

ACE-3000 Family
ACE-3200
 Cell-Site Gateway



2G, 3G and HSDPA
 cellular traffic over
 packet-switched
 networks (PSNs),
 SDH/SONET networks
 and E1/T1 transport
 links

Ace

- Multi-standard pseudowire encapsulation for delivery of Ethernet and TDM/ATM traffic over PSNs
- Advanced pseudowire connectivity verification using VCCV-BFD messages
- End-to-end fault propagation between legacy and packet-switched networks
- Full ATM switching, scheduling, policing and shaping for separation of HSDPA and voice services
- High accuracy clock recovery and distribution over PSN

ACE-3200 is a multiservice cellular-site gateway, designed for cost-effective backhauling of 2G/3G voice and HSDPA data traffic over multi-generation access networks, such as Ethernet and SDH/SONET.

ACE-3200 uses advanced pseudowire (PW) technology to deliver cellular and legacy traffic services (ATM, TDM) over next-generation PSNs (packet-switched networks), including Layer-2, MPLS and IP.

Typically located at the BTS or Node B site, the unit converts and aggregates traffic using $N \times$ E1/T1, STM-1/OC-3c and Ethernet (10/100BaseT) interfaces.

ANY-SERVICE-ANY-PORT

The STM-1/OC-3c and Ethernet interfaces operate as user or network ports, per user configuration and depending on the required application.

In addition, ATM or TDM traffic received via the E1/T1 ports is converted by ACE-3200 to either ATM (UNI or IMA), CES or SAT over PSNs, depending on the originating traffic type.

RAD

data communications

The Access Company

ACE-3200

Cell-Site Gateway

PSEUDOWIRE CAPABILITIES

ACE-3200 allows up to 32 PW connections to be established over PSN and 32 clock distribution PWs.

The following encapsulation methods are supported according to RFC 4717:

- 1-to-1 VC/VP – Each VCC/VPC is mapped to a single pseudowire connection
- N-to-1 VC/VP – Several VCs or VPs can be encapsulated to a single pseudowire connection.
- AAL5 SDU – Each VCC is mapped to a single pseudowire connection.

TDMoPSN – TDM pseudowire connections can be established over PSN according to IETF RFC 5086 (CESoPSN/ SAToP). SAToP complies with IETF RFC 4553.

Ethernet – Ethernet pseudowire encapsulation is used to carry Ethernet/802.3 traffic over an MPLS network. Ethernet PW operation complies with IETF RFC 4448.

Following PSN encapsulation formats are supported:

- MPLS
- MPLS over IP
- MPLS over GRE
- PPPoE
- UDP over IP.

PWoATM capability allows carrying any type of pseudowire payload over AAL5 VC over any ATM port (bridge PDU mode only).

BRIDGING

LAN-To-LAN

In addition to ATM and TDM backhauling, ACE-3200 supports LAN-to-LAN bridging to allow backhauling of Ethernet traffic originating from the cellular site/Node B.

LAN-To-ATM

LAN-to-ATM bridging, according to the RFC 1483/2684 requirements, allows backhauling Ethernet traffic originating from the cellular site/Node B over ATM core networks.

ETHERNET OVER ATM

Up to 32 Ethernet flows can be mapped into ATM VCCs. Ethernet flows can be defined as follows:

- VLAN ID
- VLAN ID + p-bits
- DST IP
- DST IP + IP-Precedence
- DST IP + DSCP

PPPOE AND VIRTUAL MAC ADDRESSES

To allow HSDPA connectivity in a variety of DSL-based cellular backhaul applications, ACE-3200 initiates PPPoE sessions for acquiring IP addresses for all data, voice and management connections.

When working with multiple sessions of PPPoE or other dynamic entities, ACE-3200 provides virtual MAC addresses in addition to the standard ones that are provided for each physical port.

MPLS SUPPORT - LDP

ACE-3200 uses the MPLS label distribution protocol (LDP) to automatically assign and distribute pseudowires and tunnel labels between MPLS peers.

Note: The LDP functionality requires a software license. For more information, refer to the Ordering section.

