LA-110

Advanced Integrated Access Device

- Offers multiple services over ATM or PSN

- Supports standard-compliant pseudowire (PW) with TDMoIP, CESoPSN, SAToP, ATMoPSN, and HDLCoPSN encapsulation

- Includes SHDSL IMA/E1 network interfaces

- Provides four digital ISDN user interfaces

- Corrects network errors such as jitter buffer on the fly and compensates for lost packets

LA-110 is an advanced Integrated Access Device (IAD) offering voice, data, and LAN service extension over ATM or packet-switched networks.

MARKET SEGMENTS AND APPLICATIONS

The services supported by LA-110 include:

- High-quality leased lines over E1 or serial data links

- E1 (CES, PRI, UNI)

- Cellular backhaul

- High-speed data (transparent and Frame Relay)

- Ethernet with MAC bridge and IP router

- Voice, such as ISDN BRI, or PRI.

Multiservice over ATM

The UNI network interface supports the following ATM adaptation layers:

- AAL1 – Transparent transport of serial data streams, and circuit emulation services (CES)

- AAL2 – ATM Forum Loop Emulation Services (LES) for PSTN and ISDN BRI and PRI access

- AAL5 – Packet traffic (Frame Relay, Ethernet, IP).

The network interface supports the following classes of service: CBR, VBR, UBR, and UBR+.

Per connection user-configurable traffic shaping and traffic contract enforcing

ensure improved QoS and efficient utilization of the ATM uplink bandwidth.

Multiservice over PSN

LA-110 provides legacy services over packet networks. The device converts the data stream from its user E1/T1 or data ports into packets for transmission over the network. The frame format of these packets is IP or MPLS. These packets are transmitted via the LA-110 network port to the PSN. A remote pseudowire device converts the packets back to the original user traffic format.

The unit supports various legacy over packet transport types, including TDMoIP, CESoPSN, SAToP, HDLCoPSN, and FRoPSN.

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

A jitter buffer compensates for packet delay variation (jitter) of up to 40 msec in the network.

PSEUDOWIRE

QoS/CoS

The Quality of Service/Class of Service varies according to network type:

- Ethernet networks – Outgoing pseudowire packets are assigned a dedicated VLAN ID according to 802.1Q and marked for priority using 802.1p bits.

- IP networks – Outgoing pseudowire packets are marked for priority using DSCP, ToS, or Diffserv bits.

- MPLS networks – Outgoing pseudowire packets are assigned to a specific MPLS tunnel and marked for priority using EXP bits.

Fault Propagation

The fault propagation mechanism initiates user port alarms, such as E1/T1 LOS, to reflect packet network fault conditions. Alarms detected at user ports are propagated to the remote pseudowire device via the packet network.

Performance Monitoring

Performance monitoring is provided by Ethernet and IP-layer network condition statistics, such as packet sequence errors (loss or misorder) and packet delay variation (jitter), which are monitored and stored by the device.

NETWORK INTERFACE

LA-110 has one network port that can be ordered with one of the following interfaces:

- Single 2- or 4-wire SHDSL interface

- IMA over 4 ×2-wire SHDSL for a combined data rate of up to 9.2 Mbps and extended range

- E1 interface.

ETHERNET

The Ethernet 10/100BaseT port supports autonegotiation and flow control.

The Ethernet interface can be configured to operate as a MAC bridge or an IP router.

In bridge mode, the Ethernet interface operates as a self-learning media access bridge. The MAC bridge can be configured to VLAN-aware or VLAN-unaware mode.

In bridge mode, the Ethernet traffic can be classified according to 802.1p, IP precedence, ToS, or DSCP. The traffic classes are mapped using the ATM CoS or WFQ mechanism. LA-110 supports up to eight QoS rules.

When configured to operate as an IP router, LA-110 supports:

- 1–2 IP networks (sharing the same physical Ethernet interface)
- 1–8 WAN ports, each using its own PVC
- An optional host interface for router management.

