

ACE-3000 Family

ACE-3220

Mobile Backhauling Cell-Site Gateway



Multi-generation cellular traffic over packet-switched networks (PSNs) and TDM/ATM, using fiber and DSL uplinks

Ace

- Ultimate cell-site gateway
- Multi-standard pseudowire encapsulation for delivery of Ethernet and TDM/ATM traffic over PSNs
- Two modular uplink interfaces supporting GbE, SHDSL.bis, ADSL2/2+ and VDSL2-ready
- Designed for 2G/3G/LTE and WiMAX
- Flexible clocking mechanism with IEEE 1588-2008 and Sync-E

RAD's ACE-3220 multiservice cell-site gateway is designed to accommodate the rapid expansion in cellular backhaul traffic resulting from the widespread deployment of new mobile broadband services. It simplifies service provisioning and control by enabling simultaneous delivery of GSM, UMTS and next-generation 3GPP/LTE WiMAX traffic over the same transport network.

Working opposite ACE-3400/3402/3600 or third-party aggregation site gateways, ACE-3220 minimizes investments and shortens service rollout times by leveraging available ATM, SDH/SONET, and DSL infrastructure to access high-capacity, economical packet-switched transport networks.

BROAD RANGE OF INTERFACES

A variety of built-in interfaces is available to serve as user or network ports:

- 8 or 16 ATM UNI/IMA/TDM E1/T1 user ports
- Optional STM1/OC-3c ATM port
- 4 UTP/SFP Fast Ethernet ports.

In addition, ACE-3220 supports up to two interface modules, accommodating two ADSL2+ ports, four SHDSL.bis ports supporting IMA, M-pair or EFM bonding, and a combo GbE port.

Depending on the original traffic type, IP traffic (received from IP Node B), ATM or TDM traffic (received via E1/T1) is transmitted over Ethernet, TDM, ATM PWE, EthoATM, PWEoATM or ATM cross-connects.



data communications

The Access Company

ACE-3220

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PSUEDOWIRE CAPABILITIES

ACE-3220 allows up to 128 PW connections to be established over PSN, 32 clock distribution PWs and 2 clock recovery PWs.

ATMoPSN – Pseudowire connections can be established over PSN according to RFC 4717:

- 1-to-1 VC/VP – Each VCC/VPC is mapped into a single pseudowire connection.
- N-to-1 VC/VP – Several VCs or VPs can be encapsulated into 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 (TDM PWs only).

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

ADVANCED PSUEDOWIRE QoS

Required QoS is achieved by employing different prioritization techniques:

- Layer 2 – outgoing pseudowire packets are assigned with a dedicated VLAN ID according to 802.1q. A priority is defined using 802.1p bits.
- MPLS – outgoing pseudowire packets are assigned to a specific MPLS tunnel and a priority is defined using EXP bits.
- IP – a priority is defined to outgoing pseudowire packets using ToS/DSCP bits

ATM SWITCHING AND POLICING

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.

IMA

Inverse E1/T1 multiplexing over ATM (IMA) versions 1.0 and 1.1 allows users to define up to 4 IMA groups.

EFM BONDING

Rates of up to 22 Mbps can be achieved by aggregating up to four 2-wire SHDSL.bis interfaces into a single Ethernet link. This EFM bonding technology enables carriers to deliver state-of-the-art Ethernet services while leveraging the existing copper infrastructure and DSLAM deployments.

BRIDGING

LAN-To-LAN

In addition to ATM and TDM over DSL backhauling, LAN-to-LAN bridging facilitates backhauling of Ethernet traffic originating from the cellular site/IP Node B towards the PSN.

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

MPLS SUPPORT – LDP

The MPLS label distribution protocol (LDP) is used to automatically assign and distribute pseudowires and tunnel labels between MPLS peers (LDPoMPLS according to RFC 3036/3037).