ATM SWITCHING AND POLICING CAPABILITIES

Full ATM switching capabilities include scheduling and shaping of ATM-based traffic. Operators can assign each virtual connection (VC) or virtual path (VP) to a service class, define the QoS parameters and shape the ATM egress traffic. ATM traffic policing allows operators to discard, tag or count non-conformant cells per configuration.

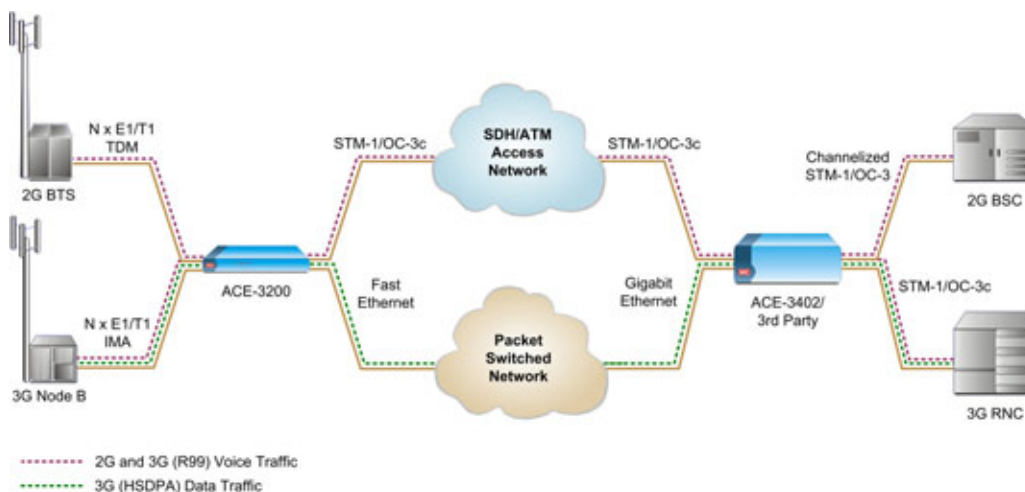


Figure 1. ACE-3200 in a Hybrid Backhaul Solution

ADVANCED PSEUDOWIRE QoS

Required QoS is achieved by employing different prioritization techniques:

- Layer-2 network – outgoing pseudowire packets are assigned a dedicated VLAN ID according to 802.1Q and marked for priority using 802.1p bits
- MPLS network – outgoing pseudowire packets are assigned to a specific MPLS tunnel and marked for priority using EXP bits
- IP network – outgoing pseudowire packets are marked for priority using ToS or DSCP bits.

GENERIC ROUTING ENCAPSULATION (GRE)

ACE-3200 encapsulates MPLS packets over GRE to establish point-to-point tunnel connection over an IP network. This tunneling service is used to transfer MPLS packets over an IP network without using the IP addressing scheme.

CLOCK SYNCHRONIZATION

ACE-3200 provides robust clock synchronization and flexible timing modes, including:

- Clock recovery – a dedicated clock recovery module (optional) allows ACE-3200 to adaptively recover the clock from a source device that distributes the ATM clock over a packet-switched network, according to G.8261
- Interface-based synchronization – the clock is recovered from the RX traffic of a selected interface, in accordance with G.823 (E1)/G.824 (T1) and depending on the network's SLA
- Unicast clock distribution – the master clock is distributed with a dedicated stream towards up to 32 remote PSN peers
- Multicast clock distribution – the master clock is distributed towards the PSN using a single IP multicast clock stream (IGMPv2 host).

Note: For the clock recovery feature, ACE-3200 must be ordered with the "A" suffix. For more information, refer to the Ordering section.

STM-1/OC-3c INTERFACE

The STM-1/OC-3c fiber optic interface performs physical layer and ATM mapping into STM-1/OC-3c according to I.432. The SDH or SONET operation mode is user-selectable.

The two STM-1/OC-3c ports (if two are ordered) can be configured to work in automatic protection switching (APS) mode, to provide 1+1 protection according to G.841 Annex B.

When required, rate limiting can be applied to the STM-1/OC-3c traffic.

The STM-1/OC-3c interface utilizes industry-standard SFP (Small Form-Factor Pluggable) hot-swappable optical transceivers that allow using different fiber optic port types.

Note: For more information, refer to the SFP Transceivers data sheet and to the Ordering section.

