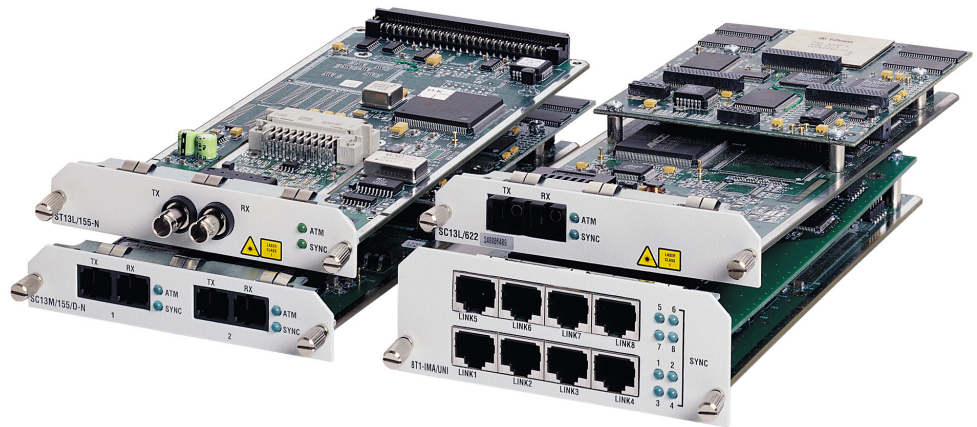


ACE-202/2002/2002E

ATM

STM-1, STM-4, IMA and ATM UNI Modules



Fiber optic and electrical ATM modules for a wide variety of multiservice applications

- Used as I/O to public ATM switches or private ATM devices
- Protection capabilities with STM-1/OC-3 and STM-4/OC-12 modules
- A wide variety of modules, including: 155/622 Mbps single mode and multimode, dual 155 Mbps, 155 Mbps over coax, 25 Mbps over UTP, E1/T1 over coax/UTP, E3/T3 over coax, 4/8 E1/T1 IMA/UNI
- Hot-swappable

ACE

The ACE-202/2002/2002E ATM modules enable connectivity to a large variety of ATM-based products. The modules are available with a wide range of interfaces with rates ranging from 1.5 to 622 Mbps.

Long Haul Capabilities

The long haul STM-4/OC-12 module reaches distances of up to 80 km (50 miles) at a data rate of 622 Mbps.

The long haul STM-1/OC-3 module reaches distances of up to 110 km (69 miles) at a data rate of 155 Mbps.

Dual Ports and APS

The dual-port STM-1/OC-3 module includes two 155 Mbps ports allowing a total of up to seven STM-1/OC-3 user ports in ACE-2002/2002E.

The dual Automatic Protection Switching (APS) STM-1/OC-3 module supports APS according to G.783 Annex A and B between its two ports.

RAD

data communications
The Access Company

ATM

STM-1, STM-4, IMA and ATM UNI Modules

IMA/UNI Modules

The IMA modules provision bandwidth in E1/T1 increments. Bandwidth consolidation across E1/T1 link groups leads to a more efficient use of the available copper infrastructure. The port can individually be configured to operate as IMA or UNI.

The ATM UNI modules provide smooth connectivity to ATM backbone equipment, as well as to ATM switches and routers that reside in private ATM networks.

A variety of modules are available:

