



# Cisco 2691, 3600 Series, and 3700 Series ATM OC-3 155-Mbps Network Modules

CISCO SYSTEMS EXTENDS WAN CONNECTIVITY BY ADDING HIGH-SPEED ATM ACCESS TO REMOTE BRANCH OFFICES WITH THE CISCO 2691, 3600, AND 3700 SERIES ATM OC-3 NETWORK MODULES.

## Overview

Three 155-Mbps ATM OC-3 network modules are available on the Cisco 3620 and 3640 starting with Cisco IOS® Release 12.0(3)T. They are also now available on the Cisco 2691 and Cisco 3725 in starting in IOS release 12.2(13)T. These three network modules support STS-3c and STM-1 framing standards over multimode, single-mode intermediate-reach, and single-mode long-reach fiber optic interfaces. All three versions consist of a single-port network module with SC type connectors. The single-mode ATM network modules provide high-speed trunking for users with access to fiber WAN, while multimode is ideal for connecting high-speed servers, switches, or hubs equipped with and OC-3/STM-1 fiber connections.

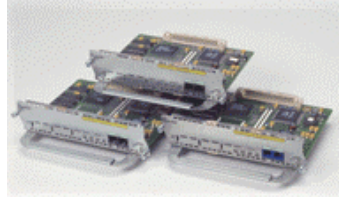
All three versions support the ATM Forum standard ATM adaptation Layer 5 (AAL5) with ATM QoS categories Unspecified Bit Rate (UBR), UBR+, Variable Bit Rate (VBR)-rt, VBR-nrt, Available Bit Rate (ABR), and Constant Bit Rate (CBR) traffic classes supported. Voice over IP (VoIP) and H.323 over ATM can be supported over the WAN using the currently available analog voice/fax network modules, and voice interface cards.

Three new Enhanced Performance (EP) ATM OC-3 network modules are released on Cisco 3745 to support the higher performance and better throughput. The ATM OC-3 EP network modules are identical to the Non-EP version in terms of features supported and physical specifications.

The ATM OC-3 network modules are supported on the Cisco 2691, 3620, 3640, 3660, and 3725 routers and the Enhanced Performance ATM OC-3 network modules are supported on Cisco 3745 router only. (Cisco 3745 does not support Non-EP ATM OC-3 network modules.) Cisco IOS "Plus" feature sets are required to support ATM. A maximum of one ATM OC-3 network module is recommended on Cisco 2691, 3600 Series and 3725. A maximum of two ATM OC-3 EP network module is recommended on Cisco 3745.



Figure 1: ATM OC-3 Network Modules



### New Features

- RFC 1577 support for routing over ATM
- RFC 1483 support for multiple encapsulations over ATM
- ATM Forum UNI 3.0, 3.1, and 4.0
- ATM PVCs and SVCs
- LANE 2.0
- Layer 2 per-VC queuing
- Up to 1024 simultaneous Virtual Circuits (VCs)
- AAL5 ATM adaptation layer
- ATM Service classes: UBR, UBR+, VBR-rt, VBR-nrt, ABR, and CBR (data only)
- Permanent virtual paths (PVPs)
- ATM bandwidth (resource) manager
- MPOA client and server
- Tag Switching (MPLS when approved)
- IETF Point-to-Point Protocol (PPP) over ATM
- NHRP (Next Hop Resolution Protocol)
- F4 and F5 operations and management (OAM) cell support
- Interim Local Management Interface (ILMI)

### System Requirements

- Supported on 2691, 3600 Series and 3725; EP version supported on 3745
- Requires "Plus" Feature sets of IOS Release 12.0(3)T or above
- Maximum of one ATM OC-3 network module supported on 2691, 3600 and 3725. Maximum of two ATM OC-3 network module supported on 3745
- No additional Flash or DRAM memory requirements other than the Cisco IOS release 12.0(3)T Plus feature set specified minimum memory requirements
- Operates in conjunction with all currently available Cisco 2600, 3600 and 3700 network modules and WAN interface cards (WICs)
- No slot placement restrictions on all platforms
- Recommended maximum of two high-speed network modules in a Cisco 3640 (includes Fast Ethernet, ATM, HSSI)



Table 1 Cisco IOS Support and Orderability Rules

Product	IOS Software Version Required	IOS Feature Sets Required	Minimum DRAM Memory	Maximum Supported
Cisco 2600 Series including 2610/11, 2620/21, 2650/51, 2610/11XM, 2620/21XM, and 2650/51XM	Not supported	N/A	N/A	N/A
Cisco 2691	12.2(13)T	Plus	Same as 2691 12.2(13)T Cisco IOS Plus feature sets DRAM minimum memory requirements	1
Cisco 3620	12.0(3)T	Plus	Same as 12.0(3)T Cisco IOS Plus feature sets DRAM minimum memory requirements	1
Cisco 3640	12.0(3)T	Plus	Same as 12.0(3)T Cisco IOS Plus feature sets DRAM minimum memory requirements	1
Cisco 3660	12.0(5)XK and 12.0(5)T	Plus	Same as 12.0(5)T Cisco IOS Plus feature sets DRAM minimum memory requirements	1
Cisco 3725	12.2(13)T	Plus	Same as 3725 12.2(13)T Cisco IOS Plus feature sets DRAM minimum memory requirements	1
Cisco 3745 (Enhanced Performance Network Module)	12.2(13)T	Plus	Same as 3745 12.2(13)T Cisco IOS Plus feature sets DRAM minimum memory requirements	2

Note: OC-3 ATM network modules not supported in IP only and IP/IPX/AT/DEC Cisco IOS feature sets. ATM is also supported in the service provider (-p-) image.

