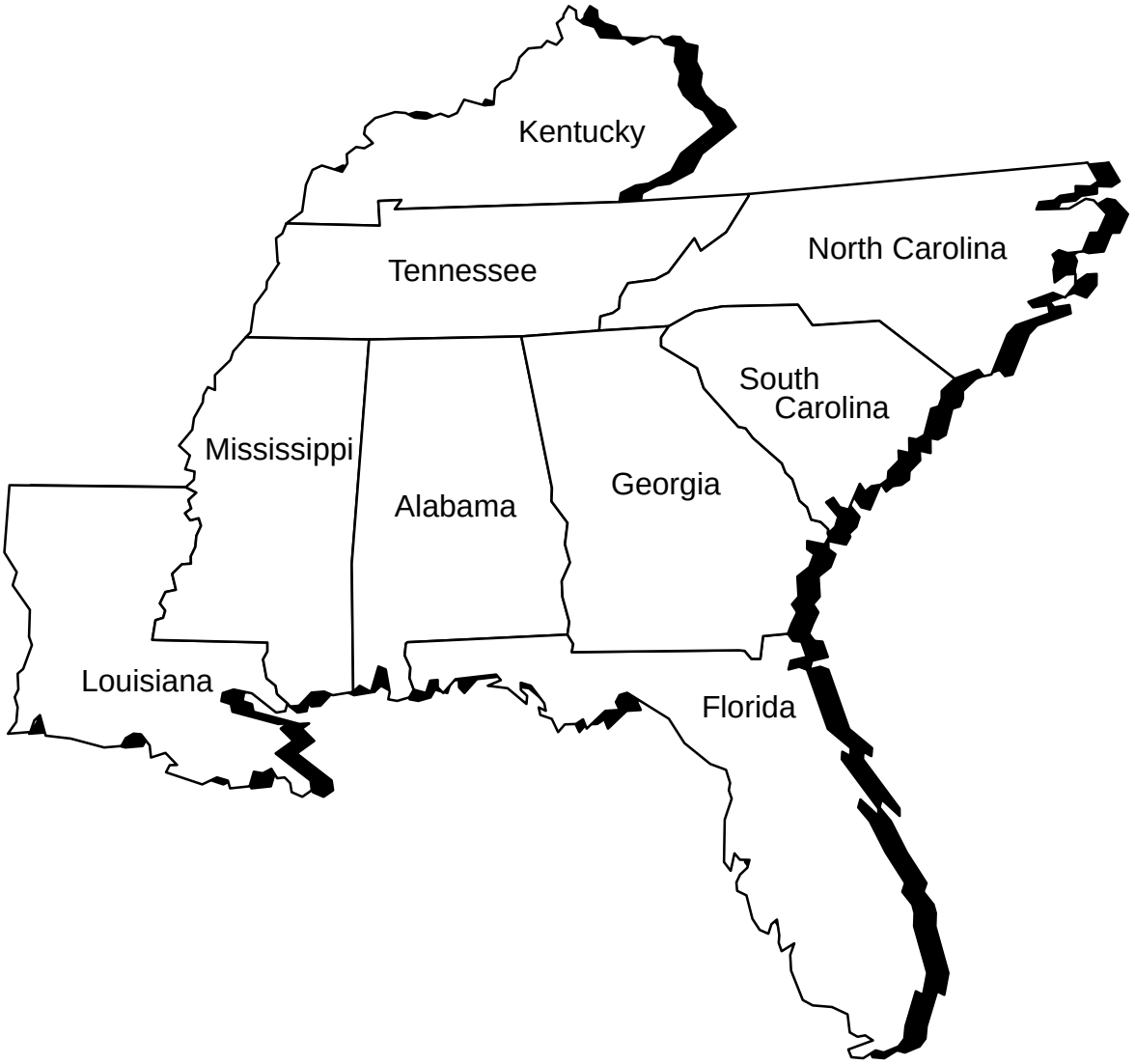
TR 73612

BELLSOUTH TELECOMMUNICATIONS




# ADSL SERVICE SPECIFICATIONS

**Technical Reference**

**December, 1998**
**Issue B**

# NOTICE

This Technical Reference is published by BellSouth Telecommunications, Inc., and provides information required for interconnecting with the BellSouth company networks.

