoS differentiation for IP applications with four priority queues, Strict Priority scheduling and user-configurable classification according to DSCP values.



SHDSL services with repeater



SHDSL.bis router for small/medium office



Daisy-chain extension of Ethernet access over SHDSL.bis





Metal case version

# ASMi-54, ASMi-54C, ASMi-54L, ASMi-54L/RT (Continued)

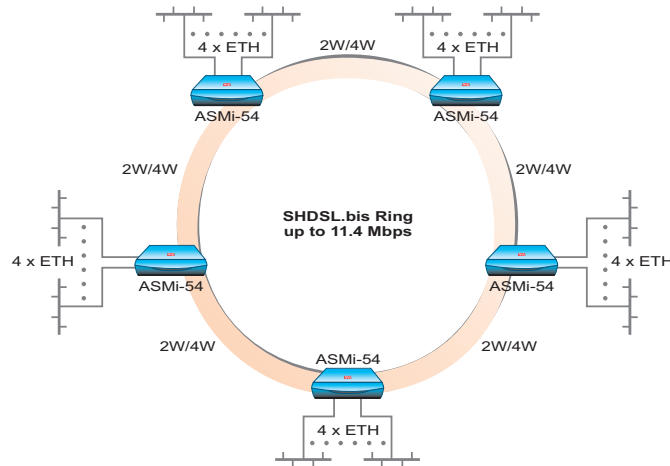
### High flexibility with daisy-chain and ring topologies

The ASMi-54 supports drop-and-insert (daisy-chain) applications, enabling bi-directional delivery of high rate Ethernet traffic over DSL lines by connecting multiple locations in a multidrop network.

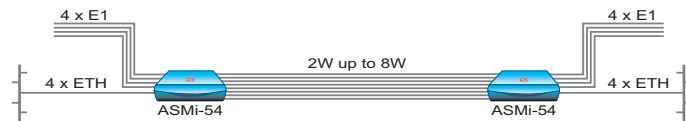
Alternatively, the device can be deployed in ring architecture, featuring spanning tree protocol (STP) support to ensure high availability and service resiliency in the event of link failure.

### Card version for modem rack

The ASMi-54C is a card version for mounting in a central LRS-102 rack. The ASMi-54C SHDSL.bis module multiplexes E1 and Ethernet over one, two or four pairs of SHDSL.bis copper lines. It is installed in an LRS-102 chassis which can contain up to 12 card modules, each with eight E1 interfaces and/or two 10/100BaseT Ethernet ports, to provide a cost-effective central-site solution for up to eight ASMi-54 standalone units over 2-wire or any other combination up to 8-wire. Alternatively, the ASMi-54C can work opposite remote ASMi-52/52L 2/4-wire SHDSL modems in applications requiring lower rates over SHDSL lines. Management traffic for all remote units is delivered via one of the ASMi-54C's Fast Ethernet ports, using a dedicated management VLAN. By supporting both E1 and Ethernet access at the central office (CO), the ASMi-54C modules enable an easy migration from TDM to IP networks.



Ring topology for Ethernet services with link redundancy



High rate Ethernet services and E1s over SHDSL.bis

### Management options

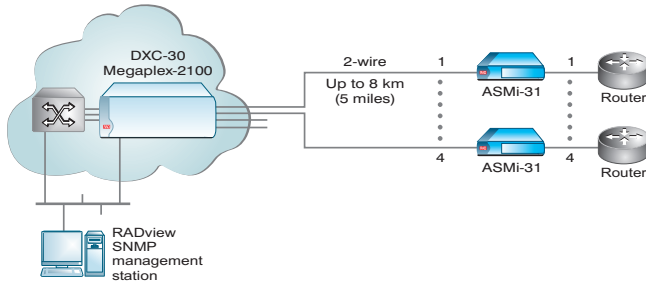
The ASMi-54 standalone units support the following management connections for configuration, monitoring and diagnostics:

- Local RS-232 terminal
- Telnet server, SNMP (ver.1)
- RADview-EMS Web server
- Network links for Inband management with a dedicated VLAN

	ASMi-54	ASMi-54C	ASMi-54L	ASMi-54L/RT
E1 user ports	Up to 4	8	1	1
10/100BaseT user ports	Up to 4	2	4	4
SHDSL.bis network links and associated data rates	5.7 Mbps over 2-wire (1 pair)	5.7 Mbps over 2-wire (1 pair)	5.7 Mbps over 2-wire (1 pair)	5.7 Mbps over 2-wire (1 pair)
	11.4 Mbps over 4-wire (2 pairs)	11.4 Mbps over 4-wire (2 pairs)	11.4 Mbps over 4-wire (2 pairs)	11.4 Mbps over 4-wire (2 pairs)
	22.8 Mbps over 8-wire (4 pairs)	22.8 Mbps over 8-wire (4 pairs)		
Built-in router	-	-	-	✓
Daisy-chain and ring support	✓	-	-	-

# ASMi-31

## Sync/Async 2-Wire Manageable IDSL Modem



The ASMi-31 manageable IDSL modem operates full duplex over twisted pair, 2-wire unconditioned lines. It has a transmission range of up to 8 km (5 miles) over 24 AWG cable and operates at user-selectable rates from 1.2 kbps to 128 kbps. The ASMi-31 can also work opposite the DXC with D8U card, or opposite the Megaplex with the U interface module.