Table 2 ATM Service Category Definitions

ATM Service Categories	Typical Use
Unspecified Bit Rate (UBR)	Best-effort service intended for nonreal-time bursty applications that do not require a guarantee of traffic characteristics such as bandwidth, cell delay, and cell delay variation
UBR+	Provides a guaranteed frame rate (GFR) service with single leaky bucket algorithm. Provides the ability to reserve UBR bandwidth minimum, or specify bandwidth maximum. Similar to VBR in that it increases the minimum cell rate (MCR) when cell rate falls below the MCR.
Variable Bit Rate (VBR-rt and VBR-nrt)	Intended for applications that have bursty traffic patterns but require a guarantee of some traffic parameters. A peak cell rate (PCR), sustained cell rate (SCR), and Maximum Burst size (MBS) can specify traffic parameters.



ATM Service Categories	Typical Use
Available Bit Rate (ABR)	Used to maximize bandwidth utilization of the ATM link through the use of congestion feedback notification (resource management cells). Both PCR and MCR specify the ABR connection. The transmit rate of each connection is flow-controlled such that the rate will always be between the user specified values for a minimum and peak rate.
Constant Bit Rate (CBR)	Intended for real-time applications such as SNA traffic, voice, and video, which require a fixed bandwidth and low cell delay. CBR in initial release supports data only.

Table 3 ATM Service Category Attributes and Guarantees

Service Category	Traffic Description	Minimum Loss Cell Loss Ratio (CLR)	Delay Variance	Bandwidth	Use of Feedback Control
UBR	PCR	No	No	No	No
UBR+	PCR	X	No	No	No
rt-VBR	PCR, SCR, MBS	X	X	X	No
nrt-VBR	PCR, SCR, MBS	X	No	X	No
ABR	PCR, MCR+, behavior parameters	X	No	X	X
CBR	PCR	X	X	X	No



ATM Service Class Application Matrix

Application Areas for ATM Service Categories					
Application Area	UBR	rt-VBR	nrt-VBR	ABR	CBR
Critical Data	N/S	*	***	*	**
LAN Interconnect LAN Emulation	**	*	**	***	*
Data Transport/Internetworking					
(IP- FR-SMDS)	**	*	**	***	*
Circuit Emulation (CES)	N/S	**	N/S	N/S	***
POTS/ISDN – Videoconference	N/S			N/S	***
Compressed Audio	*	***	**	**	*
Video Distribution	N/S	**	*	N/S	***
Interactive Multimedia	N/S	***	**	**	

\*\*\*Optimum, \*\*Good, \*Fair, N/S not suitable, not quoted entries are not applicable with current feature set, but may be supported in the future.

Physical Interface Specifications

The ATM OC-3 network modules comply with SDH G.707 and G.708 specifications. Three different versions, each with a different physical interface, support OC-3c/STM-1 multimode, OC-3c/STM-1 single-mode intermediate-reach, and OC-3c/STM-1 single-mode long-reach modes.

Table 4 Interface Specifications

Interface	Rate	Connect or Type	Cable Type	Wavelength	Maximum Distance
OC-3c/STM-1 Multimode	155 Mbps*	SC	62.5/125 m multimode	1270 to 1380 nm	2 km
OC-3c/STM-1 Single-Mode Intermediate Reach	155 Mbps*	SC	9 m single mode	1260 to 1360 nm	15 km
OC-3c/STM-1 Single-Mode Long Reach	155 Mbps*	SC	9 m single mode	1260 to 1360 nm	45 km

\*Note: this is the speed of the interface, not the maximum speed supported by the ATM network module in the Cisco 3600 series. The actual maximum supported speed ranges between 20 and 80 Mbps depending on packet size.



Table 5 OC-3c/STM-1 Optical Interface Power

Interface	TX Power (maximum)	TX Power (minimum)	RX Power (maximum)	RX Power (minimum)	Budget
OC-3c/STM-1 Multimode	-14 dBm	-19 dBm	-14 dBm	-30 dBm	11 dB
OC-3c/STM-1 Single-Mode Intermediate Reach	-8 dBm	-15 dBm	-8 dBm	-28 dBm	13 dB
OC-3c/STM-1 Single-Mode Long Reach	0 dBm	-5 dBm	-10 dBm	-34 dBm	29 dB

Connecting two long-reach single mode ports back-to-back in a very short span will require the use of optical attenuators (minimum 10 db loss required).