The router uses static routing entries or RIP I/II for routing decisions. It can also use policy-based routing (PBR) to define user-specific routing rules, overriding the routing table settings.

In IP router mode, LA-110 performs encapsulation per RFC2684, or transfers the traffic using PPPoA (with PAP and CHAP authentication).

The device serves as a DNS relay, exchanging DNS requests and replies between its hosts and the DNS server.

A firewall can be set on each router interface (WAN, LAN) for filtering inbound or outbound traffic.

LA-110 can be configured as a DHCP server or to DHCP relay mode.

When operating opposite a RADIUS server, the unit performs client authentication.

The IP router provides up to 20 NAT/NAPT translations. Each translation can be applied to a WAN or LAN port.

DATA INTERFACE

The LA-110 data port is a synchronous serial DCE port, supporting V.35 and X.21 interfaces. The data port operates at rates n × 64 kbps in the range of 64 to 2048 kbps.

The data payload is processed in accordance with the user-selectable application mode: AAL1 or Frame Relay.

In AAL1 mode, the data stream is transferred transparently in the CBR service category. The AAL1 stream mode supports any Layer-2 protocol.

When the LA-110 data port operates in Frame Relay mode, the traffic is carried over AAL5, in the user-configurable ATM service category.

The device supports up to 8 DLCIs.

The Frame Relay interworking mode can be configured to:

- Service interworking per FRF.8
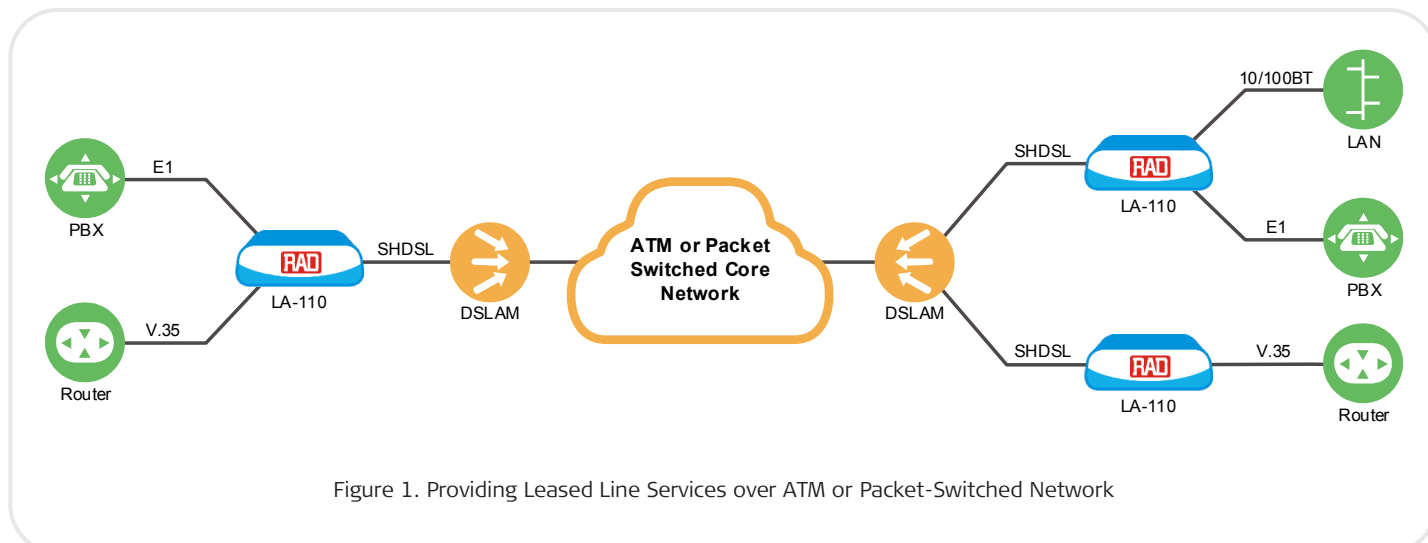- Network interworking per FRF.5.

