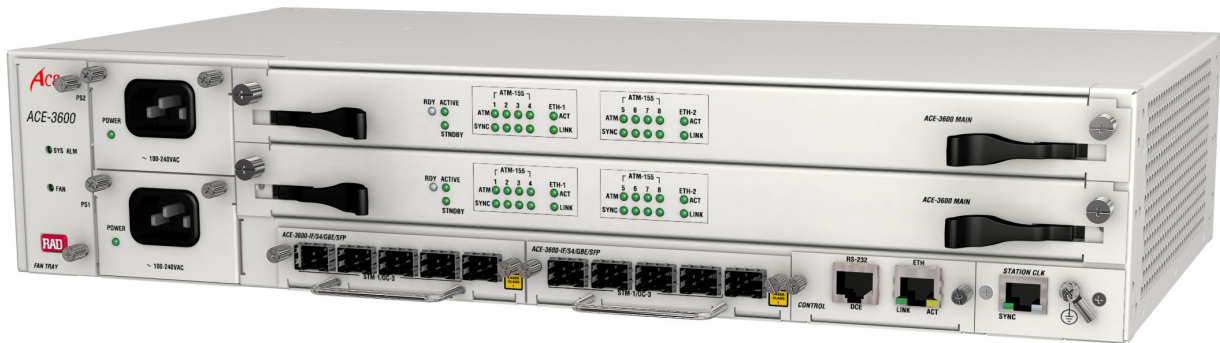


# ACE-3000 Product Family

# ACE-3600

## RNC-Site Gateway



3G and HSDPA traffic  
backhauling over  
packet-switched  
networks

**ACE**

- Pseudowire emulation of up to four protected STM-1/OC-3c (ATM) links over Gigabit Ethernet
- Advanced pseudowire connectivity verification using VCCV-BFD messages
- End-to-end fault propagation between legacy and packet-switched networks
- Full ATM switching, scheduling and shaping for separation of HSDPA and voice services
- Full system redundancy and modular hot-swappable architecture for replacing the interface, power and main modules while maintaining service continuity

ACE-3600 is an advanced carrier-class gateway, designed for cost-effective backhauling of 3G voice and HSDPA data traffic over next-generation core PSNs (packet-switched networks), including Layer-2, MPLS or IP.

Typically located at the 3G RNC site, the unit interconnects with the RNC and converts up to four STM-1/OC-3c (ATM) links to virtual pseudowire (PW) connections that are established over a packet-switched network, using its Gigabit Ethernet interface.

### ATM over Packet Capabilities

ACE-3600 allows up to 1024 pseudowire (PW) connections to be established over a packet-switched network.

The following encapsulation methods are supported according to RFC 4717:

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

ACE-3600 allows single or multiple ATM cells to be encapsulated per Ethernet frame.



**data communications**

Innovative Access Solutions

# ACE-3600

## RNC-Site Gateway

Over L2, L3 and MPLS networks, ACE-3600 uses various encapsulation types: VLANs (virtual LANs), dynamic and static MPLS label assignment, and MPLS in IP.

### ATM Switching Capabilities

ACE-3600 supports up to 1024 ATM connections with full UNI/NNI VPI and VCI ranges.

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 according to CBR, VBR, UBR and UBR+. This assures QoS in delay-sensitive voice/video applications.

### Quality of Service (QoS) over PSN

Over packet-switched networks, QoS is provided according to the network type:

- L2 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.

### System Timing

ACE-3600 provides a high accuracy clock and flexible timing modes. The Reference timing mode is supported for its ATM UNI interfaces. In this mode, timing is derived from the receive clock of the dedicated station clock port or any of the unit's STM-1/OC-3c ports.

Over the packet-switched network, ACE-3600 supports:

- Unicast clock distribution – the master clock is distributed with a dedicated stream towards up to 512 remote devices (peers)
- Multicast clock distribution – The master clock is distributed towards the PSN using a single IP multicast clock stream (IGMPv2 host).

### STM-1/OC-3c and Gigabit Ethernet Interfaces

ACE-3600 includes up to two interface modules, each including up to four STM-1/OC-3c UNI interfaces and one Gigabit Ethernet interface.

The STM-1/OC-3c interfaces map physical layer and ATM cells into STM-1/OC-3c according to ITU I.432.

The Gigabit Ethernet interface is used for packet-switched link (PW) connection and inband management access.