BellSouth Telecommunications, Inc., reserves the right to revise this document for any reason, including but not limited to, conformity with standards promulgated by various governmental or regulatory agencies, utilization of advances in the state of the technical arts, or the reflection of changes in the design of any equipment, techniques, or procedures described or referred to herein. Liability to anyone arising out of use or reliance upon any information set forth herein is expressly disclaimed, and no representations or warranties, expressed or implied, are made with respect to the accuracy or utility of any information set forth herein.

This document is not to be construed as a suggestion to any manufacturer to modify or change any of its products, nor does this document represent any commitment by BellSouth Telecommunications, Inc., to purchase any product whether or not it provides the described characteristics.

Nothing contained herein shall be construed as conferring by implication, estoppel or otherwise, any license or right under any patent, whether or not the use of any information herein necessarily employs an invention of any existing or later issued patent.

If further information is required, please contact:

BellSouth Telecommunications, Inc.

3535 Colonnade Parkway
Birmingham, Alabama 35244
Telephone Number: (205)

# ADSL SERVICE SPECIFICATIONS

## CONTENTS

# ADSL Service Specifications

## 1. General

### 1.1 Scope

This document provides service specifications for the Asymmetric Digital Subscriber Line (ADSL) service offered by BellSouth Telecommunications (BST). Technical specifications may be found in the referenced documents.

### 1.2 Availability

ADSL Service is provided on ADSL−capable local loops in those wire centers equipped with ADSL. This service is only available on local loops serving BST customers, i.e., it is not available on unbundled local loops. In some wire centers, the quantity of ADSL equipment may be limited. The service is provided subject to availability on a first−come first−served basis.

### 1.3 Revisions

This document is revised to include performance requirements, in terms of test loops and data rates.

## 2. References

The following documents are referenced:

(1) ANSI T1.413 − 1995, *Telecommunications — Network and Customer Installation Interfaces — Asymmetric Digital Subscriber Line (ADSL) Metallic Interface*

**NOTE: This document may be ordered from the American National Standards Institute (212) 642−4000.**

Issue 2 of this document has been approved, but is not available from ANSI at this writing.

(2) Alcatel 1000 ADSL, ATM Subscriber Access Multiplexer, Interface Specification

**NOTE: This document may be ordered from Alcatel (800) 252−2835.**

(3) Proposed Modeling of Crosstalk for ADSL Testing, Dick McDonald, Contribution TlEl.4/98−296

**NOTE: This document may be obtained from the Alliance for Telecommunications Solutions, (202) 434−8830.**

## 3. Overview

### 3.1 Data Network Architecture

ADSL Service employs ATM as a layer−2 protocol. In this regard, the interface toward the end−user is ATM carried on an ADSL physical−layer transport. The interface toward the Service Provider is a tariffed ATM interface, employing any of a number of conventional physical−layer transport protocols, e.g., DS3. A high−level view of the architecture is shown in Figure 1, below.