Note: *This functionality requires a software license as specified in the Ordering section.*

CLOCK SYNCHRONIZATION

Robust clock synchronization and flexible timing modes include:

- Distribution and recovery of the 1588 high-precision clock (according to IEEE 1588-2008).
- Distribution and recovery of the clock on Ethernet interfaces (Sync-E) according to the ITU-T G.8261/G.8262/G.8264 requirements.
- Clock recovery – a dedicated clock recovery module (optional) allows ACE-3220 to adaptively recover the clock from a source device that distributes the ATM clock over a PSN.
- NTR clock recovery – ACE-3220 supports clock synchronization via NTR over SHDSL. In this case, the DSLAM provides the clock reference via the DSL connection.
- Unicast clock distribution – the master clock is distributed with a dedicated stream towards up to 32 remote PSN peers via pseudowire connections
- Multicast clock distribution – the master clock is distributed towards the PSN using a single IP multicast clock stream (IGMPv2 host) via pseudowire connections.
- E1/T1 clock transmission and recovery according to G.823/G.824.
- Hardware ready for 2 MHz interface clock for external synchronization.

Note: *For the clock recovery feature, ACE-3220 must be ordered with the "S, A or AS" suffix. For more information, refer to the Ordering section.*

PATH REDUNDANCY

Pseudowire and management traffic is protected by using two static routing paths with different priority values. Only one path is operational at a time, and its status is defined by:

- Physical link
- IP-BFD (if the IP-BFD destination equals the static route next hop)
- GRE keep-alive (for GRE interfaces)
- Next hop ARP entry.

ACE-3220 supports up to 12 prioritized static routes.

MODULAR INTERFACES

The interface profile can be customized using interchangeable interface modules that can easily be inserted and extracted.

Note: The modular interfaces are not hot-swappable.

ADSL2+ Module

The module includes two ADSL2+ interfaces, which support ADSL2+ over POTS (Annex A) and ADSL2+ over ISDN (Annex B), as well as auto-mode synchronization to ADSL/ ADSL2/ ADSL2+ (complying with G.992.1/ G.992.3/ G.992.5).

SHDSL Module

The module includes four SHDSL interfaces, which support SHDSL Annex A, Annex B and SHDSL.bis Annex F & G.

SHDSL interfaces support the following bonding modes:

- IMA
- M-pair
- EFM.

GbE Module

The module supports a single combo Gigabit Ethernet interface, which can be used for a network or user connection.

FIXED INTERFACES

The chassis is also equipped with fixed E1/T1, Fast Ethernet and optional STM-1/OC-3c interfaces.

E1/T1 Interfaces

ACE-3220 includes 8 or 16 E1 or T1 multiservice ports that can be configured to work in ATM UNI/IMA or TDM mode. 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).

Fast Ethernet Interfaces

ACE-3220 includes four Fast Ethernet RJ-45 or SFP ports, used as user or network interface.

The Ethernet ports can also be used for out of band management.

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 STM1/OC-3c SFPs.

STM1-OC-3c Interface

ACE-3220 can be ordered with one STM1/OC-3c TM SFP-based interface.