Both the GbE and STM-1/OC-3c interfaces utilize industry-standard hot-swappable SFP transceivers that allow using different fiber optic port types.

### Interface Module Redundancy

The two interface modules support Automatic Protection Switching (APS) according to G.841 Annex B, to ensure a fail-safe, continuous operation of the STM-1/OC-3c and Gigabit Ethernet interfaces.

When two interface modules are installed, the second module operates as the redundant module.

### OAM and Diagnostics

Comprehensive monitoring and diagnostic capabilities include:

- Pseudowire connectivity check
- External and internal physical loopbacks on STM-1/OC-3c ports
- Cell test towards the ATM connections.

ACE-3600 periodically verifies the connectivity status of pseudowire connections, using VCCV-BFD messages according to the 'draft-ietf-bfd-base' requirements. If a failure is detected, a notification is sent to both the remote peer and the ATM connection of the specific PW. This allows complete monitoring over the pseudowire connections in real-time.

ATM and PSN port alarms are forwarded over the packet-switched network from end to end. This includes the mapping of:

- Packet-switched network alarms to ATM alarms

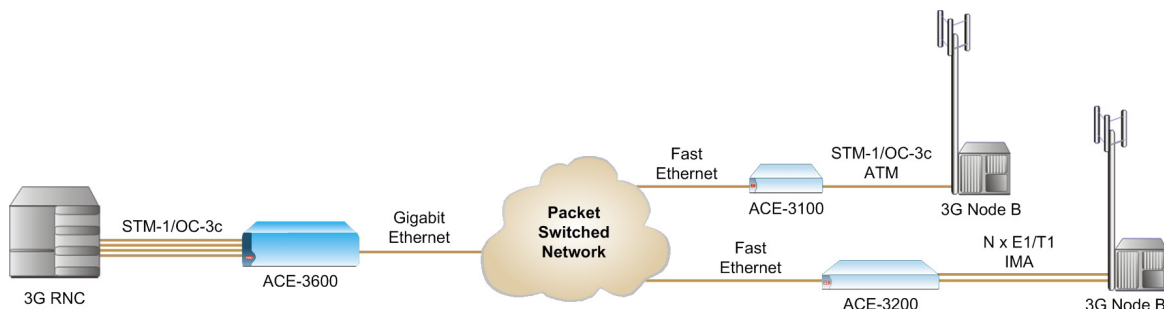


Figure 1. 3G Backhaul over a Packet-Switched Network

- ATM alarms over the PSN to the remote customer equipment (CE)
- Physical failures of ATM ports, over the packet-switched network towards both the local and remote CE.

For conventional ATM cross-connects (XCs), OAM is supported according to ITU I.610 requirements:

- F4 and F5 OAM support
- Configurable OAM mode per connection point
- Segment/intermediate mode for user connections and end-to-end mode for the management connection
- AIS and RDI cell detection and generation upon physical layer and ATM layer failures
- CC cell generation and LOC state detection per VP/VC
- Loopback location ID and configurable loopback source ID per device.

For diagnostics purposes, ACE-3600 maintains a cyclic event log file that stores up to 4096 time-stamped events.

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

ACE-3600 collects statistics per physical port and per VCC for 15-minute intervals. Statistics for the last 6 hours are stored in the device and can be retrieved at the network management station.

### Management

ACE-3600 can be managed using different access methods, via:

- Dedicated RS-232 or 10/100BaseT ports (out-of-band management)
- Dedicated ATM VC defined on an STM-1/OC-3c ATM port
- Gigabit Ethernet uplink port (inband management).

The unit can be managed by and report to up to 16 different managers simultaneously. This enables viewing the network status from different locations.

The following applications can be used for management:

- Menu-driven terminal utility via an ASCII terminal connection
- Telnet via an IP-based connection
- ConfiguRAD, Web-based element management tool via an IP-based connection
- RADview-Lite, RAD's SNMP-based management access system.

Software upgrades and configuration files can be downloaded/uploaded to/from ACE-3600 via TFTP or XMODEM.

### Modular Architecture

The modular architecture of ACE-3600 allows hot-swappable modules to be replaced in the field while maintaining uninterrupted service. The unit is also fully accessible from the front panel.

The unit's full hardware redundancy features (fans, power supplies, modules) ensure a fail-safe, continuous operation, making ACE-3600 ideal for carriers and service providers.

