



ATIS-1000627.2014(R2-119)

**Broadband ISDN – ATM Layer Functionality and
Specification**

AMERICAN NATIONAL STANDARD FOR TELECOMMUNICATIONS



As a leading technology and solutions development organization, ATIS brings together the top global ICT companies to advance the industry's most pressing business priorities. Through ATIS committees and forums, nearly 200 companies address cloud services, device solutions, emergency services, M2M communications, cyber security, ehealth, network evolution, quality of service, billing support, operations, and more. These priorities follow a fast-track development lifecycle — from design and innovation through solutions that include standards, specifications, requirements, business use cases, software toolkits, and interoperability testing.

ATIS is accredited by the American National Standards Institute (ANSI). ATIS is the North American Organizational Partner for the 3rd Generation Partnership Project (3GPP), a founding Partner of oneM2M, a member and major U.S. contributor to the International Telecommunication Union (ITU) Radio and Telecommunications sectors, and a member of the Inter-American Telecommunication Commission (CITEL). For more information, visit < www.atis.org >.

AMERICAN NATIONAL STANDARD

Approval of an American National Standard requires review by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made towards their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears in the title page of this standard.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedure of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Notice of Disclaimer & Limitation of Liability

The information provided in this document is directed solely to professionals who have the appropriate degree of experience to understand and interpret its contents in accordance with generally accepted engineering or other professional standards and applicable regulations. No recommendation as to products or vendors is made or should be implied.

NO REPRESENTATION OR WARRANTY IS MADE THAT THE INFORMATION IS TECHNICALLY ACCURATE OR SUFFICIENT OR CONFORMS TO ANY STATUTE, GOVERNMENTAL RULE OR REGULATION, AND FURTHER, NO REPRESENTATION OR WARRANTY IS MADE OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OR AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. ATIS SHALL NOT BE LIABLE, BEYOND THE AMOUNT OF ANY SUM RECEIVED IN PAYMENT BY ATIS FOR THIS DOCUMENT, AND IN NO EVENT SHALL ATIS BE LIABLE FOR LOST PROFITS OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES. ATIS EXPRESSLY ADVISES THAT ANY AND ALL USE OF OR RELIANCE UPON THE INFORMATION PROVIDED IN THIS DOCUMENT IS AT THE RISK OF THE USER.

NOTE - The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights. By publication of this standard, no position is taken with respect to whether use of an invention covered by patent rights will be required, and if any such use is required no position is taken regarding the validity of this claim or any patent rights in connection therewith. Please refer to [<http://www.atis.org/legal/patentinfo.asp>] to determine if any statement has been filed by a patent holder indicating a willingness to grant a license either without compensation or on reasonable and non-discriminatory terms and conditions to applicants desiring to obtain a license.

ATIS-1000627.2014(R2015) Broadband ISDN – ATM Layer Functionality and Specification

Is an American National Standard developed by the **Signaling, Architecture, and Control (SAC)** Subcommittee under the **ATIS Packet Technologies and Systems Committee (PTSC)**.

Published by
Alliance for Telecommunications Industry Solutions
1200 G Street, NW, Suite 500
Washington, DC 20005

Copyright © 2015 by Alliance for Telecommunications Industry Solutions
All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher. For information contact ATIS at 202.628.6380. ATIS is online at < <http://www.atis.org> >.

American National Standard for Telecommunications

Broadband ISDN – ATM Layer Functionality and Specification

Alliance for Telecommunications Industry Solutions

Approved June 2014

American National Standards Institute, Inc.

Abstract

This standard is one a series of standards on Broadband Integrated Services Digital Network (B-ISDN). These standards describe the B-ISDN capabilities, architectural model, and network interfaces including protocol functionalities and specifications, and signaling characteristics. In particular, this standard describes the protocol of the ATM Layer.

Foreword

The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. As such, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Standard.

The Alliance for Telecommunications Industry Solutions (ATIS) serves the public through improved understanding between carriers, customers, and manufacturers. The Packet Technologies and Systems Committee (PTSC) develops and recommends standards and technical reports related to services, architectures, and signaling, in addition to related subjects under consideration in other North American and international standards bodies. PTSC coordinates and develops standards and technical reports relevant to telecommunications networks in the U.S., reviews and prepares contributions on such matters for submission to U.S. ITU-T and U.S. ITU-R Study Groups or other standards organizations, and reviews for acceptability or per contra the positions of other countries in related standards development and takes or recommends appropriate actions.