#### LEDs

Table 6 ATM OC-3 Network Modules LED Description

ATM OC-3 LEDs	Function	Color
ENABLED	This LED indicates the ATM OC-3 network modules has passed self-tests and is available to the router	Green
RCLK	This LED indicates that carrier ATM receive clock signal is present	Green
FERF	This LED indicates a far-end receive failure	Yellow
OOF	This LED indicates an out-of-frame alarm condition	Yellow
AIS	This LED is an alarm indication signal	Yellow

#### OC-3 ATM Physical Specifications

Product Specifications	
Dimensions (H x W x D)	1.55 x 7.10 x 7.2 in
Weight	2 lb. Max.
Environmental Conditions	Operating temp. 32 to 104 F (0 to 40 C) Nonoperating temp. -13 to 158 F (-25 to 70 C)
Relative Humidity	5 to 95%
Protocols Supported	Full Cisco IOS in 12.0(3)T
EMI	Class A EMI
Cabling	SC type connector



Product Specifications	
LEDs	Enabled, RX cells, RX carrier, RX alarm
Network Interfaces	All supported by Cisco 3600 family

## Product Compliance Standards

### Regulatory Approvals

- IEC 825 compliant
- EN 55022, Class B, EN 50082-1
- EN 60950
- EN 41003
- UL 1950
- FCC Part 15, Class A
- AS/NZS 3260/AS TS001
- AS/NZS 3548, Class A
- CSA 22.2-950
- VCCI Class A
- FDA Class 1 laser

### Cisco IOS ATM Internetworking Services

The following Cisco IOS ATM services are supported in the initial release of all three versions of the ATM OC-3 network modules:

- ATM Internetworking
  - Multiprotocol encapsulation with support for Logical Link Control/Subnetwork Access Protocol (LLC/SNAP) encapsulation and VC multiplexing (Internet Engineering Task Force [IETF] RFC 1483)
  - Classical IP and Address Resolution Protocol (ARP) over ATM; client and ARP server (IETF RFC 1577; IETF RFC 1755; IETF RFC 1626)
  - Multiprotocol routing over ATM (MPOA) for IP, Novell IPX, DECnet IV and V, AppleTalk Phases 1 and 2, Connectionless Network Service (CLNS), Xerox Network Systems (XNS), and Banyan VINES via IETF RFC 1483
  - ATM Forum LAN Emulation (LANE) including LAN Emulation Client (LEC), Broadcast and Unknown Server (BUS), LAN Emulation Server (LES), and LAN Emulation Configuration Server (LECS).
  - IETF PPP over ATM
  - Tag Switching/MPLS (when approved)

### ATM Services

- ATM Forum UNI 3.0, 3.1 and 4.0 signaling for point-to-point and point-to-multipoint SVCs
- ATM Forum UNI 4.0 signaling for ABR SVCs

- ATM Forum ILMI for address prefix acquisition and ATM service address registration with UNI-compliant switches throughout the ATM network
- ATM network service access point (NSAP) E.164 address support
- F4 (virtual path) and F5 (virtual connection) OAM cell segment and end-to-end flows, remote defect identification (RDI), and alarm indication signal (AIS)

## Network Management

- The ATM OC-3 network modules will support the following Management Information Base (MIB) depending on the Cisco IOS release deployed:
  - MIB II
    - Synchronous Optical Network (SONET) MIB
    - AToM MIB
    - ATM ILMI MIB
    - LANE MIB
    - RFC 1406, 1595, 1695, and 2233
    - CiscoWorks2000 and CiscoWorks network management integration
    - Enhanced Setup Configuration
    - Text-based command-line interface (CLI)

Figure 2: 155-Mbps ATM OC-3 Multimode Network Module

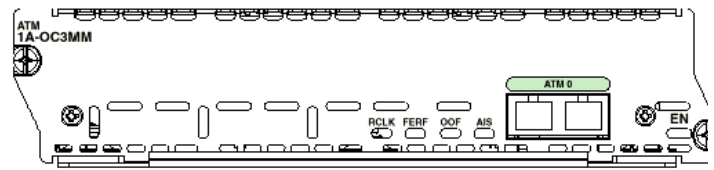


Figure 3: 155-Mbps ATM OC-3 Single-mode Intermediate-Reach Network Module

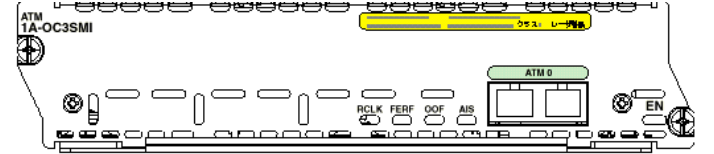
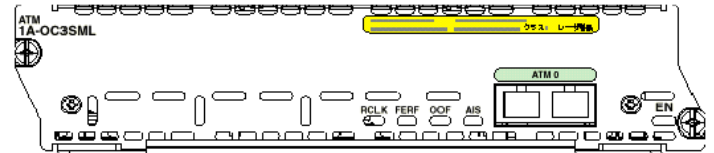


Figure 4: 155-Mbps ATM OC-3 Single-mode Long-Reach Network Module



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