Applications

Figure 1. Providing Leased Line Services over ATM or Packet-Switched Network

ISDN INTERFACE

Four independent ISDN BRI S0 interfaces comply with ETSI 300012 and ITU-T Rec. I.430. The interface characteristics are compatible with many types of ISDN switches, including NTT, 5ESS, DMS-100, and NI1.

The ISDN interface operates in NT (Network Termination) mode, enabling direct connection of ISDN terminal equipment to "S" ports.

The ISDN ports require use of LES over AAL2, allowing several connections to share the same VC. The ELCP can also be used. The signaling information carried by the multiplexed 64-kbps D channel is transported transparently to the voice gateway.

E1 AND T1 USER INTERFACE

LA-110 can be ordered with one user E1 or T1 port with balanced or unbalanced (E1) interfaces.

The E1 interface supports the following framing modes:

- G732S
- G732N
- Unframed
- ISDN PRI (AAL2 only)
- E1 ATM UNI.

In AAL1 mode, LA-110 uses the following transmission methods:

- Structured CES, transmitting each E1 bundle over a separate PVC
- Dynamic bandwidth allocation (DB-CES) for detecting voice channel activity and allocating uplink bandwidth accordingly.

In AAL2 mode, LES is used for voice support, with or without ELCP. Application identifiers determine the signaling methods:

- CAS
- PSTN signaling
- DSS1 for ISDN BRI and PRI
- ISDN PRI remote access with ELCP.

LA-110 transparently transfers the ATM-based E1 UNI services at the rate 1984 kbps.

The balanced T1 user interface offers the same transmission and signaling methods as the E1 user interface.

TIMING AND SYNCHRONIZATION

The device supports flexible timing modes for hierarchical timing distribution in the network.

The LA-110 system timing can be locked to the following sources:

- NTR – Timing reference is locked to the DSLAM clock
- Received – Clock is received from the E1 equipment
- Adaptive – Clock is locked to an average arrival rate of the ATM cells carrying voice channels
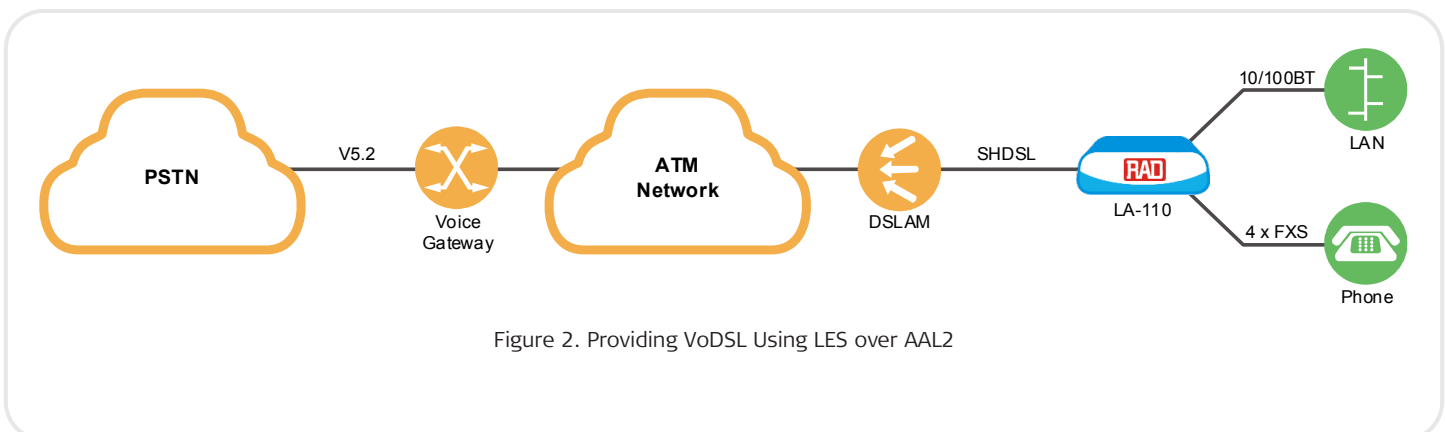- Internal – Clock is generated by the internal oscillator.