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

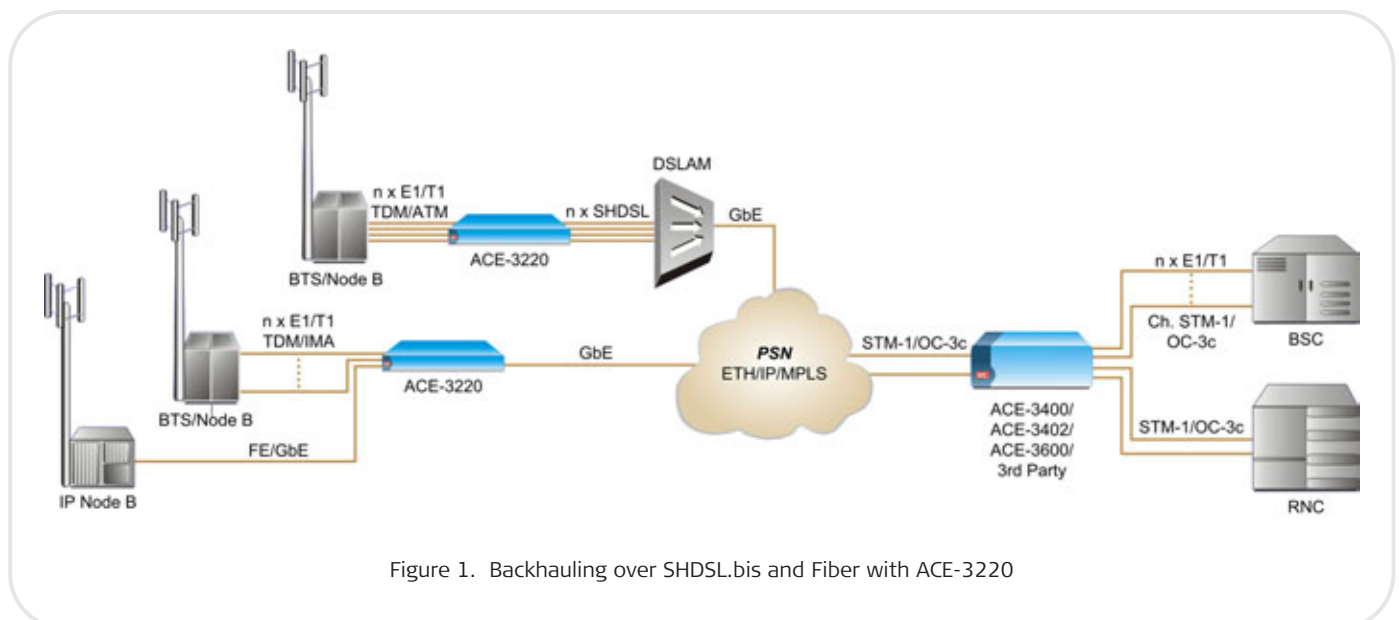


Figure 1. Backhauling over SHDSL.bis and Fiber with ACE-3220

ACE-3220

Mobile Backhauling Cell-Site Gateway

MANAGEMENT

The following access methods are available for management:

- Dedicated RS-232 or one of the four Fast Ethernet ports
- Dedicated VC defined on any ATM port or xDSL port
- Ethernet uplink port, using IP based connection (raw IP or over PW).

The following applications can be used for management:

- CLI-driven terminal utility such as HyperTerminal via an ASCII terminal connection
- Telnet via an IP-based connection
- Secure Shell (SSH) via any secure client/server application
- RADview-EMS, RAD's SNMP-based element management system. ACE-3220 and RADview-EMS support SNMPv3.

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.

The current date and time can be retrieved from a centralized location by synchronizing with an SNTP (System Network Timing Protocol) server.

To ensure reliability in event reporting, ACE-3220 synchronizes between contents of its alarm buffer and RADview-EMS management server according to the requirements defined in ITU-T Q.821.

Software upgrades and configuration files can be downloaded/uploaded to/from ACE-3220 via TFTP/SFTP or XMODEM.

ADVANCED SECURITY FEATURES

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

In addition, ACE-3220 supports SNMP version 3, providing secure access to the device by authenticating and encrypting packets transmitted over the network.

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.
- The OAM sublayer enables Ethernet nodes to monitor a link's service quality between two adjacent network elements according to IEEE 802.3ah.

- 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
- 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-3220 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.

INDUSTRIALLY HARDENED UNIT

ACE-3220/H is an industrially-hardened version of the unit, capable of withstanding higher temperature environments.