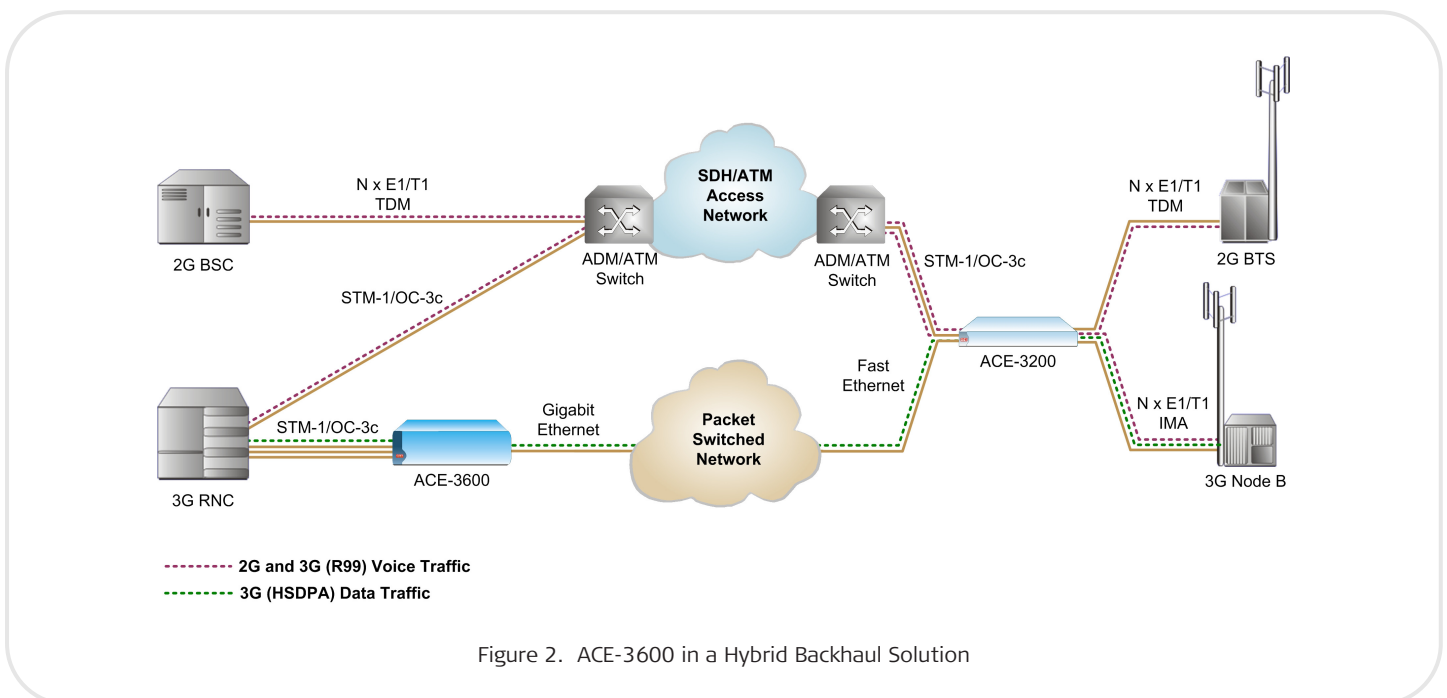


Figure 2. ACE-3600 in a Hybrid Backhaul Solution

## Specifications

### INTERFACE MODULES

#### Number of Modules

Up to 2 per unit

### STM-1/OC-3C INTERFACE

#### Number of Ports

Up to 8 in total, 4 per single interface module (4+4 in APS mode)

#### Data Rate

155 Mbps

#### Operation Mode

SDH or SONET, ATM UNI

#### Compliance

Physical layer and ATM mapping into STM-1/OC-3 according to I.432

Automatic protection switching (APS) according to G.841 Annex B (1+1, bidirectional)

#### Jitter Tolerance

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

#### Fiber Optic Interface Type

Small Form-Factor Pluggable (SFP): single mode, multimode LED, short haul or long haul laser

**Note:** For detailed specifications of the SFP transceivers supported by ACE-3600, refer to the SFP Transceivers data sheet. SFPs are ordered separately.