Figure 2. Providing VoDSL Using LES over AAL2

MANAGEMENT AND SECURITY

The unit can be managed using the following ports and applications:

- Local out-of-band management via an ASCII terminal connected to the RS-232 port

- Remote out-of-band management via the LAN port

- Remote inband management via the ATM uplink. Remote management is performed using Telnet, Web browser, or RADview, RAD's SNMP-based management access system.

Different stations can manage LA-110 simultaneously, enabling monitoring the network status from different locations.

ARCHITECTURE

LA-110 supports automatic configuration from a remote location. Once the unit is installed, it needs only to be powered up. It then automatically receives its management IP address, and all the configuration procedures can be performed from the remote location.

MONITORING AND DIAGNOSTICS

LA-110 collects performance monitoring statistics at the physical and ATM layers for the network and user interfaces. It also provides statistics for individual connections (AAL1, AAL5).

Comprehensive diagnostic capabilities include:

- Physical loopbacks on the network and user interfaces

- OAM loopback on a VCC

- Ping for IP connectivity checks.

LA-110 stores alarms detected during operation in a buffer holding up to 200 alarms.
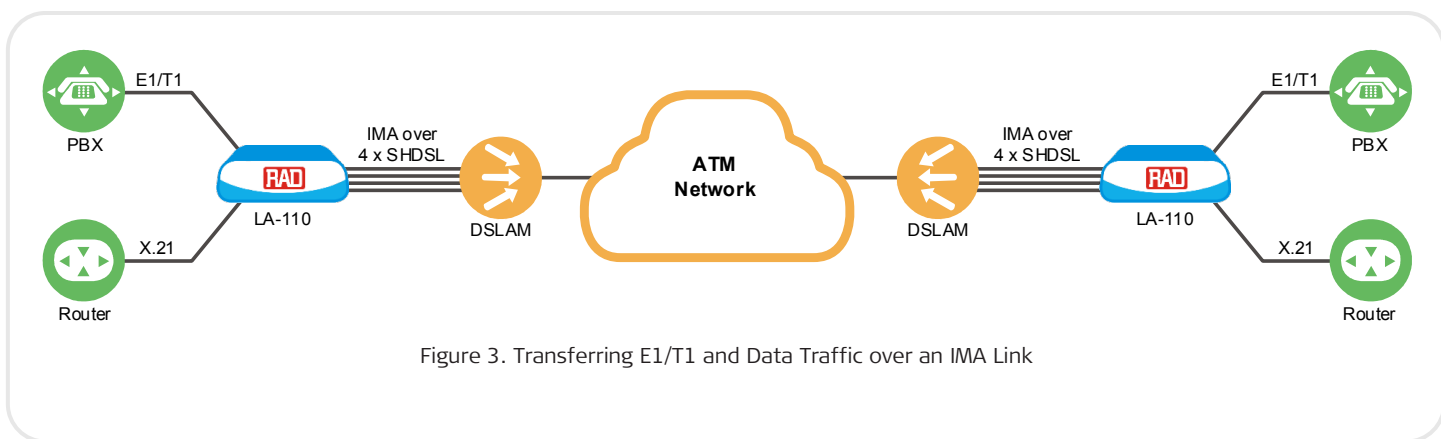

Figure 3. Transferring E1/T1 and Data Traffic over an IMA Link

Specifications

ATM NETWORK INTERFACE

Type
UNI per ATM User-Network Interface (UNI) Specification (Version 3.1) for PVCs only