SNMP management is available for the cards inside the rack via the management channel and for the customer premises standalone units. The RADview SNMP application running on an

HP OpenView UNIX or PC platform supports management of the ASMi-31 and other RAD modems.

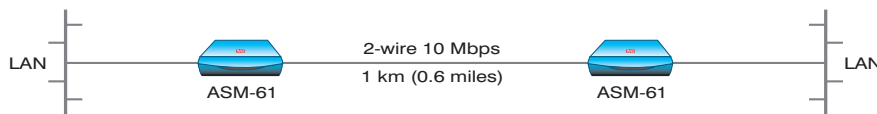
The ASMi-31 is an IDSL modem based on 2B1Q technology, which is common to both ISDN and DSL technologies. This line code enables efficient transmission over poor quality lines. Transmit timing is provided internally or recovered externally from the received signal. It can also be derived externally from the digital interface, enabling tail-end applications.

- 2-wire sync/async, all-rate short range modem
- Full inband management of local and remote modems
- Operating range up to 8 km (5 miles) over 24 AWG cable, independent of data rate
- Selectable data rates: 1.2 kbps to 128 kbps
- Supports digital interfaces: V.24/RS-232, V.35, X.21, RS-530, V.36/RS-449, Ethernet (bridge) or G.703 codirectional
- Optional built-in router
- Works opposite Megaplex and DXC IDSL cards

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# ASM-61

## 2-Wire Symmetrical VDSL-Based Modem



A complete solution for high speed services over existing copper lines, the ASM-61 provides full duplex, symmetrical 10 Mbps Ethernet traffic over 2-wire 24 AWG (0.5 mm) copper cable, for distances of up to 1 km (0.6 miles).

The ASM-61 extends the range of internal LANs using VDSL technology, based on ETSI QAM line coding requirements for the physical medium.

The ASM-61 compensates for line impairments and mixed cabling by using advanced equalization, adaptive filtering and echo cancellation technology.

An internal clock is available. In this mode, the internal clock generator provides the clock for the digital interface and the line.

The ASM-61 is powered by AC voltage. It is available as a standalone unit that can be mounted in a standard 19-inch rack using special hardware.

- Data rate of 10 Mbps
- Range of up to 1 km (0.6 miles) over 24 AWG cable
- User interface is a built-in 10/100BaseT Ethernet bridge
- Plug-and-play operation

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## S-RPT, S-RPT/4W SHDSL or SHDSL.bis Repeaters

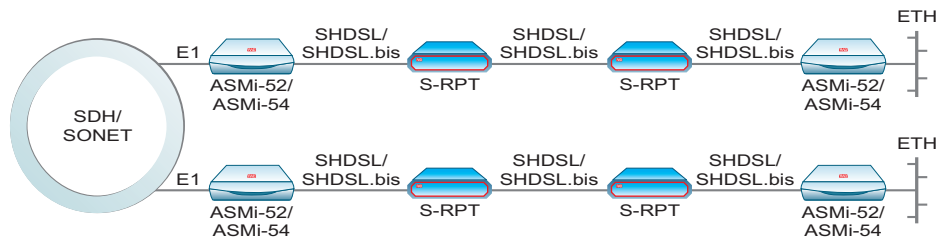
- SHDSL line repeaters for operation over 2-wire or 4-wire lines
- Based on the SHDSL standard for higher speeds and longer loop ranges
- Locally or remotely powered
- Available as a desktop unit or in IP-67 casing for installation in communication ducts
- Fully manageable via DSL link
- High quality, high performance

The S-RPT and S-RPT/4W extend the transmission range of modems using SHDSL or SHDSL.bis (TC-PAM 16) line coding. Even though SHDSL/SHDSL.bis modems provide superior reach and noise immunity in comparison with other DSL technologies, the maximum range of these modems in simple point-to-point (LTU-NTU) configurations is not sufficient for some applications:

- DSL links alongside railways, pipelines, power lines, and waterways
- DSL transport to remote concentrators in rural areas
- Military applications

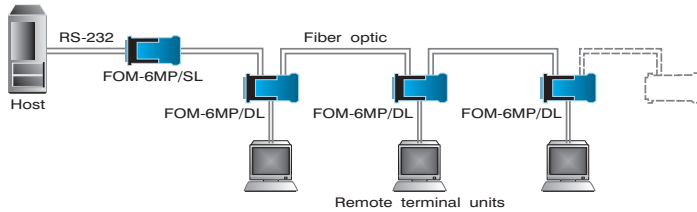
The S-RPT and S-RPT/4W repeaters, using TC-PAM 16 line coding, operate over 2-wire or 4-wire lines accordingly. The units support line rates from 192 kbps to 5.7 Mbps and fully regenerate the signal for increasing the transmission distance. The devices can be managed locally via an ASCII terminal, or remotely from the central SHDSL equipment, using standard EOC messages.