155 Mbps over coax, 25 Mbps over UTP, E1/T1 over coax/UTP and E3/T3 over coax/fiber.

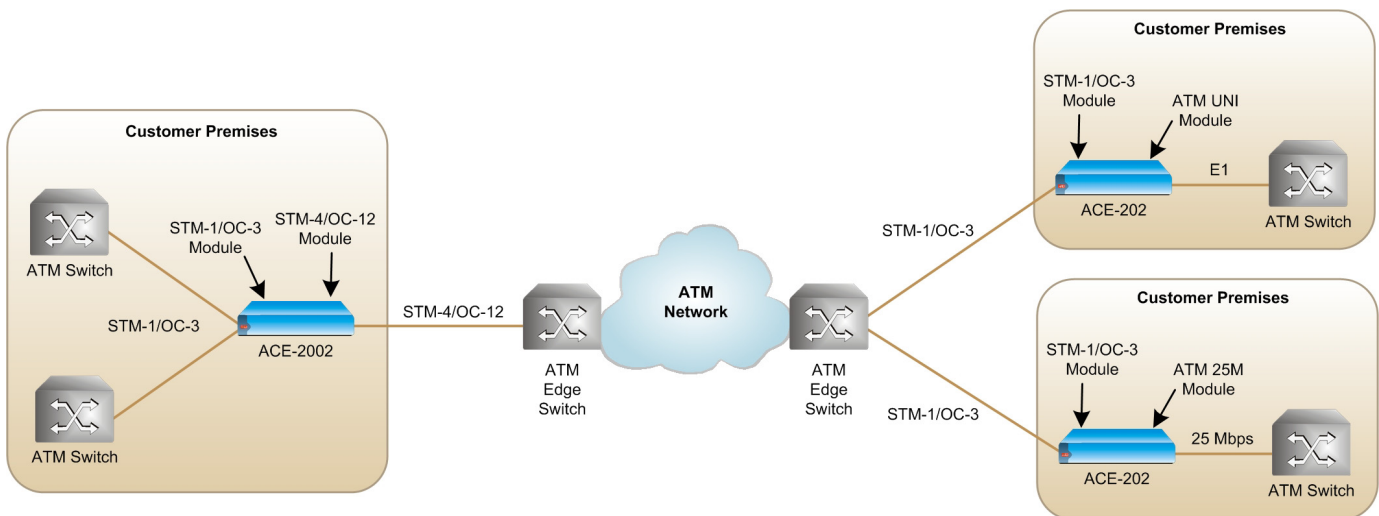


Figure 1. ACE-202 and ACE-2002 in an ATM NTU Application

Specifications

ATM MODULES

622 Mbps Single Mode 1550 nm Long Haul Module*

Compliance: I.432, G.957 (L4.2)
Framing: STS-12c/STM-4
Data rate: 622.08 Mbps
Line code: NRZ
Wavelength: 1550 nm
Optical output power: -3 to +2 dBm
Optical input range: -5 to -28 dBm
Typical range**: 80 km (50 miles)
Connector: SC

622 Mbps Single Mode 1310 nm Long Haul Module*

Compliance: I.432, G.957 (L4.1)
Framing: STS-12c/STM-4
Data rate: 622.08 Mbps
Line code: NRZ
Wavelength: 1310 nm
Optical output power: -3 to +2 dBm
Optical input range: -3 to -28 dBm
Typical range**: 15 km (9 miles)
Connector: SC

622 Mbps Multimode Module*

Compliance: ANSI T1.646 - 1995
Framing: STS-12c/STM-4
Data rate: 622.08 Mbps
Line code: NRZ
Wavelength: 1310 nm
Optical output power: -14 to -19 dBm
Optical input range: -14 to -26 dBm
Typical range**: 500m (1640 ft)
Connector: SC

622 Mbps Single Mode 1310 nm Short Haul Module*

Compliance: I.432, G.957 (S4.1)
Framing: STS-3c/STM-1
Data rate: 622.08 Mbps
Line code: NRZ
Wavelength: 1310 nm
Optical output power: -8 to -14 dBm
Optical input range: 0 to -28 dBm
Typical range**: 15 km (9 miles)
Connector: SC

155 Mbps Single Mode 1550 nm Long Haul Module

Compliance: I.432, G.957 (L1.2)
Framing: STS-3c/STM-1
Data rate: 155.52 Mbps
Line code: NRZ
Wavelength: 1550 nm
Optical output power: -1 to -4 dBm
Optical input range: -2 to -34 dBm
Typical range**: 80 km (50 miles)
Connector: FC, SC

155 Mbps Single Mode 1310 nm Long Haul Module****

Compliance: I.432, G.957 (L1.1)
Framing: STS-3c/STM-1
Data rate: 155.52 Mbps
Line code: NRZ
Wavelength: 1310 nm
Optical output power: -1 to -4 dBm
Optical input range: -2 to -34 dBm
Typical range**: 50 km (31 miles)
Connector: FC, SC or ST