ANSI guidelines specify two categories of requirements: mandatory and recommendation. The mandatory requirements are designated by the word *shall* and recommendations by the word *should*. Where both a mandatory requirement and a recommendation are specified for the same criterion, the recommendation represents a goal currently identifiable as having distinct compatibility or performance advantages.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, PTSC, 1200 G Street NW, Suite 500, Washington, DC 20005.

At the time of consensus on this document, PTSC, which was responsible for its development, had the following leadership:

- M. Dolly, PTSC Chair (AT&T)
- V. Shaikh, PTSC Vice-Chair (ACS)
- M. Dolly, PTSC SAC Chair (AT&T)

The **SAC** Subcommittee was responsible for the development of this document.

Table of Contents

ABSTRACT	I
1 SCOPE	1
2 NORMATIVE REFERENCE	1
3 DEFINITIONS	2
4 ABBREVIATIONS & ACRONYMS	5
5 B-ISDN PROTOCOL REFERENCE MODEL (PRM)	6
6 BASIC PRINCIPLES OF ATM	7
7 ATM LAYER MODEL	8
7.1 TYPES OF CONNECTION	9
7.2 VIRTUAL CHANNEL.....	9
7.2.1 QOS of a VCC	10
7.2.2 VC Traffic Parameters Negotiation & Usage Monitoring	10
7.2.3 Methods for Establishment or Release of a VCC.....	10
7.3 VIRTUAL PATH.....	10
7.3.1 QOS of a VPC.....	11
7.3.2 VP Traffic Parameters Negotiation & Usage Monitoring	11
7.3.3 Methods for Establishment or Release of a VPC.....	11
7.4 PEAK CELL RATE	11
7.4.1 Peak Cell Rate Definition for a VPC/VCC.....	12
7.4.2 Peak Cell Rate Granularity Specification	12
7.5 VPS & VCS: RELATIONSHIP & IDENTIFICATION	12
7.5.1 VC Identifier Assignment.....	14
7.5.2 VP Identifier Assignment.....	14
7.5.3 Preassigned VP & VC Identifiers.....	14
7.5.4 Number of Active Connections at the UNI.....	14
7.5.5 Number of Active Connections at the NNI.....	15
8 SERVICE CHARACTERISTICS	15
8.1 SERVICES PROVIDED TO THE UPPER LAYER.....	15
8.1.1 Description of Primitives (ATM/Upper Layer)	16
8.1.2 Description of parameters (ATM/Upper Layer).....	16
8.2 SERVICE EXPECTED FROM THE PHY	17
8.2.1 Description of Primitives (ATM/PHY).....	17
8.2.2 Description of Parameters (ATM/PHY).....	17
9 LAYER MANAGEMENT INTERACTIONS	17
9.1 INFORMATION EXCHANGED BETWEEN ATM- ENTITY & ATMM-ENTITY	19
9.1.1 Description of Primitives.....	19
9.1.2 Description of Parameters.....	20
10 FUNCTIONS OF THE ATM LAYER	21
10.1 CELL RELAYING.....	21
10.2 CELL MULTIPLEXING/DEMULTIPLEXING	21
10.3 DELAY HANDLING.....	22
10.4 CELL LOSS PRIORITY PROCESSING.....	22
10.5 USAGE PARAMETER CONTROL.....	22
10.6 EXPLICIT FORWARD CONGESTION NOTIFICATION.....	22