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# FOM-6MP

## Async Fiber Optic Multipoint Modem



The FOM-6MP async fiber optic modem operates over fiber to connect remote terminals and computers, connected in multidrop, to a central host. Transmission range (regardless of the data rate):

- 3.5 km (2 miles) using 850 nm multimode fiber
- 30 km (18 miles) using 1310 nm single mode fiber
- 46 km (28 miles) using 1310 nm laser diode single mode fiber

The FOM-6MP contains two optical interfaces and one V.24/RS-232 port. One optical interface passes data to and from the host while the

other passes data to and from the rest of the terminals in the chain. The V.24/RS-232 interface is connected to the local terminal.

Terminal contention for transmission to the host is selectable: transmitting data or raising RTS signal.

The FOM-6MP includes anti-streaming protection, which prevents blockage of data transmission. The FOM-6MP disables a port that blocks the polling for a preset, user-selectable period of time.

LED indicators help the user to easily isolate faulty segments along the chain of terminals.



- Asynchronous transmission up to 38.4 kbps
- Multidrop operation over a fiber link
- Transmission range up to 46 km (28 miles) over single mode fiber
- RTS or data contention for multipoint operation
- Automatic disabling in the event of streaming
- Variety of optical options, including: multimode, single mode and laser diode for extended range

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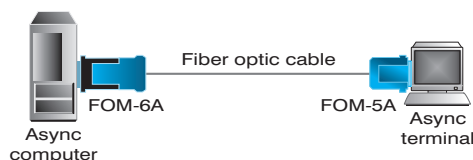
The FOM-6MP requires an external DC power supply of 10–30 VDC/500 mA.

# FOM-5A, FOM-6A

## Asynchronous Fiber Optic Modems

FOM-5A and FOM-6A are miniature fiber optic modems used for local data distribution, connecting full or half duplex async computers and terminals. A pair of modems ensures integrity of data transmission over multimode fiber optic cables for distances up to 3 km (1.9 miles) at data rates up to 19.2 kbps.

The FOM-5A is a sub-miniature version of the FOM-6A, offering all the features in half the size.



Innovative circuitry allows the modems to operate without external power, by drawing low power from the DTE data and control signals.

The FOM-5A and FOM-6A have a V.24/RS-232 interface and are available with either a male or female integral 25-pin connector.



- Asynchronous transmission up to 19.2 kbps
- Transmission range up to 3 km (1.9 miles) over multimode fiber
- Full or half duplex
- Continuous or controlled carrier
- DCE/DTE switch
- LED indicator for data transmit
- No external power required
- Optional metal case (FOM-6A only)
- Available as a card for 19-inch rack

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## FOM-485

### Miniature RS-485 Fiber Optic Modem

- Converts from RS-485 to fiber
- Asynchronous transmission up to 115.2 kbps
- Full duplex over 4-wire or half duplex over 2-wire
- V.54 diagnostics
- LED indicators for status display

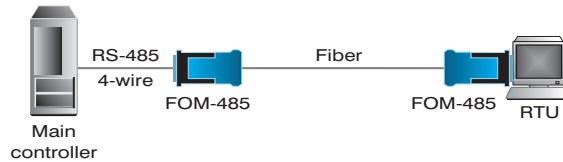
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The FOM-485 is an asynchronous miniature fiber optic modem that transmits RS-485 signals over fiber optic cables. The FOM-485 is used in utility applications where there is a need to connect the main controller to a remote terminal unit (RTU).

The FOM-485 allows connection of up to 32 RTUs to a single host, at a wide range of data rates up to 115.2 kbps.

The FOM-485 supports full duplex transmission over 4-wire or half duplex over 2-wire cables. It supports diagnostic capabilities complying with the ITU V.54 standard.

The modem has six LED indicators to display the status of the modem: TD, RD, DCD, RTS, TEST, and ERR.



## SRM-5SC

### Sync Multipoint Short Range Modem



- 4-wire, full or half duplex
- Selectable data rates: 1.2 to 19.2 kbps
- Range up to 5 km (3 miles) at 9.6 kbps
- Transfers one control signal
- Internal, external or loopback clock
- No external power required
- LED indicator for carrier detect
- Line connector options: terminal block, RJ-12 and RJ-45

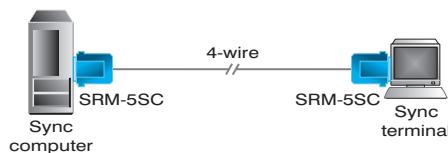
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The sub-miniature SRM-5SC is a short range modem connecting full or half duplex synchronous terminals, controllers and computers in point-to-point or point-to-multipoint applications. The modem operates at data rates from 1.2 kbps to 19.2 kbps (selectable) with a range of 5 km (3.0 miles) at 9.6 kbps.