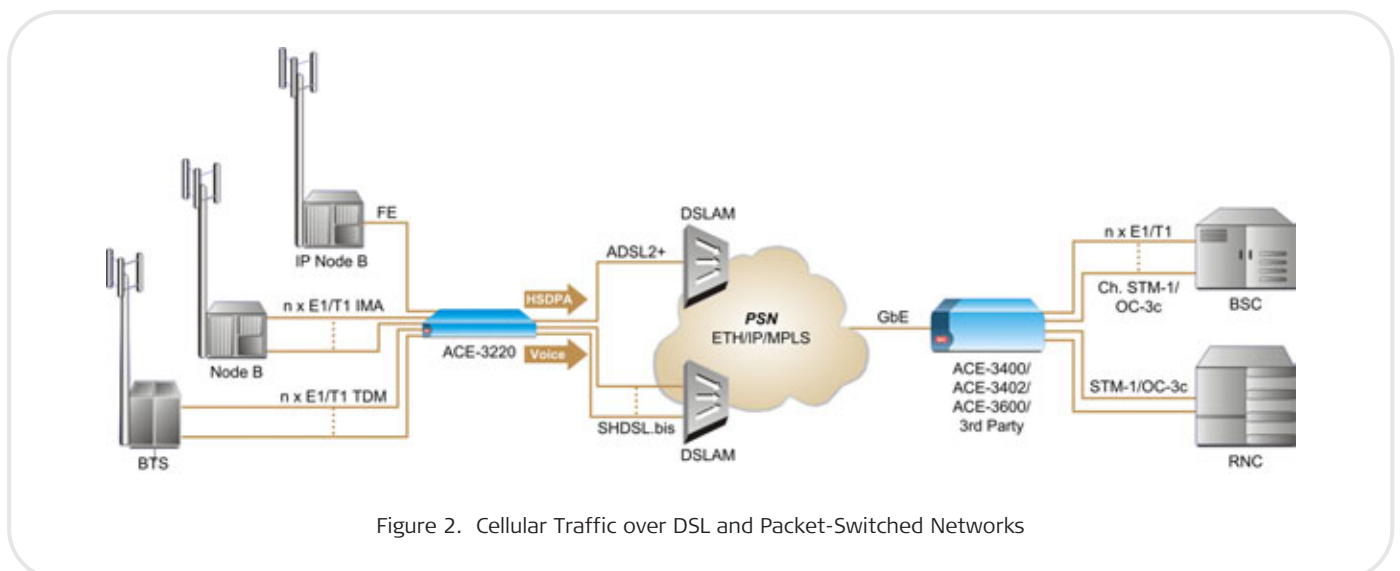


Figure 2. Cellular Traffic over DSL and Packet-Switched Networks

Specifications

E1/T1 INTERFACES

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: 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: DSU

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: BNC, via an RJ-45 to BNC adapter cable (supplied)

ETHERNET INTERFACES

Number of Ports

4

Type

10/100BaseTX, full or half duplex, RJ 45 or fiber optic, based on RAD SFPs

Data Rate

10/100 Mbps

Max. Frame Size

1600 bytes

Compliance

IEEE 802.1Q

RFC 4717 (ATM over PSN)

Draft-ietf-pwe3-cell-transport

RFC 5086 (CESoPSN)

RFC 4553 (SAToP)

RFC 4448 (Ethernet over MPLS)

Draft-ietf-pwe3-vccv

Draft-ietf-pwe3-bfd-base

Draft-ietf-bfd-v4v6-1hop-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.*

Note: Copper SFPs do not support Sync-E.

Connector

RJ-45 or via SFP transceiver

STM-1/OC-3c INTERFACE

Number of Ports

1 (if ordered)

Data Rate

155 Mbps

Operation Mode

UNI, SDH or SONET

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.*

Interface Type

Fiber optic, via Small Form-Factor

Pluggable (SFP) transceiver

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

TERMINAL CONTROL INTERFACE

Type

RS-232/V.24 (DCE)

Bit Rate

9.6, 19.2, 38.4, 57.6 or 115.2 kbps

Connector

9-pin, D-type, female

GENERAL

LED Indicators

Chassis:

PS1/PS2 (green): Power supply status

RDY (green): Self-test result

ALM (red): Alarm condition

Every DSL port LED:

SYNC (green): Synchronizing and transmitting data

SYNC (red): DSL link not detected

E1/T1 ports:

SYNC (green): Physical layer synchronization status

Every Ethernet port LED:

(green): Ethernet link status

(yellow): Ethernet traffic indication

Fans

Four internal cooling fans

ACE-3220

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Power

AC: 100–240 VAC ($\pm 10\%$), 50/60 Hz
Single AC power supply

ACR: 100–240 VAC ($\pm 10\%$), 50/60 Hz
Dual AC power supply

DC: -36–72 VDC (-48 or -60 VDC nominal)
Single DC power supply

DCR: -36–72 VDC (-48 or -60 VDC nominal)
Dual DC power supply

24DC: 20–36 VDC (24 VDC nominal)
Single DC power supply

24DCR: 20–36 VDC (24 VDC nominal)
Dual DC power supply

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-3220: 0° to 50°C
(32° to 122°F)

ACE-3220/H: -20° to 65°C
(-4° to 149°F)

Storage: -20° to 70°C (-4° to 158°F)

Humidity: Up to 90%, non-condensing

CSG MODULES

ADSL2+ Interface

Number of Ports

1 or 2 ports based on RJ-45, one pair on each port

Type

ADSL2/2+: ITU-T Rec. G.992.5
Annex A and B

Line Code

DMT

Data Rate

Downstream: 24 Mbps

Upstream: 1 Mbps

Connector

RJ-45

SHDSL Interface

Number of Ports

2 ports based on RJ-45, two pairs on each port.