E1/T1 INTERFACE

ACE-3200 includes 8 or 16 (as ordered) E1 or T1 multiservice ports that can be configured to work in ATM UNI/IMA or TDM mode, per user configuration. This Any-Service-Any-Port framework enables high flexibility in deployment within various backhaul solutions.

The E1 ports are available with balanced or unbalanced interfaces (via an optional RJ-45 to BNC adapter cable).

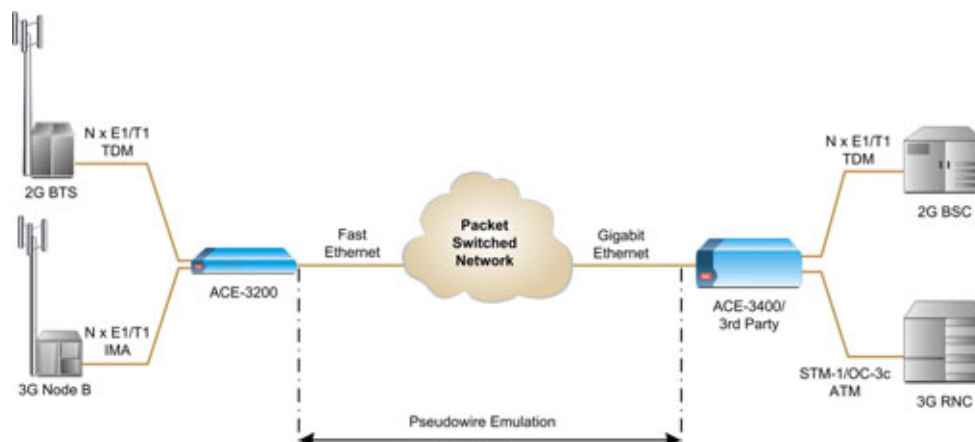


Figure 2. Emulated ATM/TDM Services over a Packet Switched Network (PSN)

ACE-3200

Cell-Site Gateway

ETHERNET INTERFACE

ACE-3200 includes two Fast Ethernet (10/100BaseT) ports, used for pseudowire (PW) connectivity, user connections and inband management access.

The Ethernet ports are also used for out-of-band management in applications that do not utilize an Ethernet uplink.

The Ethernet interfaces can be ordered as electrical (RJ-45) or fiber optic ports. The fiber optic ports utilize hot-swappable Ethernet-compliant SFPs, which are identical in structure to the STM-1/OC-3c SFPs.

Note: For more information, refer to the *SFP Transceivers data sheet* and to the *Ordering section*.

OAM AND DIAGNOSTICS

Comprehensive OAM and diagnostic capabilities include the following.

- PW connectivity verification using VCCV-BFD according to 'draft ietf bfd-base' and 'draft-ietf-pwe3-vccv-bfd' requirements
- Path verification using single-hop IP-BFD according to 'draft-ietf-bfd-v4v6-1hop-08'
- Monitoring status of a GRE tunnel, using GRE keep-alive messages
- LSP ping and traceroute for path verification and fault localization in MPLS networks
- 802.3ah ETH-OAM on Fast Ethernet ports
- Fault propagation between PSN and TDM/ATM connections
- Performance monitoring statistics
- Statistic collection per port and per connection
- External and internal physical loopbacks.

For diagnostics purposes, ACE-3200 maintains a cyclic event log file that stores up to 2000 time stamped events. In addition, an internal system log agent can send all reported events to a centralized repository or remote server.

MANAGEMENT

ACE-3200 can be managed using different access methods, via:

- Dedicated RS-232 or 10/100BaseT ports
- Dedicated VC defined on any ATM port
- Ethernet uplink port, using IP-based connection (raw IP or over PW).