Three alternative sources for transmit timing are available: internal oscillator, external clock from the terminal or loopback clock derived from the

receive signal. The carrier can be strapped for continuous operation or switched operation controlled by the RTS signal.

The unit has an RS-232-C/V.24 interface, and is available with a choice of a male or female integral 25-pin connector for the DTE interface and a 5-screw (4-wire and ground) terminal block for the line. The SRM-5SC has both a terminal block and RJ-45 or RJ-12 as its line connectors.

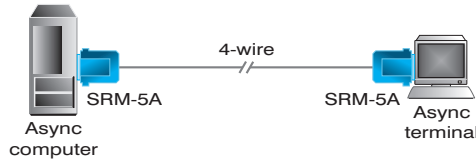


#### Approximate Range (for 24 AWG/0.5 mm)

Data Rate kbps	km	miles
19.2	4.5	2.8
9.6	5.0	3.0
4.8	6.0	3.7
1.2-2.4	6.5	4.0

# SRM-5A

## Short Range Modem



- 4-wire, full duplex
- Internal filter for high noise immunity
- Data rates up to 19.2 kbps
- DCE/DTE switch
- No external power required
- Transformer line isolation

The miniature SRM-5A is an asynchronous short range modem connecting full duplex asynchronous terminals to computers. The SRM-5A operates at data rates of up to 19.2 kbps with a range of 4.5 km (2.8 miles) at 9.6 kbps.

The DCE/DTE switch allows operation as a DTE for connection to another DCE, without requiring a cross cable. It operates without external power by drawing low power from the data and control signals.

Connection to the line is through isolation transformers for protection against AC or DC overvoltages.

The SRM-5A modem is available with an internal filter. The filter is designed to overcome radiated and conducted interference for high noise immunity.

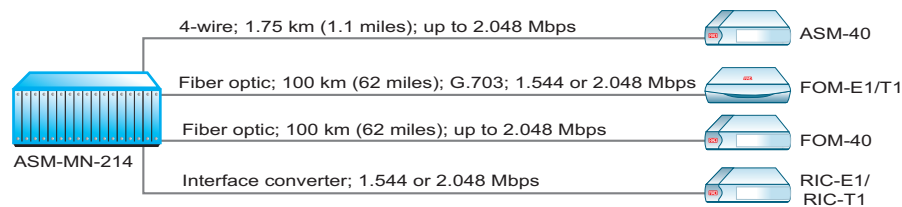
### Approximate Range (for 24 AWG/0.5 mm)

Data Rate kbps	km	miles
19.2	2.0	1.2
9.6	4.5	2.8
4.8	5.0	3.0
1.2-2.4	5.5	3.4

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# ASM-MN-214

## Chassis for Short Range Modems



Central solution for copper and fiber modems

The ASM-MN-214 versatile modem rack is a high density unit capable of housing any combination of up to 14 cards.

The ASM-MN-214 accommodates two separate power supplies. Each power supply supports a full rack of any combination of cards. The power supplies can be either AC or DC and are suitable for power redundancy. Replacement during operation (hot-swapping) is possible, with no

effect on the modems and their data transmission.

Cards that are currently supported: ASM-10/8/R, ASM-31/R, ASM-40-1/R, FOM-20/R, FOM-40/R, FOM-E1T1/R, FCD-2L/R, RIC-E1/R, RIC-T1/R.

The ASM-MN-214 has a terminal block for the line interface and a 25-pin connector for the digital interface. The terminal block is a snap-type connector for easy replacement.

- High density 19" modem rack (up to 14 cards)
- Central solution for copper and fiber modems
- Compact - 4U-high
- Hot-swappable cards and power supplies
- Indicator LEDs on each card
- Fully redundant power supply
- Optional power feeding from different power sources (AC or DC)

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An optional mechanical adapter, the CIA, is used to convert the 25-pin connector to the required physical connector for either V.35 or X.21 interfaces.





## LRS-16

### Managed SHDSL Modem Concentrator

- **Transparent modem concentrator**
- **Operates 16 SHDSL, E1 modems on 2-wire**
- **Multiple data rates: between 64 kbps and 2,048 kbps**
- **ITU-T standards: G.703, G.704**
- **User-friendly GUI for management**
- **Compact unit**

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The LRS-16 is a managed SHDSL modem concentrator presenting a cost-effective central-site solution for point-to-point extension of E1 services in the Local Loop.

The concentrator can operate opposite 16 ASMi-52 SHDSL modems at remote locations, providing E1 services over 2-wire lines. Each one of the 16 fixed ports inside the LRS-16 can have its own separate clocking.

#### Extended range

LRS-16 employs standard SHDSL TC-PAM 16 technology to extend the transmission range, thus enabling carriers to reach more customers at lower costs. The device uses an embedded operation channel (EOC) for controlling and monitoring the remote unit. The management channel uses SHDSL overhead bits in compliance with ITU-T G.991.2 requirements, and operates without interfering with the data transmission.