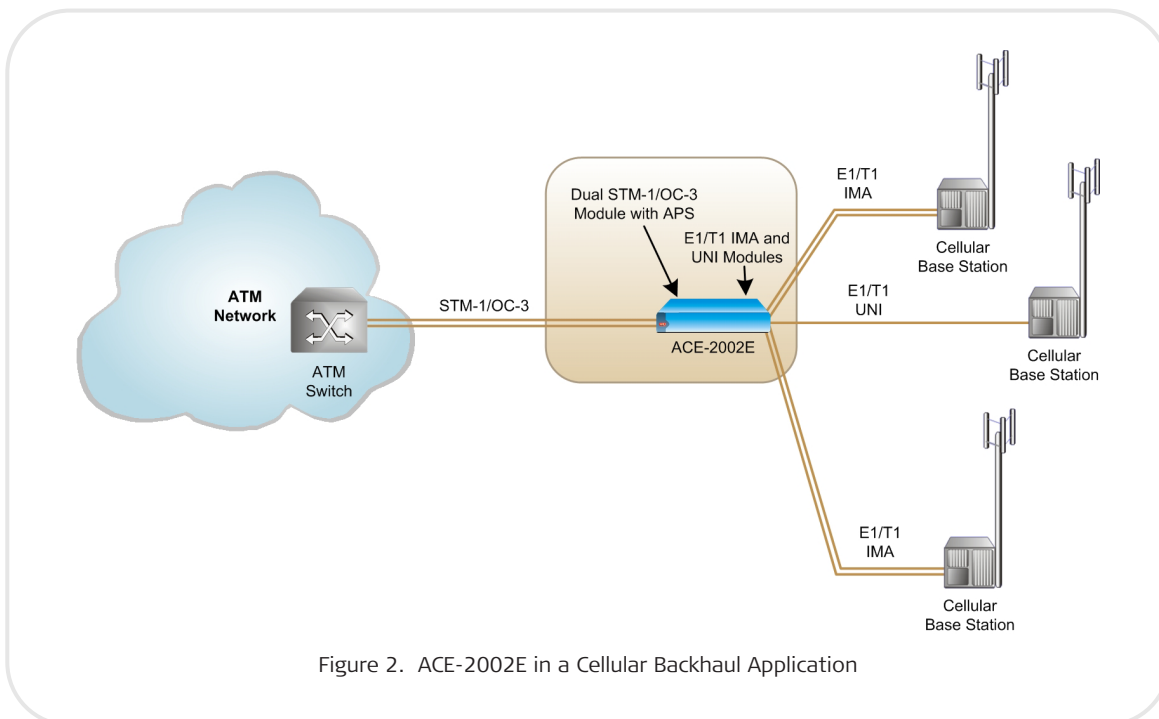


Figure 2. ACE-2002E in a Cellular Backhaul Application

155 Mbps Single Mode 1310 nm Short Haul Module****

Compliance: I.432, G.957 (S1.1)

Framing: STS-3c/STM-1

Data rate: 155.52 Mbps

Line code: NRZ

Wavelength: 1310 nm

Optical output power: -8 to -11 dBm

Optical input range: -2 to -31 dBm

Typical range**: 30 km (19 miles)

Connector: FC, SC or ST

155 Mbps Multimode Module****

Compliance: ANSI T1.646 -1995

Framing: STS-3c/STM-1

Data rate: 155.52 Mbps

Line code: NRZ

Wavelength: 1310 nm

Optical output power: -15 to -18 dBm

Optical input range: -14 to -31 dBm

Typical range**: 2 km (1.25 miles)

Connector: SC

155 Mbps Electrical G.703 Module

Compliance: G.703, I.432

Framing: STS-3c/STM-1

Data rate: 155.52 Mbps

Line code: CMI

Line impedance: 75Ω, unbalanced

Typical range**: 150m (492 ft)

(depending on cable quality)

Connector: BNC

25 Mbps Module

Compliance: ATM Forum af-phy-0040 and ITU-T I.432.5

Data rate: 25.6 Mbps

Line code: NRZI

Typical range**: 100m (328 ft)

Connector: RJ-45, 8-pin

E1 Module

Compliance: G.703, G.704, G.804, G.706, G.732 and G.823

Data rate: 2.048 Mbps

Line code: HDB3

Receive level:

-10 to -30 dB user-selectable

-1 to -10 dB user-selectable

Transmit level:

Balanced: $\pm 3V \pm 10\%$ Unbalanced: $\pm 2.37V \pm 10\%$

Connector:

Balanced: RJ-45, 8-pin

Unbalanced: BNC 75Ω

T1 Module

Compliance: ANSI T1.403, AT&T TR-62411, G.703, G.704 and G.804

Data rate: 1.544 Mbps

Line code: B8ZS

Receive level: 0 to -30 dB

Transmit level:

 $\pm 2.75V \pm 10\%$ at 0-655 ft

0, -7.5, -15, -22.5 dB, user selectable

LBOs with CSU

Connector: RJ-45, 8-pin

E3 Module

Compliance: G.703, G.804, G.832

Data rate: 34.368 Mbps

Line code: HDB3

Line impedance: 75Ω unbalanced

Typical range: 150m (492 ft; depending on cable quality)