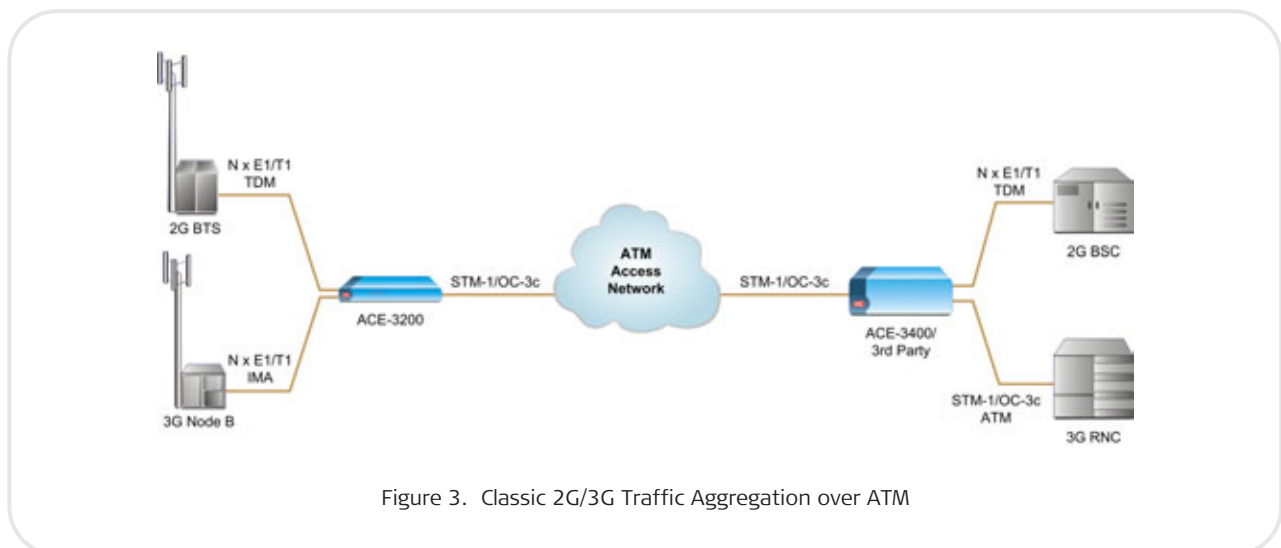


Figure 3. Classic 2G/3G Traffic Aggregation over ATM

The following applications can be used for management:

- CLI-driven terminal utility via an ASCII terminal connection
- Telnet via an IP-based connection
- Secure Shell (SSH) via any secure client/server application
- RADview-EMS, RAD's CORBA-based element management access system.

The unit can be managed by and report to up to 16 different users simultaneously. Accounts of existing and new users can be defined/changed remotely, using a dedicated RADIUS server.

ACE-3200 allows retrieval of the current date and time from a centralized location, by synchronizing with an SNTP (System Network Timing Protocol) server.

Software upgrades and configuration files can be downloaded/uploaded to/from ACE-3200 via TFTP or XMODEM.

ADVANCED SECURITY FEATURES

Telnet-like management can be secured using a Secure Shell (SSH) client/server program. Instead of sending plain-text ASCII-based commands and login requests over the network, SSH provides a secure communication channel.

In addition, ACE-3200 supports SNMP version 3, providing secure access to the device by authenticating and encrypting packets transmitted over the network.

INDUSTRIALLY HARDENED UNIT

ACE-3200/H is an industrially-hardened version of the unit, capable of withstanding higher temperature environments.

Specifications

STM-1/OC-3c INTERFACE

Number of Ports
0 or 2 (as ordered)

Data Rate
155 Mbps

Operation Mode
UNI, SDH or SONET

Interface Type
Fiber optic, via Small Form-Factor Pluggable (SFP) transceiver

SFPs
For full details, see the SFP Transceivers data sheet at www.rad.com

Note: *It is strongly recommended to order this device with **original RAD SFPs installed**. This will ensure that prior to shipping, RAD has performed comprehensive functional quality tests on the entire assembled unit, including the SFP devices. RAD cannot guarantee full compliance to product specifications for units using non-RAD SFPs.*

Jitter Performance
Output: according to G.825
Tolerance: according to G.823
Transfer: according to G.783

Compliance
Physical layer and ATM mapping into STM-1/OC-3c according to I.432
Automatic protection switching (APS) according to G.841 Annex B (1+1, bidirectional)

E1/T1 INTERFACE

Number of Ports
8 or 16 (as ordered)