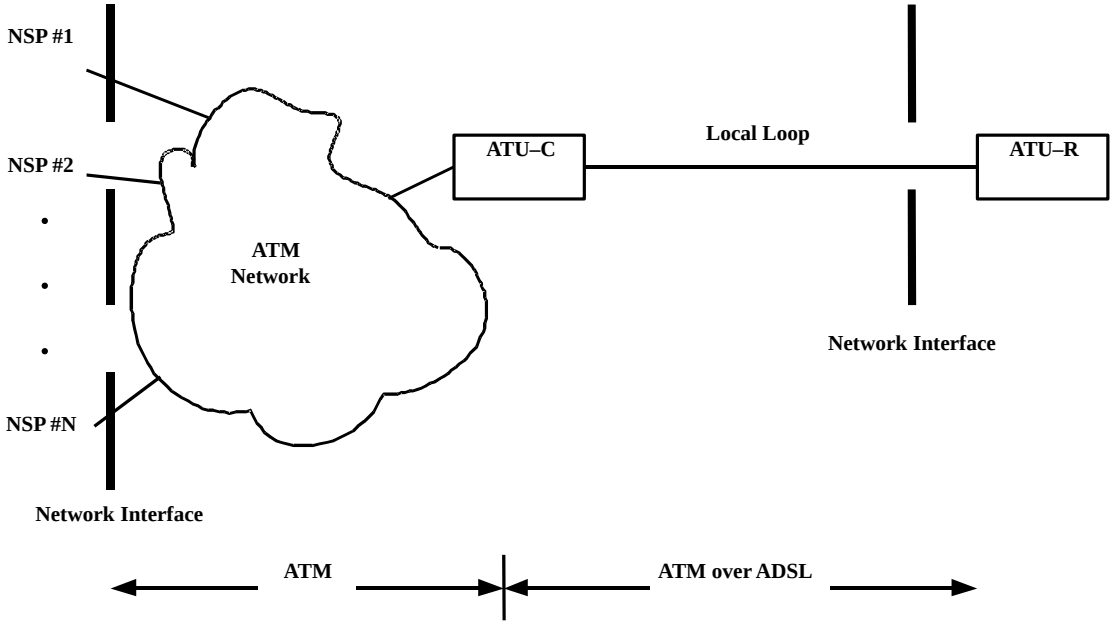



**Figure 1 − High Level Architecture**

At this time, only ATM Permanent Virtual Circuits (PVC's) are supported. Switched Virtual Circuits (SVC's) are not supported. While the BST network is only transporting ATM cells, an application of ATM that has been tested extensively is Multiprotocol Encapsulation of Ethernet frames over ATM AAL5 as specified in the IETF RFC 1483.

### 3.2 ADSL Physical Layer

The ADSL Physical Layer Access reference model is shown in Figure 2, below.

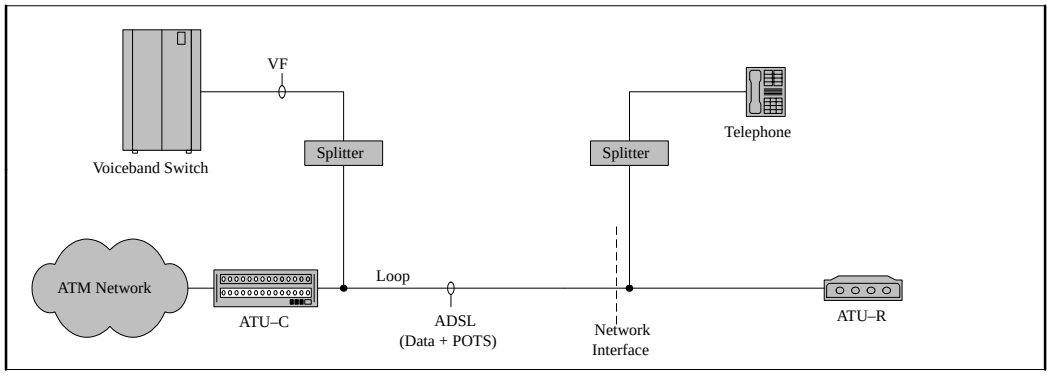



**Figure 2 − ADSL Physical Layer Access Reference Model**

It should be noted that not all loops are candidates for ADSL. Standard design of voiceband lines dictates the addition of inductance at regular intervals to improve the performance of longer loops in the voiceband. These inductors, denoted load coils, act as low−pass filters above the voiceband and make the use of ADSL impossible.

Additionally, BellSouth employs Digital Loop Carrier (DLC) to provide access to many customers. BellSouth is examining various alternatives to provide ADSL service to customers served by DLC. ADSL service may not be available to these customers.

### 3.3 Nomenclature Regarding the Direction of Data

In this document, the direction of data toward the end−user is denoted the 'downstream' direction. The direction of data toward the Network Service Provider (NSP) is denoted the 'upstream' direction.