Connector: BNC

T3 Modules

Compliance: G.703, ANSI T1.102 and T1.107

Data rate: 44.736 Mbps

Line code: B3ZS

Line impedance: 75Ω unbalanced

Typical range**: 150m (492 ft; depending on cable quality)

Connector: BNC

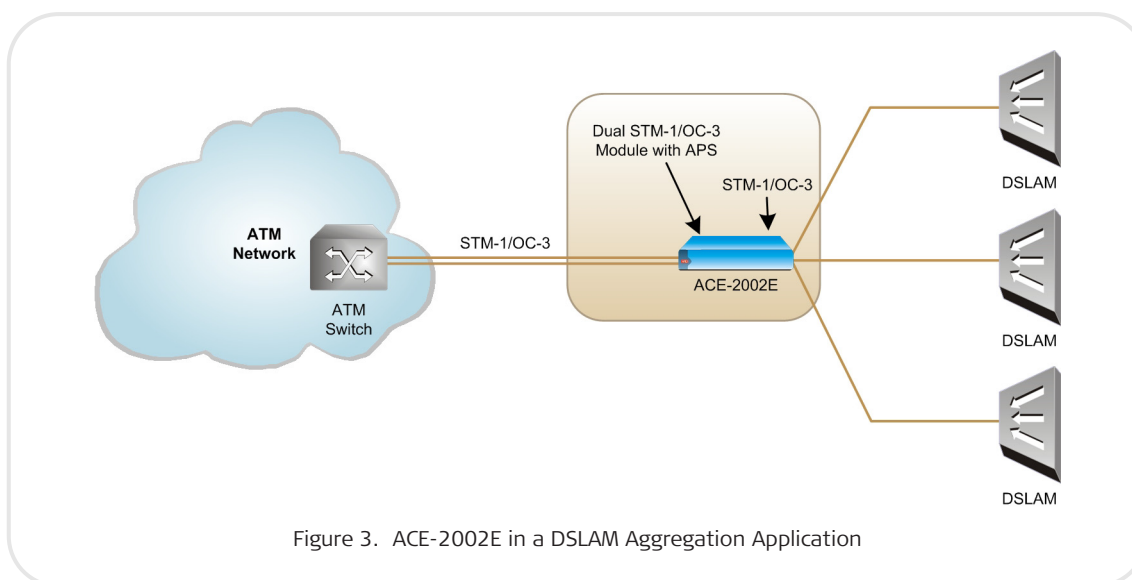


Figure 3. ACE-2002E in a DSLAM Aggregation Application

ATM

STM-1, STM-4, IMA and ATM UNI Modules

IMA MODULES

IMA Module

Compliance:
ATM FORUM IMA specifications version 1.0 and 1.1 (user configurable)

Supporting:

- Up to four groups
- Asymmetric/symmetric configuration and operation
- Two clock modes: Independent Transmit Clock (ITC) and Common Transmit Clock (CTC)
- Differential delay of up to 100 ms for E1 or T1
- Group and per-link statistics

E1 Port

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

Framing: MF+CRC4

Data rate: 2.048 Mbps

Line code: HDB3

Line impedance:

120Ω balanced

75Ω unbalanced

Signal levels:

Transmit:

Balanced: ±3V ±10%

Unbalanced: ±2.37V ±10%

Receive:

-10 to -28 dB with LTU

0 to -10 dB without LTU

Notes:

- * Supported by ACE-2002 and ACE-2002E only.
- ** Typical distance is calculated using common peripheral equipment and environment conditions, and may vary according to user-specific equipment and environment conditions.
- *** Can be used only with another ACE-2002 or ACE-2002E unit equipped with an identical interface, or with RAD's FOM E3/T3 fiber optic modems.
- **** Also available with a standard dual port or an APS redundancy dual port.

Jitter performance: per ITU-T G.823

Connector:

Balanced: RJ-45

Unbalanced: RJ-45 (using an RJ-45 to BNC adapter cable)

T1 Port

Compliance: ANSI T1.403, AT&T TR-62411

Framing: ESF

Data rate: 1.544 Mbps

Line code: B8ZS

Line impedance: 100Ω balanced

Signal levels:

Transmit:

0, -7.5, -15 or -22.5 dB with CSU

3V ±10%, software adjustable, to be measured at 0 to 655 feet without CSU

Receive:

0 to -30 dB

Jitter performance: Per AT&T TR-62411

Connector: RJ-45, 8-pin

Ordering

ACE-M/+

Legend

+ Interface module type:

E1	Balanced E1 (G.703)
T1	Standard T1 (G.703)
E3	E1 UNI
T3	T3 UNI
UTP/25	25.6 Mbps UTP
CX/BNC/155	155 Mbps, electrical, unbalanced (G.703)
IMA-UNI/4E1	4 balanced IMA/UNI E1
IMA-UNI/4E1/UNBAL	4 unbalanced IMA/UNI E1
IMA-UNI/4T1	4 IMA/UNI T1
IMA-UNI/8E1	8 balanced IMA/UNI E1, for ACE-2002E only
IMA-UNI/8E1/UNBAL	8 unbalanced IMA/UNI E1, for ACE-2002E only
IMA-UNI/8T1	8 IMA/UNI T1 for ACE-2002E only
FC13L/155	155 Mbps, single mode, 1310 nm short haul laser, FC
FC13L/155D	Dual STM-1/OC-3, single mode, 1310 nm short haul laser, FC, for ACE-2002 and ACE-2002E only
FC13L/155R	Dual STM-1/OC-3 with APS redundancy, single mode, 1310 nm short haul laser, FC
FC13LH/155	155 Mbps, single mode, 1310 nm long haul laser, FC
FC13LH/155D	Dual STM-1/OC-3, single mode, 1310 nm long haul laser, FC, for ACE-2002 and ACE-2002E only
FC15LH/155	155 Mbps, single mode, 1550 nm long haul laser, FC
SC13L/155	155 Mbps, single mode, 1310 nm short haul laser, SC

ATM

STM-1, STM-4, IMA and ATM UNI Modules

SC13L/155	155 Mbps, single mode, 1310 nm short haul laser, SC	SC13LH/155J	155 Mbps, single mode, 1310 nm long haul laser, SC, for the Japanese market	ST13L/155R	Dual STM-1/OC-3 with APS redundancy, single mode, 1310 nm short haul laser, ST
SC13L/155D	Dual STM-1/OC-3, single mode, 1310 nm short haul laser, SC, for ACE-2002 and ACE-2002E only	SC13LH/622	622 Mbps, single mode, 1310 nm long haul laser, SC, for ACE-2002 and ACE-2002E only	ST13LH/155D	Dual STM-1/OC-3, single mode, 1310 nm long haul laser, ST, for ACE-2002 and ACE-2002E only
SC13L/155R	Dual STM-1/OC-3 with APS redundancy, single mode, 1310 nm short haul laser, SC	SC13M/155	155 Mbps, multimode, 1310 nm, SC	ST13LH/155R	Dual STM-1/OC-3 with APS redundancy, single mode, 1310 nm long haul laser, ST
SC13L/155J	155 Mbps, single mode, 1310 nm short haul laser, SC, for the Japanese market	SC13M/155D	Dual, multimode, 1310 nm, SC, for ACE-2002 and ACE-2002E only		
SC13L/622	622 Mbps, single mode, 1310 nm short haul laser, SC, for ACE-2002 and ACE-2002E only	SC13M/155R	Dual STM-1/OC-3 with APS redundancy, 1310 nm multimode LED, SC		
SC13LH/155	155 Mbps, single mode, 1310 nm long haul laser, SC	SC13M/622	622 Mbps, 1310 nm, multimode LED, SC, for ACE-2002 and ACE-2002E only		
SC13LH/155D	Dual STM-1/OC-3, single mode, 1310 nm long haul laser, SC, for ACE-2002 and ACE-2002E only	SC15LH/155	155 Mbps, single mode, 1550 nm long haul laser, SC		
SC13LH/155R	Dual STM-1/OC-3 with APS redundancy, single mode, 1310 nm long haul laser, SC	SC15LH/155J	155 Mbps, single mode, 1550 nm long haul laser, SC, for the Japanese market		
SC13LH/155J	155 Mbps, single mode, 1310 nm long haul laser, SC, for the Japanese market	SC15LH/622	622 Mbps, single mode, 1550 nm long haul laser, SC, for ACE-2002 and ACE-2002E only		
SC13LH/155R	Dual STM-1/OC-3 with APS redundancy, single mode, 1310 nm long haul laser, SC	ST13L/155	155 Mbps, single mode, 1310 nm short haul laser, ST		
		ST13L/155D	Dual port, single mode, 1310 nm short haul laser, STM-1/OC-3, ST, for ACE-2002 and ACE-2002E only		

Notes:

* *Unbalanced E1 is provided via an adapter cable (see Supplied Accessories).*

** *FC, SC and ST are fiber optic connector types.*

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

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

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@rad.com

www.rad.com



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