#### Power supplies

LRS-16 operates with single or dual power supplies. A power supply can be hot-swapped (replaced) during operation, without affecting system performance.

#### Management

The modem rack is managed by the RADview-EMS, RAD's UNIX-based element management system embedded in the SHDSL rack. The SNMP management session can be run over a 10BaseT Ethernet port.

Network management allows centralized control of all LRS-16 hubs, modem ports and remote modems in the network, including interface configuration, connection setup, alarms, and monitoring.

LRS-16 can also be managed from an ASCII terminal that performs all SNMP functions without a GUI interface.

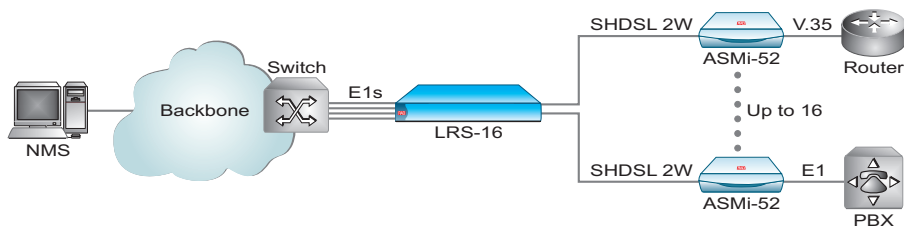
Telnet allows terminal connection over any IP network.

#### Diagnostics

LRS-16 has comprehensive diagnostics capabilities that are activated from either the ASCII terminal or from an SNMP management tool. They include the following test options:

- Local analog and remote digital loopbacks
- SHDSL statistics collection for line performance monitoring
- E1 performance statistics per ITU-T G.706 requirements

LRS-16 is supplied in a 1U-high 19-inch enclosure



Backbone data transmission to customer premises

# LRS-24

## Modular Modem Rack with SNMP Management



The LRS-24 is RAD's manageable access system for providing full coverage of the Last Mile with a variety of technologies, rates, interfaces, and media. The system supports standard technologies such as repeated G.703 and SHDSL.

### Point-to-point configuration

Each card in the LRS-24 works in a point-to-point configuration opposite a remote unit with no connection to the adjacent cards. This allows each card to support a different rate, interface or media. The solutions supported include interface converters, 2/4-wire copper modems, 2/4-wire xDSL modems, fiber optic multiplexers, and fiber optic modems.

The LRS-24 has 12 slots and supports single, dual and quad modem cards.

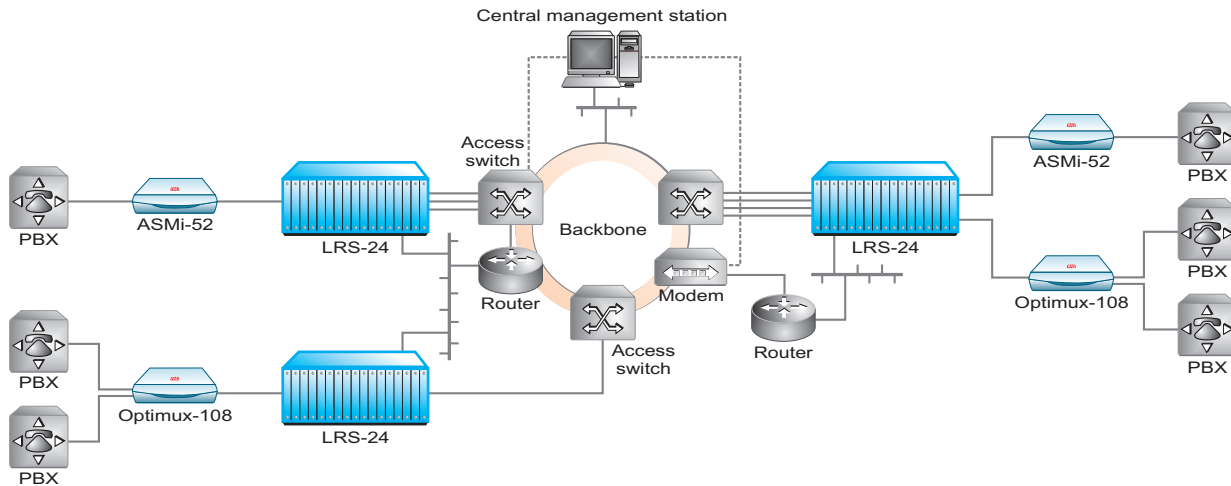
### SNMP management

The LRS-24 supports SNMP management via the CM-2 common management module. The CM-2 supports all the different types of cards, including cards with or without SNMP agents on board. The module includes a built-in Ethernet bridge and an Ethernet port for the connection of a large number of racks to single or multiple management stations. The same Ethernet segment used for managing the LRS-24 can be used for managing other parts of the network, such as the backbone equipment, from the same management station. The module has two additional ports – one for local ASCII terminal management and the other for the station clock connection.

The RADview SNMP application running on an HP OpenView UNIX or PC platform enables full management of the LRS-24, the remote units and other RAD products.