## 4. Data Rates

### 4.1 General

The ADSL service provided by BellSouth is rate−adaptive, i.e., given the loss and noise present on a particular loop, it will achieve the highest data rate possible, subject to the following constraints.

### 4.2 Definition And Measurement Of ADSL Loop Speed

For all Service Activation and Maintenance conditions and parameters, the ADSL Loop Speed will be defined as that measured — in the downstream direction —by the Management system over the End User's Loop between the BellSouth ATU−C (i.e., the ADSL "Modem" in the BST network) and a proper ATU−R device (CPE ADSL "Modem") connected at the Network Interface.

It should be noted that the Management System reports the ATM data rate, not the ADSL rate, or the Layer 3 (e.g., IP) data rate. The reported data rate includes the ATM overhead, such as header bytes in each cell, and OA&M cells. Approximately 10 OA&M cells per second are sent in each direction.

### 4.3 Service Activation Parameters

The End User ADSL service profile in the Management System will initially be set at a Maximum Downstream Bandwidth Level of 1.5 Mbps and a Minimum Downstream Level of 256 Kbps. The Management System will not allow initialization of the ATU−R if the loop speed is less than 256 Kbps Downstream. An ADSL service installation will only be considered acceptable when the ADSL Loop Speed for an individual End User is 256 Kbps downstream, or greater, at the time ADSL Service is activated.

### 4.4 Out Of Service Condition

An Out of Service Condition will exist when the ADSL Loop Speed for an individual End User falls below 256 Kbps. If the downstream loop speed falls below 256 Kbps, subsequent to initial installation, the Minimum data rate in the Management system will be relaxed to 128 Kbps.

If the ATU−R then initializes, at a speed between 128 Kbps and 256 Kbps, the service will be considered acceptable and no further action will be taken by BST.

## 5. ADSL & ATM Assignments

### 5.1 ADSL

In the downstream direction, all data shall be transmitted on the AS0 channel, defined in Reference 1. In the upstream direction, all data shall be transmitted on the LS0 channel, also defined in Reference 1.

### 5.2 ATM

At this time, BST supports only one PVC per end−user. Toward the end−user, i.e., ATU−R, the VPI used shall be 8. The VCI shall be 35.

The PVC will most likely be mapped to different VPI and VCI assignments in the ATM network. The specific assignments at the network interface toward the NSP will be determined at the time of service negotiation.

## 6. Customer Installation

### 6.1 CPE

The ATU−R is considered to be Customer Premises Equipment (CPE). It shall comply with the requirements in Reference 1. It shall be locally powered, i.e., BST will not provide line powering.

### 6.2 Inside Wiring

New wire, meeting at least Category 3 requirements as defined in EIA/TIA 568A, is recommended for use between the splitter and the ATU−R.

### 6.3 Splitter

A low−pass filter is required for this service. For historical reasons, this low−pass filter is termed a ‘splitter.’ Since the low−pass filter is considered to be CPE, it is the responsibility of the end−user or the NSP.

The filter serves two purposes. First, it isolates the ADSL line from impedance irregularities and high−frequency artifacts due to voiceband equipment. Secondly, it prevents the high−power ADSL signal from appearing across the non−linearities inherent in many telephone instruments. Without this isolation, the resultant Inter−Modulation Distortion could produce enough noise to make the voice service unacceptable.

The low−pass filter must be placed in series to isolate ALL voiceband equipment from the ADSL line. The line toward the ATU−R is then bridged across the local loop, on the CO side of the filter. The need to isolate all voiceband equipment requires placement of the filter at a point common to all inside wiring. One such point, if available, for placement of the filter is the Network Interface Device (NID) which terminates the drop, houses the electrical protector, and houses the Network Interface. If the filter is connected at the NID, it must be connected on the ‘customer accessible’ side of the NID. It CANNOT be placed in the network side of the NID.

## 7. Performance

### 7.1 General

The performance of the ADSL service offering will depend, of course, on the performance of the ATU−C, the loop, and the ATU−R. It is essential that both the ATU−C and ATU−R perform well, in order to provide an acceptable grade of service across the wide variety of loops in BellSouth. In fact, BellSouth's decision as to the usability of loop pre−supposes a high level of performance.