10.7	CELL PAYLOAD TYPE DISCRIMINATION	22
10.8	GENERIC FLOW CONTROL AT UNI (GFC).....	23
10.9	CONNECTION ASSIGNMENT	23
10.10	CONNECTION REMOVAL	24
10.11	CELL CONSTRUCTION.....	24
10.12	UNASSIGNED CELL GENERATION	24
10.13	UNASSIGNED CELL EXTRACTION	24
10.14	CELL COPYING	24
10.15	CELL RECEPTION.....	24
10.16	CELL HEADER VALIDATION	24
10.17	CELL FORWARDING.....	24
11	FUNCTIONS OF THE LAYER MANAGEMENT.....	25
12	CELL STRUCTURE & ENCODING	25
12.1	ENCODING PRINCIPLES.....	25
12.2	CELL STRUCTURE	26
12.2.1	Cell Header Fields of the UNI format.....	26
12.2.2	Cell Header Fields of the NNI Format.....	27
12.3	PREASSIGNED HEADER FIELD VALUES.....	28
	ANNEX A: TRAFFIC MANAGEMENT FRAMEWORK.....	29
A.1	ADMISSION CONTROL	29
A.2	USAGE PARAMETER CONTROL	29
A.3	CONGESTION DEPENDENT NETWORK ELEMENT CELL PROCESSING	29
A.4	BACKWARD NOTIFICATION OF CONGESTION	29
A.5	EXCEPTION/FAILURE HANDLING	30
	ANNEX B: LAYER SERVICE CONCEPTS.....	31
B.1	LAYER SERVICE CONCEPT	31
B.2	NAMING CONVENTION FOR THE PRIMITIVES	31
	ANNEX C: ATM PROTOCOL PROCESSES	32
C.1	ELEMENTS OF PROCESSES	32
C.2	CONNECTION-ASSIGNMENT (REASSIGNMENT) PROCESS.....	32
C.3	CONNECTION-REMOVE PROCESS	32
C.4	ATM-CELL-CONSTRUCTION PROCESS	33
C.5	ATM-CELL-SEND PROCESS	33
C.6	LINK-STATUS-UPDATE PROCESS	34
C.7	ATM-CELL-RECEIVE PROCESS	34
C.8	DISPATCH PROCEDURE	35
C.9	RECEPTION PROCEDURE	35
C.10	RELAY PROCEDURE	36
C.11	UPC/NPC PROCEDURE	36
	ANNEX D: SDL D ACPAMS.....	37
	ANNEX E: PEAK CELL RATE MONITOR ALGORITHMS ACCOUNTING FOR CELL DELAY VARIATION TOLERANCE.....	45
	ANNEX F: TECHNICAL DIFFERENCES WITH ITU-T RECOMMENDATIONS	47
	ANNEX G: BIBLIOGRAPHY	48

Table of Figures

FIGURE 1 - B-ISDN PROTOCOL REFERENCE MODEL.....	8
FIGURE 2 - EXAMPLE OF CELL RELAYING AND MULTIPLEXING	9
FIGURE 3 - REFERENCE CONFIGURATION AND EQUIVALENT TERMINAL FOR THE DEFINITION OF THE PEAK CELL RATE OF AN A5M CONNECTION.....	13
FIGURE 4 - ATM LAYER RELAYING SCHEMES	21
FIGURE 5 - FIELD ENCODING CONVENTION	25
FIGURE 6 - ATM CELL STRUCTURE	27
FIGURE 7 - ATM CELL HEADER FIELDS FOR THE UNI FORMAT.....	27
FIGURE 8 - CELL HEADER FIELDS FOR THE NNI FORMAT	27

Table of Tables

TABLE 1 - PREASSIGNED HEADER FIELD VALUES AT THE UNI (EXCLUDING THE HEC)	15
TABLE 2 - PREASSIGNED HEADER FIELD VALUES AT THE NNI (EXCLUDING THE HEC)	16
TABLE 3 - PTI FIELD AND CODING	18

ATIS Standard on –

Broadband ISDN – ATM Layer Functionality and Specification

1 Scope

This standard is one of a series of ANSI standards on Broadband Integrated Service Digital Network (B-ISDN). These standards describe the B-ISDN capabilities, architectural model, and network interfaces including protocol functionalities and specifications, and signaling characteristics. In particular, this standard describes the protocol of the ATM Layer. This document specifies:

- the service provided by the ATM Layer;
- the service required from the Physical Layer (PHY);
- the interrelation with Layer Management;
- the encoding of the protocol data units;
- the protocol procedures.

In specifying the service, it defines:

- the primitives and the resulting actions and events;
- the parameters and format associated with each primitive;
- interrelationship between the primitives;
- valid sequence of primitives.

The primitives and their associated parameters describe in an abstract manner the logical exchange of information between the ATM Layer and its service users (e.g., the ATM Adaptation Layer and the ATM Layer Management). They do not specify nor constrain the implementation of entities or interfaces.

2 Normative Reference

The following standard contains provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ANSI T1.624-1993, Broadband ISDN User- Network Interfaces: Rates and Formats Specifications