- Modular chassis with 12 I/O slots
- Single chassis for fiber or copper
- Saves central office space and equipment costs
- Up to 48 modems in a 4U chassis
  - Higher modem density reduces the price per port
- Supports wide range of data rates
  - Enables migration path to higher speeds with the same platform
- RADview SNMP management
  - Enables simple and user-friendly operation and reduces operational costs

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Central Last Mile solution with management







# LRS-102

## Fiber and Copper Mux Rack with SNMP Management

- Transports any traffic over fiber optic or SHDSL.bis links
- Modular chassis with 12 I/O slots
- 24 Optimux-108 and/or Optimux-106 modules in a single chassis
- 96 ASMi-54 modules in a single chassis
- Transports up to 96 E1/T1s and 24 x 10/100BaseT Ethernet links
- Hot-swappable, redundant uplinks
- Redundant power supplies
- Supports single mode, multimode and single mode over single fiber (WDM)
- RADview SNMP management

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The LRS-102 is a cost-effective, modular central rack solution for RAD's Optimux fiber or ASMi-54/ASMi-54L SHDSL.bis mux products, extending E1/T1s, data and Ethernet traffic up to 120 km (74.5 miles) over fiber optic links, or up to 2.9 km (1.8 miles) over copper. The LRS-102 fiber mux rack provides optional redundant power supplies, optional redundancy of the common logic and 12 I/O slots. 12 dual-port Optimux-108 and/or Optimux-106 modules support 24 remote units. In addition, the ASMi-54 module enables the device to work opposite up to eight remote units.

The unit has central management via the common logic module and occupies one-third of the space of the equivalent number of standalone units.

### Multiple fiber modes

As a central solution for Optimux fiber optic (WDM) products, LRS-102 supports single mode, multimode and single mode over single fiber optic types, as well as different connectors, such as SC, FC or ST.

The rack is managed using a single IP address. It supports an SNMP RADview application running on an HP OpenView UNIX or PC platform, enabling full management of the LRS-102 and the remote units.

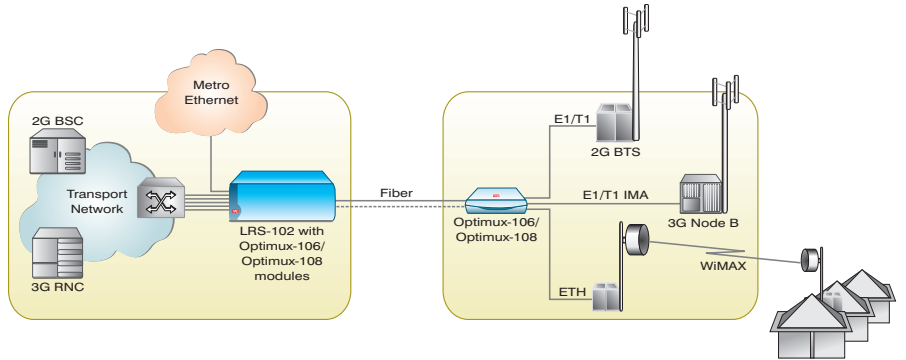
### Cost-effective central solution

By deploying the LRS-102 as a central solution, users save colocation costs, avoid multiple IP addresses in the network, and benefit from a higher port density chassis, resulting in a lower price per port.

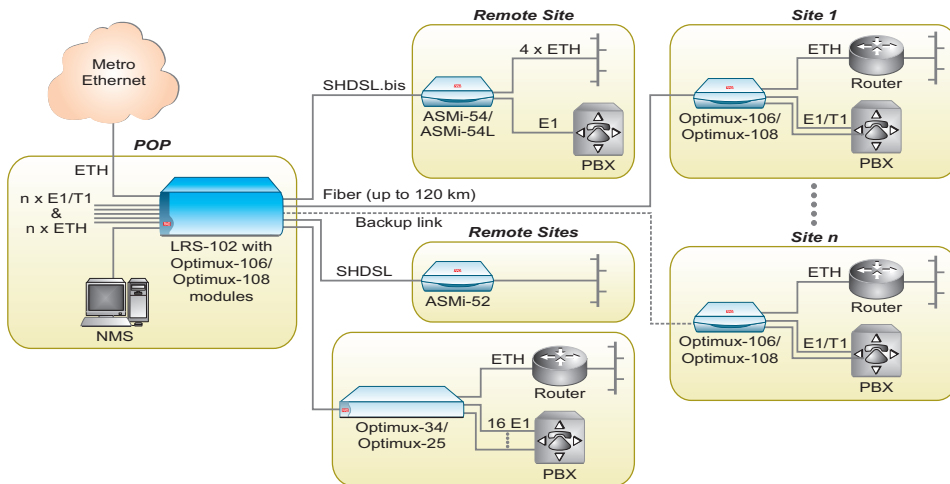
LRS-102 applications include:

- Campus service sharing
- Ethernet, data and voice range extension
- Cellular backhaul extension
- Video conferencing
- Surveillance cameras connectivity

LRS-102 comes in a 4U-high chassis, mountable in a 19-inch ETSI or ANSI rack.