While the ATU−C is under BellSouth's control, the ATU−R is not. For that reason, loop performance requirements are included in this document. These requirements were developed in support of the ITU G.lite (G.992.2) Recommendation. As such, they do not require operation above l.5 Mb/s, even on shorter loops. For use with products intended to operate at higher data rates, these requirements can only be used to evaluate performance on longer loops.

### 7.2 Requirements

Performance shall be evaluated using the test setup defined in Reference 1.

It should be noted that the loops presented below do not model the effects of the customer premises wiring or equipment.

The required bit rates listed below are Net Data Rates as defined in Reference 1.

The noise models (except G.lite) specified below as defined in Reference 1. The G.lite noise models are specified in Reference 3.

In evaluating conformance to these requirements, no power cutback by the ATU−R transmitter is required.

The margin referenced in Table 1 is defined as the difference, in dB, between the level of the noise specified in the table and that value that produces a Bit Error Rate (BER) of $1x10^{-7.}$

In addition to the noise indicated in Table 1 (refer to page 6) a background−noise of −140 dBm/Hz Additive White Gaussian Noise shall be used.

The test loops are show in in Figure 3 on page 6.

The requirements listed below include both nominal requirements and extended−reach requirements. It should be noted that the nominal requirements provide for coverage of about 87% of the loops in the BellSouth network. The extended−reach loops provide coverage of about 99% of the loops. **Both sets of requirements must be met**.

Any ATU−C, that meets the requirements in Reference 1, may be used to demonstrate compliance to these requirements.

