Data Sheet

ACE-3000 Family

ACE-3105

Mobile Backhauling Cell-Site Gateway

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

- Low-cost cell-site gateway for delivering Ethernet and TDM/ATM traffic over PSNs using pseudowire emulation
- Multi-generation cellular backhauling over one ADSL2+ or up to four SHDSL.bis pairs using IMA or EFM bonding, VDSL2-ready
- Flexible clocking mechanism with IEEE 1588-2008
- Path redundancy using different static routes

ACE-3105 is a low-cost multiservice cellular site gateway, designed for cost-effective backhauling of 2G/3G HSDPA data traffic over multi-generation access networks (such as Ethernet and SDH/SONET), using DSL access technology.

ACE-3105 uses advanced pseudowire (PW) transmission technology over SHDSL, ADSL2+ or Ethernet links to deliver cellular and legacy traffic services (ATM or TDM) over next generation PSNs (packet-switched networks), such as Layer-2, MPLS and IP.

PORTS DESCRIPTION

ACE-3105 allows operators to use a variety of interfaces as user or network ports:

- 0 or 4 ATM UNI/IMA/TDM E1/T1 user ports (as ordered)
- 2 UTP or SFP-based Fast Ethernet ports (as ordered)
- 1 ADSL2+ or 4 SHDSL.bis ports (as ordered).

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.

The Ethernet interfaces operate as user or network ports, per user configuration and depending on the required application.

RAD data communications
The Access Company

ACE-3105

Mobile Backhauling Cell-Site Gateway

CELLULAR BACKHAUL OVER DSL

ACE-3105 delivers data or voice traffic over different DSL link types. For voice traffic (2G, RT99) backhauling, an SHDSL uplink is used. For data traffic (HSDPA) backhauling, an SHDSL or an ADSL2+ uplink is used. Backhauling of cellular voice and data is illustrated in Figures 1 and 2.

PSEUDOWIRE CAPABILITIES

ACE-3105 allows up to 16 pseudowire connections to be established over a packet-switched network (PSN).

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.

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

ADVANCED PSEUDOWIRE QOS

Required quality of service 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 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.

IMA

ACE-3105 performs inverse E1/T1 multiplexing over ATM (IMA) versions 1.0 and 1.1 and 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 technolgy (according to IEEE 802.3) 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, ACE-3105 supports LAN-to-LAN bridging to allow 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.

CLOCK SYNCHRONIZATION

ACE-3105 provides robust clock synchronization and flexible timing modes, including:

- Clock recovery of the 1588 high precision clock performed according to IEEE 1588-2008.
- Clock recovery – a dedicated clock recovery module (optional) allows ACE-3105 to adaptively recover the clock from a source device that distributes the ATM clock over a PSN.
- NTR clock recovery – ACE-3105 synchronizes clock 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.
- Precise E1/T1 clock transmission and recovery according to G.823/G.824.

Note: *For the clock recovery feature, ACE-3105 must be ordered with the "A" 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-3105 supports up to 12 prioritized static routes.

INTERFACES

ACE-3105 is equipped with E1/T1, Fast Ethernet, ADSL2+ or SHDSL interfaces (as ordered).

ADSL2+ Interfaces
Units ordered with an ADSL2+ interface support ADSL2+ over POTS (Annex A) and ADSL2+ over ISDN (Annex B), if ordered, as well as auto-mode synchronization to ADSL/ADSL2/ADSL2+ (complying with G.992.1/G.992.3/G.992.5).

SHDSL Interfaces
Units ordered with four SHDSL interfaces comply with SHDSL Annex A (in North America), Annex B (in Europe) and SHDSL.bis Annex F & G.

SHDSL interfaces operate with the following bonding modes:

- IMA
- M-Pair
- EFM.

E1/T1 Interfaces
ACE-3105 includes 4 E1 or T1 multiservice ports (if ordered) that can be configured to work in ATM UNI/IMA, 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).

ETHERNET INTERFACES

ACE-3105 includes two Fast Ethernet (10/100BaseT) RJ-45 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.

MANAGEMENT

The following access methods are available for management:

- Dedicated RS-232 or 10/100BaseT ports
- Dedicated VC defined on any ATM 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 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-3105 retrieves current date and time from a centralized location, by synchronizing with an SNTP (System Network Timing Protocol) server.

To facilitate integration into a network, ACE-3105 automatically requests an IP address from the DHCP server for each interface that needs it.

To ensure reliability in event reporting, ACE-3105 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-3105 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-3105 supports SNMP version 3, providing secure access to the device by authenticating and encrypting packets transmitted over the network.