### GIGABIT ETHERNET INTERFACE

#### Number of Ports

2 in total, 1 per single interface module

#### Data Rate

1000 Mbps

#### Compliance

IEEE 802.3z, 802.1Q, 802.1p

#### Max. Frame Size

1600 bytes

#### Operation Mode

Full Duplex

#### Connector

Fiber optic via SFP transceiver

**Note:** The STM-1/OC-3c and Gigabit Ethernet ports require SFP transceivers that are fitted into the empty cage. For more information, refer to Optional Accessories and to the SFP Transceivers data sheet.

### ETHERNET CONTROL PORT

#### Type

100BaseTx, full-duplex

#### Compliance

IEEE 802.3

#### Connector

RJ-45

### TERMINAL CONTROL PORT

#### Type

RS-232/V.24 (DCE)

#### Data Rate

9.6, 19.2, 38.4, 57.6 or 115.2 kbps, user-configurable

#### Connector

RJ-45 (RJ-45 to DB-9 adapter cable is supplied)

### STATION CLOCK INTERFACE

#### Type

Balanced E1, unbalanced E1 (via an adapter cable) or T1

#### Impedance

Balanced E1: 120Ω  
Unbalanced E1: 75Ω (via an adapter cable)  
T1: 100Ω

### GENERAL

#### Fan Tray

Field-replaceable, two independent cooling fans

#### Power

One or two hot-swappable AC or DC:  
AC: 100 to 240 VAC, 47–63 Hz  
DC: -48 VDC nominal (-41 to -71 VDC) or 24 VDC nominal (20 to 36 VDC)

**Note:** AC and DC power supplies cannot be installed together in the same unit.

#### Power Consumption

AC: 120 VA max

DC: 80W max

#### LED Indicators

POWER (green/red) –  
Green: power supply is OK  
Red: power supply failure  
SYS ALM (green/red) –  
Green: no system alarm is detected  
Red: at least one system alarm has been detected  
FAN (green/red) –  
Green: all the fans are working properly  
Red: at least one fan is not working properly  
RDY (green) –  
On: self-test completed successfully  
Blinking: self-test failed  
ACTIVE (green) –  
On: this main module is in Active mode  
Off: this main module is not in Active mode  
STANDBY (green) –  
On: this main module is in Standby mode  
Off: this main module is not in Standby mode  
ATM-155 SYNC 1–4, 5–8 (green) –  
On: the port's physical link is synchronized  
Off: the port's physical link is not synchronized  
Blinking: RDI has been detected  
ATM-155 ATM 1–4, 5–8 (green) –  
On: ATM cells are being received or transmitted  
Off: ATM cells are not being received or transmitted  
ETH 1/2 LINK (green) –  
On: Gigabit Ethernet link is detected  
Off: Gigabit Ethernet link is not detected  
ETH 1/2 ACT (green) –  
On: Frames are being received or transmitted  
Off: Frames are not being received or transmitted  
MNG-ETH LINK (green) –  
On: Ethernet link is detected  
Off: Ethernet link is not detected

# ACE-3600

## RNC-Site Gateway

### MNG-ETH ACT (yellow) –

On: ETH frames are being received or transmitted

Off: ETH frames are not being received or transmitted

### STATION CLK SYNC (green) –

On: E1/T1 physical link is synchronized

Off: E1/T1 physical link is not synchronized

### Environment

Temperature:

Operating: 0°–50°C (32°–122°F)

Storage: -20°–70°C (-4°–158°F)

Humidity: Up to 90%, non-condensing

### Physical

Height: 8.74 cm (3.4 in / 2U)

Width: 44.0 cm (17.3 in)

Depth: 25.0 cm (9.0 in)

Weight: 8.0 kg (17.6 lb)