Cellular backhaul extension



Ethernet and legacy services extension over fiber and copper



Even Remote  
**Observation Points**  
are Within Easy Access of Your  
**Surveillance Center**

**Connect Video Surveillance and Security  
Devices to Your Network with RAD's  
Airmux Wireless Multiplexer**

Just because your strategic observation points are beyond reach of existing network infrastructure, doesn't mean you can't maintain constant real-time audio and video surveillance. With RAD's point-to-point, license-free Airmux wireless multiplexer, you can transport multiple E1s and Ethernet traffic tens of kilometers – even under extreme link conditions.

Airmux features and benefits:

- High data rates up to 50 Mbps full duplex payload throughput
- Extended range - up to 120 km (75 miles)
- Sub-6GHz bands
- Superior OFDM and MIMO technology
- AES encryption
- Up to two Ethernet ports
- Up to 16 E1 ports



**Airmux-400**

Broadband Wireless Multiplexer  
**Best Price/Performance in  
the Market**



**data communications**  
The Access Company



# Airmux-400

## Broadband Wireless Multiplexer



- Carrier-class, high capacity
- Sub-6 GHz wireless multiplexer for high traffic networks.
- 50 Mbps full duplex net throughput
- Up to 16 E1/T1s
- Superior OFDM and MIMO technology
- Unparalleled performance
- Extended range - up to 120 km (75 miles)
- Easy to install and simple to maintain
- Cost-effective solution

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The Airmux-400 broadband wireless multiplexer delivers carrier-class, high capacity, extended range voice and data communications for today's and tomorrow's networks.

Airmux-400 is the ideal choice for carriers seeking cost-effective backhaul solutions. While demand for mobile bandwidth and migration to 3G and 4G networks will require carriers to significantly increase their backhaul capacity, they cannot expect a similar growth in ARPU and therefore need backhaul solutions to keep OpEx and CapEx to a minimum. Airmux-400 enables carriers to accommodate capacity growth and maintain profitability through unparalleled price and excellent performance.

### High capacity solution

The high capacity radio system provides 50 Mbps full duplex net throughput, with a flexible combination of Ethernet and up to 16 E1/T1 interfaces with a range of up to 120 km (75 miles) in various sub-6 GHz frequencies. Airmux-400 offers native Ethernet and native

TDM over a single wireless link, enabling carriers to migrate to Ethernet with no additional cost and to protect their investment in the legacy TDM infrastructure.

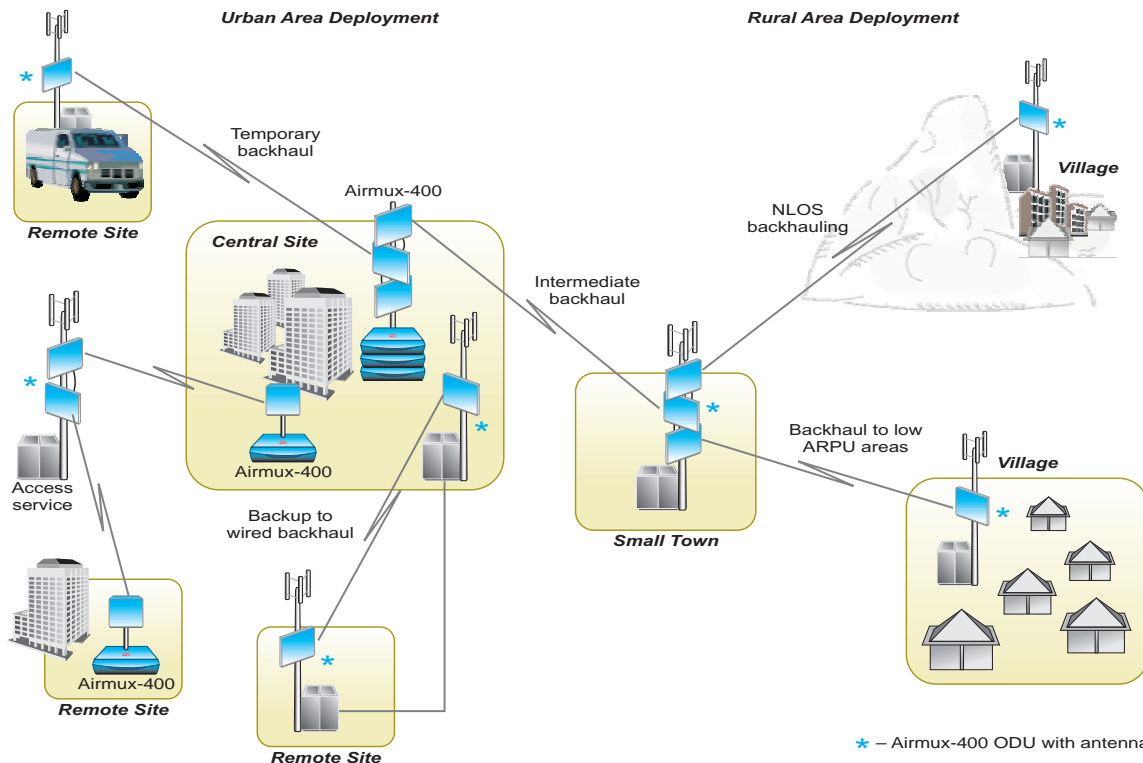
Airmux-400 delivers optimal performance and unmatched robustness in all environments, based on its advanced space diversity configuration, MIMO and OFDM technologies.