Data Rate
E1: 2.048 Mbps
T1: 1.544 Mbps

Compliance
E1: G.703, G.704, G.732
T1: G.703, ANSI T1.403

Framing
E1: MF CRC-4
T1: ESF

Line Code
E1: HDB3
T1: B8ZS

Line Mode
E1: N/A
T1: CSU or DSU

Operation Mode
ATM UNI, ATM IMA or TDM

Jitter Performance
E1: Output and tolerance according to G.823, transfer according to G.705
T1: According to AT&T TR-62411

LIU Support
E1: Short haul
T1: N/A

CRC-6 Calculation
E1: N/A
T1: According to G.704

Line Impedance
E1: 120Ω (balanced), 75Ω (unbalanced, via an adapter cable)
T1: 100Ω (balanced)

Connector
E1/T1 balanced: RJ-45
E1 unbalanced: RJ-45, via an RJ-45 to BNC adapter cable (supplied)

ETHERNET INTERFACE

Number of Ports
2

Type
10/100BaseT, full or half duplex, autonegotiation

ACE-3200

Cell-Site Gateway

Data Rate

10 Mbps, 100 Mbps

Max. Frame Size

1600 bytes

Compliance

IEEE 802.1Q
 RFC 4717 (ATM over PSN)
 Draft-ietf-pwe3-cell-transport
 RFC 5086 (CES over PSN)
 RFC 4553 (SAToP)
 Draft-ietf-pwe3-vccv
 Draft-ietf-pwe3-bfd-base
 Draft-ietf-bfd-v4v5-1hop-08
 Draft-ietf-pwe3-oam-msg-map
 ITU G.8261 (PSN clock recovery)

SFPs

For full details, see the SFP Transceivers data sheet at www.rad.com

Note: It is strongly recommended to order this device with **original RAD SFPs installed**. This will ensure that prior to shipping, RAD has performed comprehensive functional quality tests on the entire assembled unit, including the SFP devices. RAD cannot guarantee full compliance to product specifications for units using non-RAD SFPs.

Connector

RJ-45 or via SFP transceiver

Note: For more information, refer to the SFP Transceivers data sheet and to the Ordering section.

TERMINAL CONTROL INTERFACE

Type

RS-232/V.24 (DCE)

Bit Rate

9.6, 19.2, 38.4, 57.6 or 115.2 kbps (user-selectable)

Connector

9-pin, D-type, female

GENERAL

LED Indicators

Chassis –

- PS (green): Power supply status
- RDY (green): Self-test result
- ALM (red): Alarm condition

STM-1/OC-3c ports –

- SYNC (green): Synchronization status
- ATM (green): ATM traffic indication

E1/T1 ports –

- SYNC (green): Physical layer synchronization status

Ethernet ports –

- LINK (green): Ethernet link status
- ACT (yellow): Ethernet traffic indication

Fans

Two internal cooling fans

Power

AC: 100 to 240 VAC ($\pm 10\%$), 50/60 Hz
 DC: -48 VDC nominal (-41 to -72 VDC)
 or 24 VDC nominal (20 to 36 VDC)

Power Consumption

60VA max

Physical

Height: 4.37 cm (1.7 in)
 Width: 44.0 cm (17.5 in)
 Depth: 24.0 cm (9.4 in)
 Weight: 3.68 kg (8.11 lb)

Environment

Temperature: ACE-3200: 0° to 50°C
 (32° to 122°F)
 ACE-3200/H: -20° to 65°C
 (-4° to 149°F)

Storage: -20° to 70°C (-4° to 158°F)