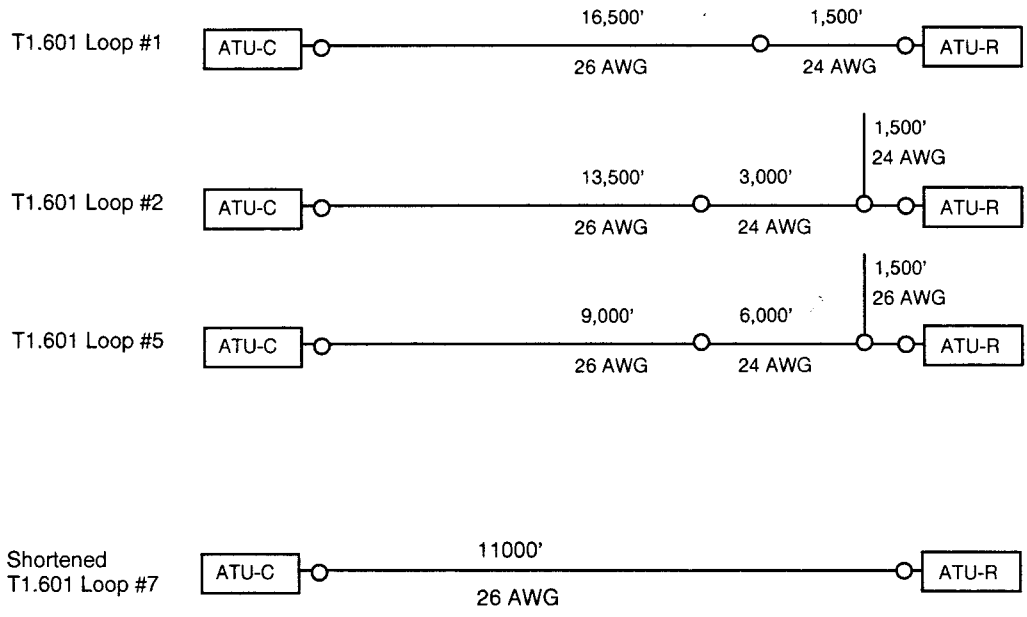



**Figure 3: Test Loops**

**(Figure 3 Continued)**

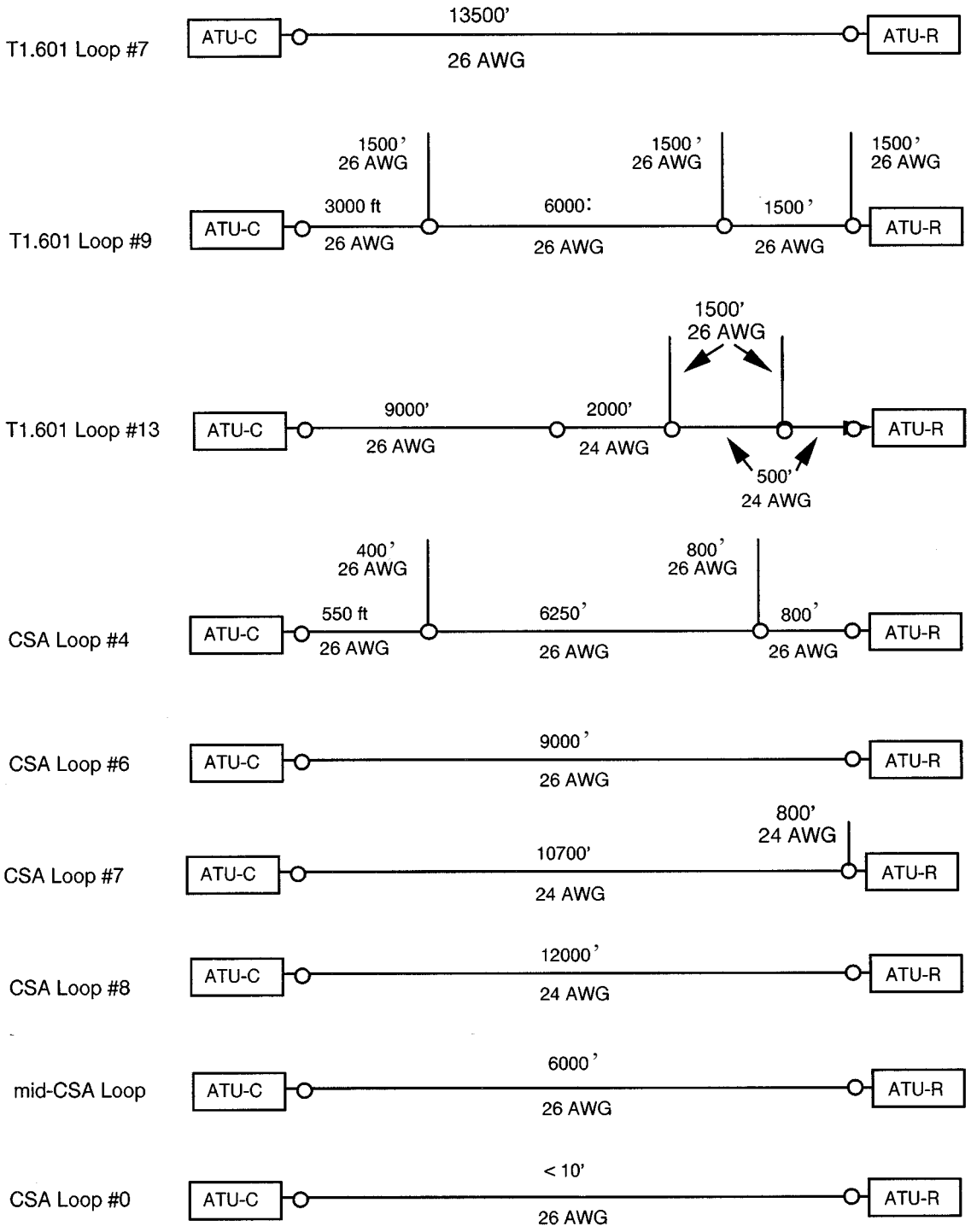


**Table 1: Nominal Test Cases**

| Case # | Loop | Downstream Net Data Rate (kbps) | Upstream Net Data Rate (kbps) | Margin (dB) | Noise @ ATU-C | Noise @ ATU-R |
|---|---|---|---|---|---|---|
| 1 | Null Loop | 1536 | 512 | 4 | None | None |
| 2 | T1.601 #7 | 1536 | 224 | 4 | 49 FDM G.lite | 49 FDM G.lite |
| 3 | T1.601 #7 | 1536 | 224 | 4 | 24 DSL | 24 DSL |
| 4 | T1.601 #13 | 1184 | 224 | 4 | 49 FDM G.lite | 49 FDM G.lite |
| 5 | T1.601 #13 | 1184 | 224 | 4 | 24 DSL | 24 DSL |
| 6 | Shortened T1.601 #7 | 1184 | 256 | 4 | 10 HDSL | 10 HDSL |
| 7 | Shortened T1.601 #7 | 512 | 512 | 4 | 5 adjacent binder T1 | 5 adjacent binder T1 |
| 8 | T1.601 #8 | 256 | 96 | 4 | 24 FDM G.lite | 24 FDM G.lite |
| 9 | T1.601 #8 | 256 | 96 | 4 | 10 DSL | 10 DSL |

**Table 2 Extended Reach Cases**

| Case # | Loop | Downstream Net Data Rate (kbps) | Upstream Net Data Rate (kbps) | Margin (dB) | Noise @ ATU-C | Noise @ ATU-R |
|---|---|---|---|---|---|---|
| 1 | T1.601 #1 | 256 | 96 | 4 | 10 FDM G.lite | 10 FDM G.lite |
| 2 | T1.601 #2 | 256 | 96 | 4 | 24 FDM G.lite | 24 FDM G.lite |
| 3 | T1.601 #5 | 768 | 256 | 4 | 49 FDM G.lite | 49 FDM G.lite |
| 4 | T1.601 #5 | 768 | 256 | 4 | 24 DSL | 24 DSL |
| 5 | T1.601 #9 | 1536 | 256 | 4 | 49 FDM G.lite | 49 FDM G.lite |
| 6 | T1.601 #9 | 1536 | 256 | 4 | 24 DSL | 24 DSL |
| 7 | Shortened T1.601#7 | 1536 | 256 | 4 | 24 HDSL | 24 HDSL |

## 8. Glossary

| | |
|---|---|
| AAL5 | ATM Application Layer 5 |
| ADSL | Asymmetric Digital Subscriber Line |
| ANSI | American National Standards Institute |
| ATM | Asynchronous Transfer Mode |
| ATU−C | ADSL Transceiver Unit, Central Office End |