### Flexible deployment options

The Airmux-400 solutions are ideally suited for applications such as backhaul for cellular and WiMAX networks, access and backhaul solutions for ISPs and enterprise networks, as well as for temporary applications for both carriers and private networks.

Airmux-400 incorporates safeguards to secure the wireless transmission against possible attack by supporting the advanced encryption standard (AES).

Airmux-400 can be managed by a Windows-based RADview SNMP manager.



# Airmux-200

## Broadband Wireless Multiplexer



Airmux-200 is a carrier-class, high capacity, affordable multiplexer, connecting E1/T1 and Ethernet networks point-to-point over a wireless link. Compliant with FCC, CAN/CSA and ETSI regulations for license-exempt transmission, the Airmux-200 operates over 2.3 GHz, 2.4 GHz, 4.9 GHz, and 5.x GHz, as well as licensed 2.5 GHz BRS bands. Wireless transmission saves enterprises the cost of leased lines while eliminating the service provider's need for deploying fiber. The Airmux-200 thereby enables the rapid deployment of E1/T1 and Ethernet links at a fraction of the cost of laying down new cabling.

Airmux-200 consists of an indoor and an outdoor unit connected by a Cat-5e outdoor Ethernet cable, allowing a maximum distance of 100 meters (328 feet) between the two units. The outdoor unit can be ordered with an integrated antenna or with a connector for an external antenna.

### Cost-effective voice and data transport

Airmux-200 integrates up to four unframed E1 or T1 ports and up to two Ethernet ports for a net payload throughput of up to 18 Mbps full duplex. The maximum range of the Airmux-200 is 80 km (50 miles). Throughput is a function of distance and regulation.

An integrated 10/100BaseT Ethernet bridge transparently forwards frames and learns up to 2,000 MAC addresses. The accurate E1/T1 clock

recovery, low round-trip delay and high link availability position the Airmux-200 as a carrier-class wireless transmission system.

### Advanced encryption and security features

Airmux-200 incorporates safeguards to secure the wireless transmission against possible attack. The advanced encryption standard (AES) and dynamic encryption key change are aimed to prevent unauthorized eavesdropping. These mechanisms, together with a coded time stamp (CCM), prevent false transmission from an intruding terminal. The network management system and the equipment are protected by a password and a challenge/response scheme.

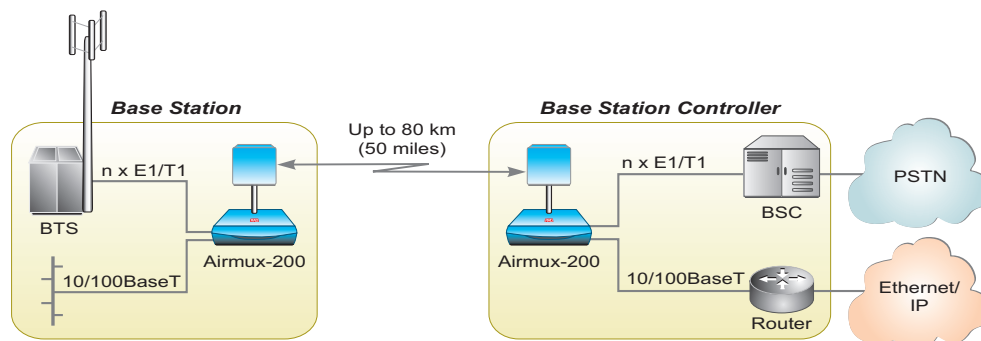
An Airmux-200 link can be managed by a Windows-based application supplied with the device. The RADview SNMP fault management application can be ordered in cases where multiple links are to be deployed and managed from a central platform. All parameter configurations are link-based, simplifying maintenance and installation.

Airmux-200 is an ideal solution for connecting remote enterprise locations, cellular backhaul, broadband Last Mile services, and hotspot backhauling.

**Configurations:** Airmux-200 also functions in a Power over Ethernet mode for Ethernet services and in a colocation (multipoint-to-point) mode.

- **Wireless multiplexer combining up to four E1/T1 and up to two Ethernet interfaces**
- **Point-to-point and multiple point-to-point topologies**
- **18 Mbps full duplex net throughput**
- **Long range up to 80 km (50 miles)**
- **Operation in sub-6 GHz frequencies: 2.3 GHz, 2.4 GHz, 4.9 GHz, 5.x GHz, licensed 2.5 GHz BRS**

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Connecting cellular base stations and base station controller sites