AAL Support
AAL1 (CES and DB-CES)
AAL2 (LES and ELCP)
AAL5

Traffic Shaping
Per VC

ATM Service Categories
CBR, VBR, UBR+, UBR

F5 OAM Cells
Per ITU-T Rec. I.610

VPI Range
0–31

VCI Range
0–255

Maximum Number of VCs
8

PSEUDOWIRE

Standard Compliance
ATM:
    IETF: RFC 4717

TDM:
    IETF: RFC 4553 (SAToP), RFC 5087 (TDMoIP), RFC 5086 (CESoPSN)
    ITU-T: Y.1413 (TDMoIP)
    MFA: IA 4.0

HDLC:
    IETF: RFC 4618 (excluding clause 5.3 – PPP)

Number of PW Connections
8

Jitter Buffer Size
0.5–200 msec (unframed) with 0.1 msec granularity

2.5–200 msec (framed) with 0.5 msec granularity.

SHDSL NETWORK INTERFACE

Type
Single 2-wire or 2/4-wire per ITU-T Rec. G.991.2, Annex A and Annex B

IMA over 4 × 2-wire, per ATM Forum 1.0 (AF-PHY-0086.000) or ATM Forum 1.1 (AF-PHY-0086.001)

Line Code
TC-PAM

Range
See *Error! Reference source not found.*

Line Rate
200–2320 kbps (2-wire)

200–4620 kbps (4-wire)

800–9280 kbps (4 × 2-wire IMA)

Handshake Protocol
ITU-T Rec. G994.1

EOC Support
Mandatory

Connector
RJ-45

Note: *For 4 × 2-wire IMA interface, the data rates represent the value for a single pair. Typical ranges of the IMA interface are also relevant for data rates above 2304 kbps. To obtain a typical range for a data rate between 2304–9216 kbps, divide the data rate by four and then consult Table 1.*

E1 INTERFACE

Payload Rate
n × 64 kbps (n = 1–26)

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

Framing
G732N or G732S, with or without CRC-4

Line Rate
2.048 Mbps ± 32 ppm

Line Code
HDB3

Line Interface
120Ω, balanced

75Ω, unbalanced

Receive Input Level
0 to -43 dB or 0 to -12 dB, user-configurable

Transmit Output Level
±3V ±10%, balanced

±2.37V ±10%, unbalanced

Jitter
ITU-T Rec. G.823

Connectors
RJ-45, balanced

Two BNC, unbalanced (via RJ-45 to BNC adapter cable)

Table 1. Typical SHDSL Ranges (26 AWG)

Data Rate [kbps]	2-wire		4-wire		4 x 2-wire IMA	
	[km]	[mi]	[km]	[mi]	[km]	[mi]
384-512	5.5	3.4	6.3	3.9	5.2	3.2
576–832	5.0	3.1	5.4	3.3	4.9	3.0
896–1152	4.5	2.7	5.1	3.1	4.6	2.8
1216–1344	4.2	2.6	5.1	3.1	4.5	2.7
1408–1856	3.9	2.4	4.5	2.7	4.0	2.4
1920–2176	3.5	2.1	4.5	2.7	3.7	2.2
2304	3.3	2.0	4.5	2.7	3.5	2.1
2432–3072	–	–	3.9	2.4	–	–
3200–4624	–	–	3.3	2.0	–	–

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SERIAL USER INTERFACE

Data Link Protocol
Frame Relay using AAL5
Transparent using AAL1

Data Rate
n × 64 kbps (64–2048 kbps)

Frame Relay Interworking
Network interworking per FRF.5
Service interworking per FRF.8

Frame Relay Connections
Up to 8 DLCIs

Timing
DCE

Type
V.35 via 34-pin connector
X.21 15-pin D-type female connector

ETHERNET USER INTERFACE

Type
10/100BaseT

IMA over 4 × 2-wire, per ATM Forum 1.0
    (AF-PHY-0086.000) or ATM Forum 1.1
    (AF-PHY-0086.001)