Humidity: Up to 90%, non-condensing

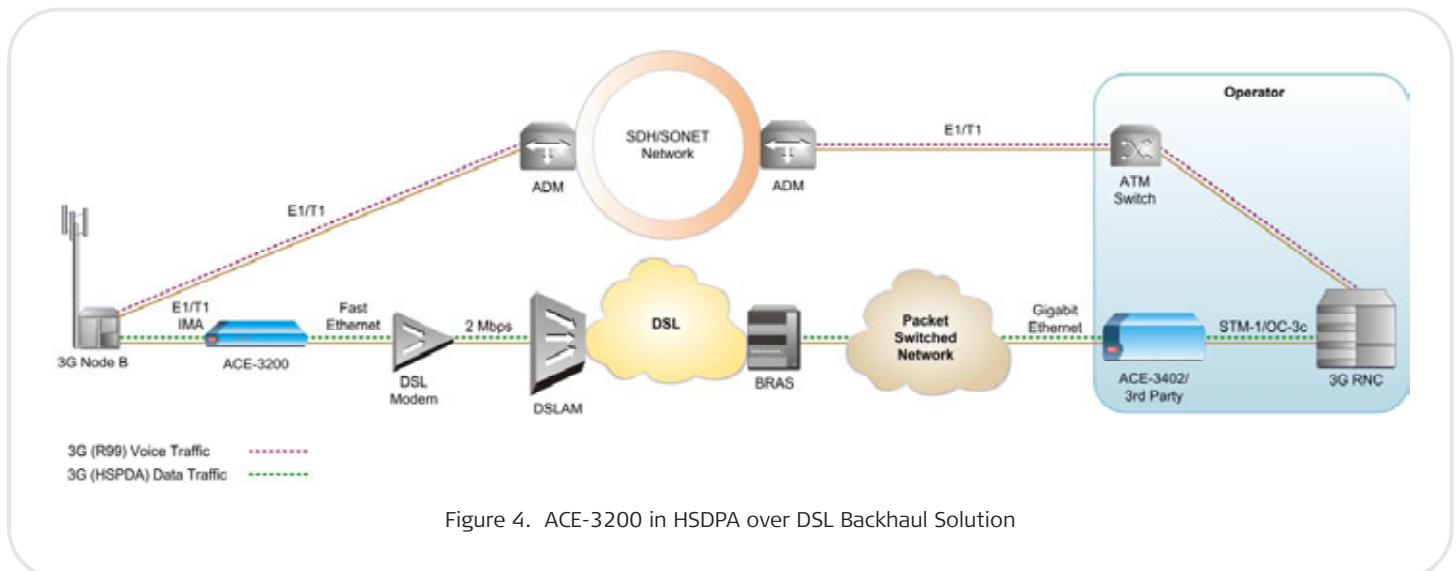






Figure 4. ACE-3200 in HSDPA over DSL Backhaul Solution

ACE-3000 Cell Site Gateway Comparison Table

| Features |  |  |  |  |
|---------------------------------|---|---|--|---|
| | ACE-3220 (Ver. 6.1) | ACE-3105 (Ver. 6.1) | ACE-3205 (Ver. 6.1) | ACE-3200 (Ver. 6.1) |
| E1/T1 traffic aggregation | ✓ | ✓ | ✓ | ✓ |
| STM-1/OC-3c traffic aggregation | ✓ | | | ✓ |
| E1/T1 ports | 8 or 16, built-in | 0 or 4, built-in | 8 or 16, built-in | 8 or 16, built-in |
| ATM-155 ports | 0 or 1, built-in | None | None | 0 or 2, built-in |
| ADSL2+ port | 1 or 2 per module | 1 | 2 | |
| SHDSL ports | 4 per module | 4 | 4 | |
| Gigabit Ethernet ports | 1 per module | None | None | None |
| Fast Ethernet ports | 4 | 2 | 2 | 2 |
| SFPs for ATM-155 ports | ✓ | | | ✓ |
| SFPs for GbE ports | ✓ (optional) | | | |
| SFPs for FE ports | ✓ (optional) | ✓ (optional) | ✓ (optional) | ✓ (optional) |
| IEEE 1588 clock distribution | ✓ (optional) | | | |
| IEEE 1588 clock recovery | ✓ | ✓ | | |
| NTR clock recovery | ✓ | ✓ | ✓ | |
| PSN clock distribution | ✓ | ✓ | ✓ | ✓ |
| PSN clock recovery | ✓ | ✓ | ✓ | ✓ |
| PPPoE functionality | | ✓ | ✓ | ✓ |
| Bridging | ✓ | ✓ | ✓ | ✓ |
| Max. ATM VCCs | 128 | 16 | 16 | 32 |
| Max. data PW links | 128 | 16 | 16 | 32 |
| Max. remote PSN peers | 32 | 8 | 8 | 32 |
| Power supply | Single/dual, fixed | Single wide range, fixed | Single/dual, fixed | Single/dual, fixed |
| Physical width | 44 cm (17.5") | 21.5 cm (8.4") | 44 cm (17.5") | 44 cm (17.5") |
| Physical height | 1U | 1U | 1U | 1U |

ACE-3200

Cell-Site Gateway

Ordering

ACE-3200/#/@/\$/!/€/*/~/~/?