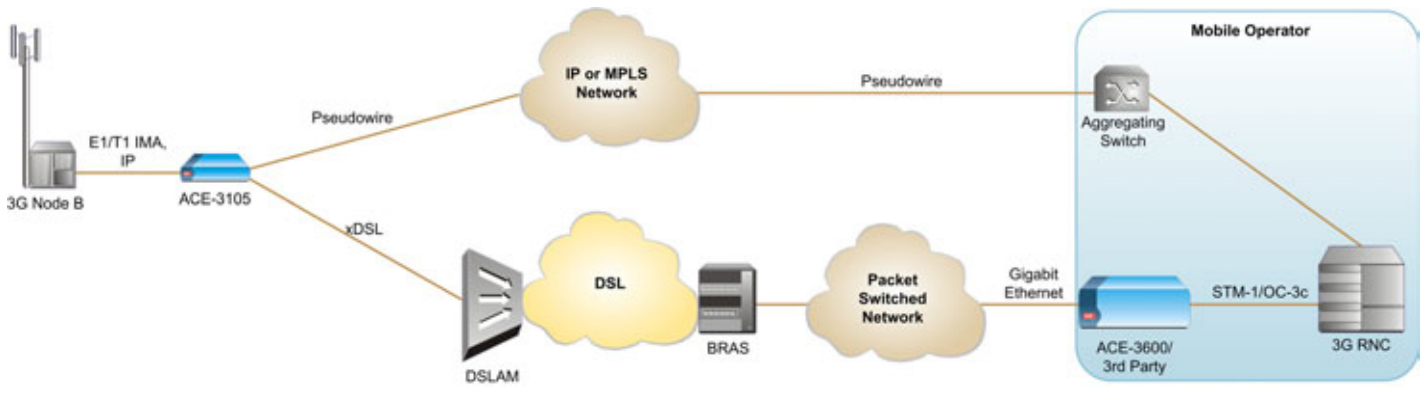

Figure 1. HSDPA over DSL and Packet-Switched Networks

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
- PW connectivity verification using single–hop IP-BFD according to 'draft-ietf-bfd-v4v6-1hop-08'
- The OAM sublayer enables Ethernet nodes to monitor a link's service quality between two adjacent network elements according to IEEE 802.3ah.
- Monitoring status of a GRE tunnel, using GRE keep-alive messages
- Fault propagation between PSN and TDM/ATM connections
- Performance monitoring statistics
- Statistic collection per port and per connection
- External and internal physical loopbacks.

For diagnostic purposes, ACE-3105 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-3105/H is an industrially-hardened version of the unit, capable of withstanding higher temperature environments.

Specifications

SHDSL INTERFACE

Number of Ports
4 pairs based on 2 × RJ-45, 2 pairs on each RJ-45 (or none if ADSL2+ is ordered)

Standard
G. 991.2 (SHDSL, SHDSL.bis)

Line Code
16-TC PAM

32-TC PAM

Line Rate per Link
Up to 2304 kbps (Annex A, Annex B)

Up to 5696 kbps (Annex F, Annex G)

Handshake Protocol
ITU-T Rec. G994.1

Connector
RJ-45

EFM BONDING

Standard
IEEE 802.3ah, ITU-T G.998.2

Combined Line Rate
Up to 22 Mbps

IMA BONDING

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

M-PAIR BONDING

One M-pair group
2-wire, M=1
4-wire, M=2
8-wire, M=4

ADSL2+ INTERFACES

Number of Ports
1 pair (or none if SHDSL is ordered)

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

Line Code
DMT

Data Rate
Downstream: Up to 24 Mbps

Upstream: Up to 1 Mbps

Connector
RJ-45

Note: *ACE-3105 is available with either ADSL2+ or SHDSL interfaces.*

E1/T1 INTERFACES

Number of Ports
4 or none (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, 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)

