

# American National Standard

*for Telecommunications –  
Network and Customer  
Installation Interfaces –  
Asymmetric Digital Subscriber  
Line (ADSL) Metallic Interface*



**American National Standards Institute**

11 West 42nd Street  
New York, New York  
10036



American National Standard  
for Telecommunications –

Network and Customer Installation Interfaces –  
Asymmetric Digital Subscriber Line (ADSL) Metallic Interface

Secretariat

**Alliance for Telecommunications Industry Solutions**

Approved August 18, 1995

**American National Standards Institute, Inc.**

**Abstract**

This standard presents the electrical characteristics of the Asymmetric Digital Subscriber Line (ADSL) signals appearing at the network interface. The physical interface between the network and the customer installation is also described. The transport medium for the signals is a single twisted-wire pair that supports both Message Telecommunications Service (POTS) and full-duplex (simultaneous two-way) and simplex (from the network to the customer installation) digital services.

This interface standard provides the minimal set of requirements for satisfactory transmission between the network and the customer installation. Equipment may be implemented with additional functions and procedures.

## American National Standard

Approval of an American National Standard requires verification 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 toward 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 on the title page of this standard.

**CAUTION NOTICE:** This American National Standard may be revised or withdrawn at any time. The procedures 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.

**NOTE** – The user's attention is drawn 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 the validity of this claim or of any patent rights in connection therewith. The patent holder has, however, filed a statement of willingness to grant a license under these rights on reasonable and non-discriminatory terms and conditions to applicants desiring to obtain such a license. Details may be obtained from the publisher.

Published by

**American National Standards Institute**  
**11 West 42nd Street, New York, New York 10036**

Copyright ©1995 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 prior written permission of the publisher.

Printed in the United States of America

## Contents

	Page
Foreword .....	vii
<b>1</b> Scope and purpose .....	<b>1</b>
1.1 Scope .....	1
1.2 Purpose .....	1
<b>2</b> Normative references .....	<b>2</b>
<b>3</b> Definitions, abbreviations, acronyms and symbols.....	<b>3</b>
3.1 Definitions.....	3
3.2 Abbreviations, acronyms and symbols .....	3
<b>4</b> Reference models .....	<b>6</b>
4.1 System reference model.....	6
4.2 ATU-C transmitter reference model.....	7
4.3 ATU-R transmitter reference model.....	8
<b>5</b> Transport capacity .....	<b>9</b>
5.1 Simplex bearers.....	9
5.2 Duplex bearers .....	13
5.3 Combined options.....	14
5.4 ADSL system overheads and aggregate data rates.....	17
5.5 Classification by ATM options .....	21
<b>6</b> ATU-C functional characteristics .....	<b>22</b>
6.1 ATU-C input and output V interfaces.....	22
6.2 Framing .....	23
6.3 Scramblers .....	35
6.4 Forward error correction .....	35
6.5 Tone ordering .....	36
6.6 Constellation encoder – with trellis coding .....	37
6.7 Constellation encoder – without trellis coding .....	45
6.8 Gain scaling.....	45
6.9 Modulation .....	46
6.10 Cyclic prefix .....	47
6.11 Transmitter dynamic range.....	48
6.12 Transmitter spectral response.....	48
6.13 Transmit power spectral density and aggregate power level .....	49
<b>7</b> ATU-R functional characteristics .....	<b>51</b>
7.1 ATU-R input and output data interfaces .....	51
7.2 Framing .....	52
7.3 Scramblers .....	57
7.4 Forward error correction .....	57
7.5 Tone ordering .....	57
7.6 Constellation encoder – with trellis coding .....	57
7.7 Constellation encoder – without trellis coding .....	57
7.8 Gain scaling.....	58
7.9 Modulation .....	58
7.10 Cyclic prefix .....	59
7.11 Transmitter dynamic range.....	60
7.12 Transmitter spectral response.....	61
7.13 Transmit power spectral density and aggregate power level .....	62

# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.