Legend

Power supply type:

| | |
|-----|-----------------------|
| AC | Single 100 to 240 VAC |
| DC | Single -48/-60 VDC |
| ACR | Dual 100 to 240 VAC |
| DCR | Dual -48/-60 VDC |
| 24 | Single 20 to 36 VDC |
| 24R | Dual 20 to 36 VDC |

@ Number of STM-1/OC-3c ports:

| | |
|----|---------------------------|
| S0 | Without STM-1/OC-3c ports |
| S2 | Two STM-1/OC-3c ports |

Note: SFP transceivers for the STM-1/OC-3c ports are ordered separately. For more information, refer to *Optional Accessories* and to the *SFP Transceivers* data sheet.

\$ Number of E1/T1 ports:

| | |
|------|-------------|
| 8E1 | 8 E1 ports |
| 8T1 | 8 T1 ports |
| 16E1 | 16 E1 ports |
| 16T1 | 16 T1 ports |

Note: Unbalanced E1 interface is provided via an adapter cable, which can be ordered separately (see *CBL-RJ45/2BNC/E1/X* in *Optional Accessories*).

€ Type of Ethernet ports (leave empty for two built-in electrical RJ-45 ports):

SE Two empty SFP cages

Note: Fiber optic Ethernet ports require SFP transceivers that are fitted into the empty cages.

* The required **software** license pack (Default= ATM network functionality):

P1 ATM and PSN functionality, not including clock recovery over packet

P2 Complete functionality, including clock recovery over packet

~ Optional clock recovery **hardware** component:

A Clock recovery hardware component

Note: For activating the clock recovery hardware, the **P2** software license pack is required. It is possible, however, to order the hardware only, for future software upgrade.

? Enclosure type:

H Industrially hardened enclosure

Note: By default, ACE-3200 is supplied in a regular enclosure. The /H version requires temperature-hardened SFP transceivers.

SUPPLIED ACCESSORIES

AC power cord or a DC power connection kit (as ordered)

RM-34

Hardware kit for mounting one ACE-3200 unit into a 19" rack

OPTIONAL ACCESSORIES

SFP Transceivers

SFP-1 FE/STM-1, 1310 nm, multimode LED, 2 km (1.2 miles), LC

SFP-2 FE/STM-1, 1310 nm, single mode laser, 15 km (9.3 miles), LC

SFP-3 STM-1, 1310 nm, single mode laser, 40 km (24.8 miles), LC

SFP-4 STM-1, 1550 nm, single mode laser, 80 km (49.7 miles), LC

Note: For the complete list of SFPs, refer to the *SFP Transceivers* data sheet. It is strongly recommended to order ACE-3200 with original RAD SFPs installed. This will ensure that prior to shipping, RAD has performed comprehensive functional quality tests on the entire assembled

unit, including the SFP devices. RAD cannot guarantee full compliance to product specifications for ACE-3200 units using non-RAD SFPs.

CBL-LC/#/€/

LC to SC/ST/FC fiber optic converter cable for operation with multimode or single mode fibers. The cable is 2m (6.5 ft) long.

Connector type:

| | |
|----|--------------|
| SC | SC connector |
| ST | ST connector |
| FC | FC connector |

€/ Fiber type:

| | |
|----|-------------------|
| MM | Multimode fiber |
| SM | Single mode fiber |

CBL-DB9F-DB9M-STR

Standard DB-9 to DB-9 control port cable

CBL-RJ45/2BNC/E1/X

Interface adapter for converting a balanced E1 RJ-45 connector to a pair of BNC unbalanced connectors (if unbalanced E1 interface is ordered)

WM-34

Hardware kit for wall-mounting one unit

ACE-3200-8-SW/!

ACE-3200-16-SW/!

Software upgrade pack for a unit with 8 or 16 E1/T1 ports (select either 8 or 16)

! Software pack type:

| | |
|-----|------------------------------|
| P1 | PW over PSN functionality |
| P2 | Clock recovery functionality |
| LDP | LDP functionality |

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