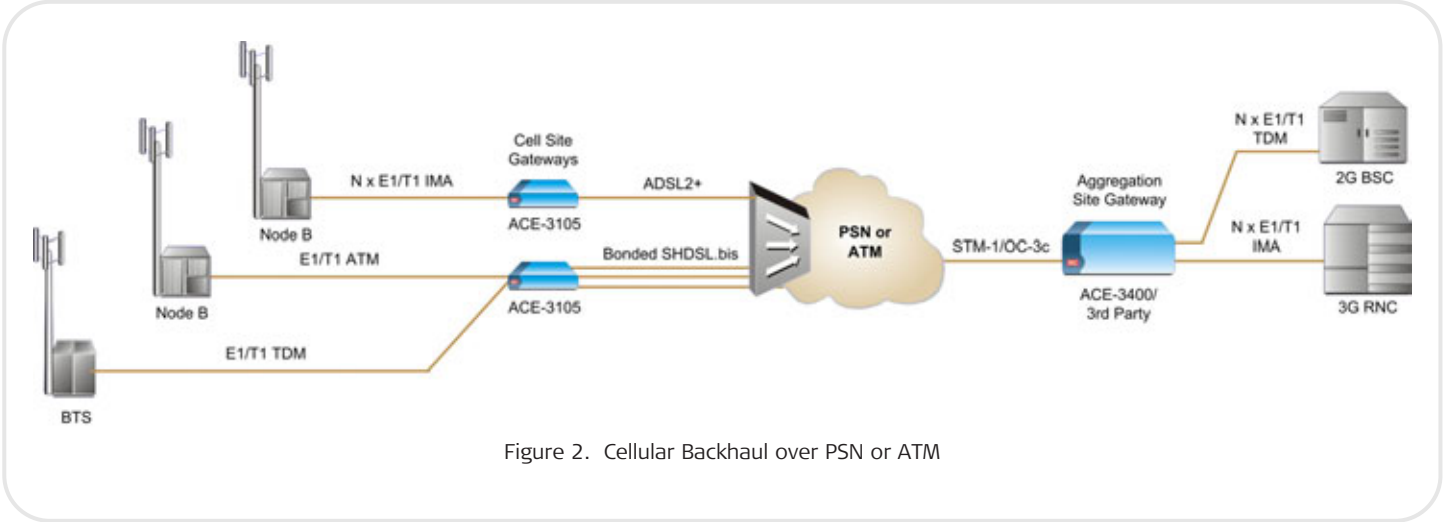

Figure 2. Cellular Backhaul over PSN or ATM

ACE-3105

Mobile Backhauling Cell-Site Gateway

ETHERNET INTERFACES

Number of Ports
2

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

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 (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.*

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

Connector
9-pin, D-type, female

GENERAL

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

DSL ports:
- SYNC (green): Synchronizing and transmitting data
- SYNC (red): DSL link not detected
- Blinking (green and red): Initializing

E1/T1 ports:
- SYNC (green): Physical layer synchronization status

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

Fans
One internal cooling fan in the industrially hardened unit (ACE-3105/H)

Power
AC/DC: 100–240 VAC or -40/-60 VDC (wide range)

Power Consumption
33VA max

Physical
Height: 4.37 cm (1.7 in)
Width: 21.5 cm (8.4 in)
Depth: 31.25 cm (12.3 in)
Weight: 2.4 kg (5.2 lb)

Environment
Temperature:

ACE-3105: 0° to 50°C (32° to 122°F)

ACE-3105/H: -20° to 65°C (-4° to 149°F)

Storage: -20° to 70°C (-4° to 158°F)

Humidity: Up to 90%, non-condensing

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-3105

Mobile Backhauling Cell-Site Gateway

Ordering

ACE-3105/#/C1/$/+2/@/~/?

Legend

Power supply (Default= wide range AC/DC):
- **24** Single 20 to 36 VDC

C1 DSL ports:
- **1+A** 1 × ADSL2+ Annex A port
- **1+B** 1 × ADSL2+ Annex B port
- **SH** 4 × SHDSL ports

$ Number of E1/T1 ports (leave empty for no E1/T1 ports):
- **4E1** 4 × E1 ports
- **4T1** 4 × 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).*

+2 Ethernet ports (Default= 2 × UTP ports):
- **SE** 2 × SFP slots
- **1SE** 1 × SFP slot and 1 × UTP port

@ 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
- **P3** ATM and PSN uplink including software support for synchronization over packet, and MPLS LDP software functionality
- **P4** ATM and PSN uplink, including MPLS LDP software functionality, not including clock recovery over packet

~ 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 (Default= regular enclosure)
- **H** Industrially hardened enclosure

SUPPLIED ACCESSORIES

AC power cord
AC/DC adapter plug (for wide range only)
DC power connection kit (for 24 VDC only)

OPTIONAL ACCESSORIES

SFP Transceivers

- **SFP-1** FE, 1310 nm, multimode LED, up to 2 km (1.2 miles), LC
- **SFP-2** FE, 1310 nm, single mode laser, up to 15 km (9.3 miles), LC

Note: *For the complete list of SFPs, refer to the SFP Transceivers data sheet. It is strongly recommended to order ACE-3105 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-3105 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.

Legend

Connector:
- **SC** SC connector
- **ST** ST connector
- **FC** FC connector

& 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 (if unbalanced E1 interface is ordered)

RM-35/@
Hardware kit for mounting one or two ACE-3105 units into a 19" rack

Legend

@ Rack mounting kit:
- **P1** Fitting one unit
- **P2** Fitting two units

WM-35
Hardware kit for wall-mounting one unit

ACE-3105-SW/!
Software upgrade pack

Legend

! Software pack:
- **P1** PW over PSN functionality (applicable with E1/T1 ports)
- **P2** Clock recovery functionality (applicable with E1/T1 ports)
- **LDP** LDP functionality

731-100-05/10 (6.1)

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