Standard

G. 991.2 (SHDSL, SHDSL.bis)

Line Rate per Link

Up to 2312 kbps (Annex A, Annex B)

Up to 5696 kbps (Annex F, Annex G)

Line Code

16-TC PAM

32-TC PAM

Handshake Protocol

ITU-T Rec. G994.1

EOC Support

Mandatory

Connector

RJ-45

IMA Bonding

IMA over up to 4 × 2-wire, per ATM Forum 1.1 (AF-PHY-0086.001)

M-Pair Bonding

One M-pair

2-wire, M=1

4-wire, M=2

8-wire, M=4

EFM bonding

According to ITU-T G.998.2 at a combined line rate of up to 22 Mbps.

Gigabit Ethernet Interface

Number of Ports

1

Type

100BaseFX or 1000BaseLX/CX, full duplex, fiber optic, based on RAD SFPs

Data Rate

100/1000Mbps

Max. Frame Size

1600 bytes

Compliance

IEEE 802.3z, 802.1Q, 802.1p

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

Gigabit Ethernet SFP transceiver or RJ-45

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-3220

Mobile Backhauling Cell-Site Gateway

Ordering

ACE-3220/!/##/\$/+2/@/~/?

Legend

! Power supply (Default=AC):

AC	Single 100 to 240 VAC
ACR	Dual 100 to 240 VAC
DC	Single -48 VDC
DCR	Dual -48 VDC
24DC	Single 24 VDC
24DCR	Dual 24 VDC

SDH/SONET ports (Default=None):

S1 1 × OC-3c/STM1-UNI

\$ E1/T1 ports (Default=8E1/T1):

8E1	8 × E1 ports
8T1	8 × T1 ports
16E1	16 × E1 ports
16T1	16 × T1 ports

+2 4 FE ports (Default= UTP ports):

4SE 4 × SFP slots

@ The required **software** license pack (leave empty for ATM network functionality):P1 ATM and PSN functionality, not including clock recovery over packetP2 Complete functionality, including clock recovery over packetP3 ATM and PSN uplink including software support for synchronization over packet, and MPLS LDP software functionalityP4 ATM and PSN uplink, including MPLS LDP software functionality, not including clock recovery over packet~ Optional clock recovery **hardware** components:

A Synchronization over Packet hardware component

AS Synchronization over Packet hardware component & Synchronous Ethernet hardware component
S Synchronous Ethernet hardware component*Note: For activating the clock recovery hardware, the P2 or P3 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-3220 is supplied with a regular enclosure. The /H version requires temperature hardened SFP transceivers.

SFP-9G Gigabit Ethernet, RJ-45, 100BaseT, 100 m (328 ft)

CBL-LC/#/ε

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:

SC	SC connector
ST	ST connector
FC	FC connector

ε Fiber:

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

RM-34

Hardware kit for mounting one unit in a 19" rack

WM-34

Hardware kit for wall-mounting one unit

ACE-3220-8-SW/!

ACE-3220-16-SW/!

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

! Software:

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

OPTIONAL ACCESSORIES

ACE-CSG-IF/C1

Modular interfaces and peripherals

C1 Interface:

2AV-A	2 × ADSL2+ ports (Annex A)
2AV-B	2 × ADSL2+ ports (Annex B)
4SH	4 × SHDSL.bis ports
AV-A	1 × ADSL2+ port (Annex A)
GBE	Gigabit Ethernet port
SFP-1	FE/STM-1, 1310 nm, multimode LED, 2 km (1.2 mi)
SFP-2	FE/STM-1, 1310 nm, single mode, laser, 15 km (9.3 mi)
SFP-3	STM-1, 1310 nm, single mode, laser, 40 km (24.8 mi)
SFP-4	STM-1, 1550 nm, single mode, laser, 80 km (49.7 mi)
SFP-5	GbE, 850 nm, multimode, VCSEL, 0.55 km (0.3 mi)
SFP-6	GbE, 1310 nm, single mode, laser, 10.0 km (6.2 mi)
SFP-9F	Fast Ethernet, RJ-45, 100BaseT, 100 m (328 ft)

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