| ATU−R | ADSL Transceiver Unit, Remote End |
| BST | BellSouth Telecommunications |
| CO | Central Office |
| CPE | Customer Premises Equipment |
| DLC | Digital Loop Carrier |
| EIA | Electronics Industry Association |
| IETF | Internet Engineering Task Force |
| IP | Internet Protocol |
| kbps | kilobits per second |
| NID | Network Interface Device |
| NSP | Network Service Provider |
| OA&M | Operations, Administration & Maintenance |
| PVC | Permanent Virtual Circuit |
| SVC | Switched Virtual Circuit |
| TIA | Telecommunications Industry Association |
| VCI | Virtual Channel Identifier |
| VPI | Virtual Path Identifier |

# PLEASE HELP US

Please take a minute to provide us with feedback about this Technical Reference by completing the questions below. BellSouth is interested in receiving comments and suggestions to improve the quality of our publications. We will reply to your feedback individually, and appreciate your taking time to complete this form.

**Technical Reference TR 73612**

Why did you order this document (please check appropriate box)?

General Reference _____

Product Development _____

Service Development _____

Other (please explain) _____

Did this document provide the technical information you needed? Yes _____ No _____

Was the information presented logically and clearly? Yes _____ No _____

How could this document be improved? _____

_____

_____

_____

_____

Your name: _____

Position: _____

Company: _____

Address: _____

_____

_____

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

**BUSINESS REPLY MAIL**

FIRST–CLASS MAIL PERMIT NO. 83 BIRMINGHAM, AL

Postage will be paid by addressee:

OPERATIONS MANAGER – STR&D
BELLSOUTH TELECOMMUNICATIONS, INC.
3535 COLONNADE PKY. RM. W1D1
BIRMINGHAM, AL. 35243–9828

.....

*FOLD HERE*