Functionality
Ethernet MAC bridge

IP router

MAC Bridge
Number of ports: 1 LAN, 1–8 WAN

VLAN: Aware or unaware mode

IP Router
Routing: static, RIP I, RIP II, or both RIP I
    and RIP II, policy based

Number of ports: 1–2 IP networks (sharing
    the same physical LAN interface), 1–8
    WAN, host (optional)

DHCP services: DHCP server (up to
    10 address pools), DHCP relay

NAT, PAT services

Maximum Frame Size
1536 bytes

Connector
RJ-45

ISDN USER INTERFACES

Number of interfaces
4

Type
"S"

Compliance
ETS 300012, ITU-T Rec. I.430, compatible
    with NTT, 5ESS, DMS 100, and NI1
    switches

Bit Rate
192 Kbps

Line Coding
Pseudoternary

Mode
NT with phantom feed

Line impedance
100Ω

Connector
RJ-45

E1 USER INTERFACE

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

Line Rate
2.048 Mbps±32 ppm

Line Code
HDB3, AMI

Framing
Unframed

G732N with or without CRC-4

G732S with or without CRC-4

ISDN PRI

UNI (multiframe or non-multiframe)

Line Impedance
120Ω, balanced

75Ω, unbalanced

Receive Input Level
0 to -43 dB

0 to -12 dB

Transmit Output Level
±3V ±10%, balanced

±2.37V ±10%, unbalanced

Jitter
ITU-T Rec. G.823

Connectors
RJ-45, balanced

Two BNC, unbalanced (via RJ-45 to BNC
    adapter cable)

T1 USER INTERFACE

Compliance
AT&T TR-62411, ANSI T1.403, ITU-T Rec.
G.703, G.704, G.706

Line Rate
1.544 Mbps±32 ppm

Line Code
B8ZS

Framing
Unframed
ESF
SF

Line Impedance
100Ω, balanced

Receive Input Level
0 to -36 dB (normal sensitivity)

0 to -30 dB (low sensitivity)

Transmit Output Level
±3V ±10%; 0 dB, -7.5 dB,
-15 dB, -22.5 dB (CSU)

±3V ±10%, 0 to 655 feet, (DSU)

Jitter
ITU-T Rec. G.824

Connectors
RJ-45, balanced

LA-110
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MANAGEMENT

Inband: SNMP, Telnet, Web

Out-of-band: LAN port, serial V.24 (RS-232) port

Terminal Control Interface
Type: V.24 (RS-232) async DCE

Baud rate: 0.3–115.2 kbps

Connector: 9-pin D-type female

TIMING

Recovered from xDSL interface (NTR)

Recovered from E1 interface

Adaptive

Internal

GENERAL

Indicators
PWR (green) – Power status

WAN (red/green) – WAN interface synchronization status

LAN (green) – LAN transmit/receive activity status

Physical
Height: 43.7 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: 100–240 VAC
DC: -48 VDC (-40/-60 VDC)

Note: *The DC option is not available for units with ISDN or E1 network interfaces.*

Power Consumption
7.5W max

Environment
Temperature: 0 to 50°C (32 to 122°F)

Humidity: Up to 90%, non-condensing

Ordering

RECOMMENDED CONFIGURATIONS

LA-110/SHDSL/V35

Advanced Integrated Access Device with 2-wire SHDSL, V.35 serial data interface

SPECIAL CONFIGURATIONS

Please contact your local RAD partner for additional configuration options

SUPPLIED ACCESSORIES

AC/DC adapter plug (if DC option is ordered)

OPTIONAL ACCESSORIES

RM-33-2
Hardware kit for mounting one or two LA-110 units in a 19-inch rack

CBL-RJ45/2BNC/E1
RJ-45 to BNC adapter cable for unbalanced E1 network or user interface

CBL-DB9F-DB9M-STR
Control port cable

RAD
Your Network's Edge