Table 1. ACE-3000 Product Family Comparison Table

	ACE-3600	ACE-3402	ACE-3400	ACE-3200	ACE-3100
E1/T1 traffic aggregation			✓	✓	✓
STM-1/OC-3c traffic aggregation	✓	✓	✓	✓	✓
Channelized STM-1/OC-3 traffic aggregation		✓	✓		
E1/T1 ports			32 or 63 using patch panels	8 or 16, built-in	0 or 4, built-in
ATM-155 ports	Up to 8, 4 per module	Up to 3, 1 per module	Up to 3, 1 per module	2, built-in	1 or 2, built-in
SFPs for ATM-155 ports	✓			✓	✓
Fast Ethernet ports	1 for OOB* management only	1 for OOB* management only	1 for OOB* management only	2 for PSN traffic and inband management	2 for PSN traffic and inband management
Gigabit Ethernet ports	Up to 2, 1 per module	1, using a dedicated module	1, using a dedicated module		
SFPs for GbE ports	✓				
SFPs for FE ports				✓ (optional)	✓ (optional)
PSN clock distribution	✓	✓	✓	✓	✓
PSN clock recovery				✓	✓
APS on ATM-155 ports	✓	✓	✓	✓	✓
System redundancy	✓	✓	✓		
BSC/RNC-site gateway	✓ (RNC only)	✓ (BSC/RNC)	✓ (BSC/RNC)		
Cell-site gateway				✓	✓
Modular unit	✓	✓	✓		
Power supply	Single/dual, hot-swappable	Single/dual, hot-swappable	Single/dual, hot-swappable	Single/dual, fixed	Single, fixed
Physical width	17.3"	17.3"	17.3"	17.3"	8.5"

\* OOB = out-of-band

## ACE-3600

## RNC-Site Gateway

## Ordering

**ACE-3600/#**  
RNC-Site Gateway

*Legend*

- # Power supply type and redundancy:  
**AC** Single 100 to 240 VAC  
**DC** Single -48 VDC  
**ACR** Dual 100 to 240 VAC  
**DCR** Dual -48 VDC

**ACE-MC/\***

ACE-3600 main module (main card)

*Legend*

- \* Main module type:  
**155-4/PACK-1** STM-1/OC-3c to GbE traffic

**Note:** For full system redundancy, order two main module units.

**ACE-IF-GbE+/@**

ACE-3600 interface module

*Legend*

- + STM-1/OC-3c ports:  
**S4** Four STM-1/OC-3c ports (four empty SFP cages)  
 @ GbE port:  
**SFP** One GbE port (empty SFP cage)

**Note:** For interface redundancy (APS), order two interface modules. The fiber optic STM-1/OC-3c and Gigabit Ethernet ports require SFP transceivers that are fitted into the empty cage. For more information, refer to *Optional Accessories* and to the *SFP Transceivers data sheet*, available on RAD's Web site.

## SUPPLIED ACCESSORIES

AC power cord or a DC power connection kit (if a DC-powered unit is ordered)

**RM-36**

Hardware kit for mounting one ACE-3600 unit into a 19-inch rack

**CBL-RJ45/D9/F/STR**

Control port adapter cable (RJ-45 to DB-9)

## OPTIONAL ACCESSORIES

## SFP Transceivers

- SFP-1** 1310 nm multimode LED, LC connector  
**SFP-2** 1310 nm single mode laser, LC connector  
**SFP-3** 1310 nm single mode laser, LC connector  
**SFP-4** 1550 nm single mode laser, LC connector  
**SFP-5** 1000BaseSX GbE, LC connector  
**SFP-6** 1000BaseLX10 GbE, LC connector  
**SFP-9G** 1000BaseT GbE, RJ-45 electrical connector

**Note:** For the complete and detailed list, refer to the *SFP Transceivers data sheet*. It is strongly recommended to order ACE-3600 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-3600 units using non-RAD SFPs.

**CBL-LC/#/E**

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

*Legend*

- # Connector type:  
**SC** SC connector  
**ST** ST connector  
**FC** FC connector  
 E Fiber type:  
**NM** Multimode fiber  
**SM** Single mode fiber

**CBL-RJ45/2BNC/E1/X**

Interface adapter for converting a balanced E1 RJ-45 station clock connector to a pair of BNC unbalanced coaxial connectors (if unbalanced E1 station clock source is used)

**ACE-PS/\***

ACE hot-swappable power supply unit (for replacement)

*Legend*

- \* Power supply type:  
**AC** 100 to 240 VAC  
**DC** -48 VDC

**ACE-FTC/ACE-3600**

Fan tray card (for replacement)

**International Headquarters**  
 24 Raoul Wallenberg Street  
 Tel Aviv 69719, Israel  
 Tel. 972-3-6458181  
 Fax 972-3-6498250, 6474436  
 E-mail market@rad.com

**North America Headquarters**  
 900 Corporate Drive  
 Mahwah, NJ 07430, USA  
 Tel. 201-5291100  
 Toll free 1-800-4447234  
 Fax 201-5295777  
 E-mail market@radusa.com

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