BELLSOUTH TELECOMMUNICATIONS

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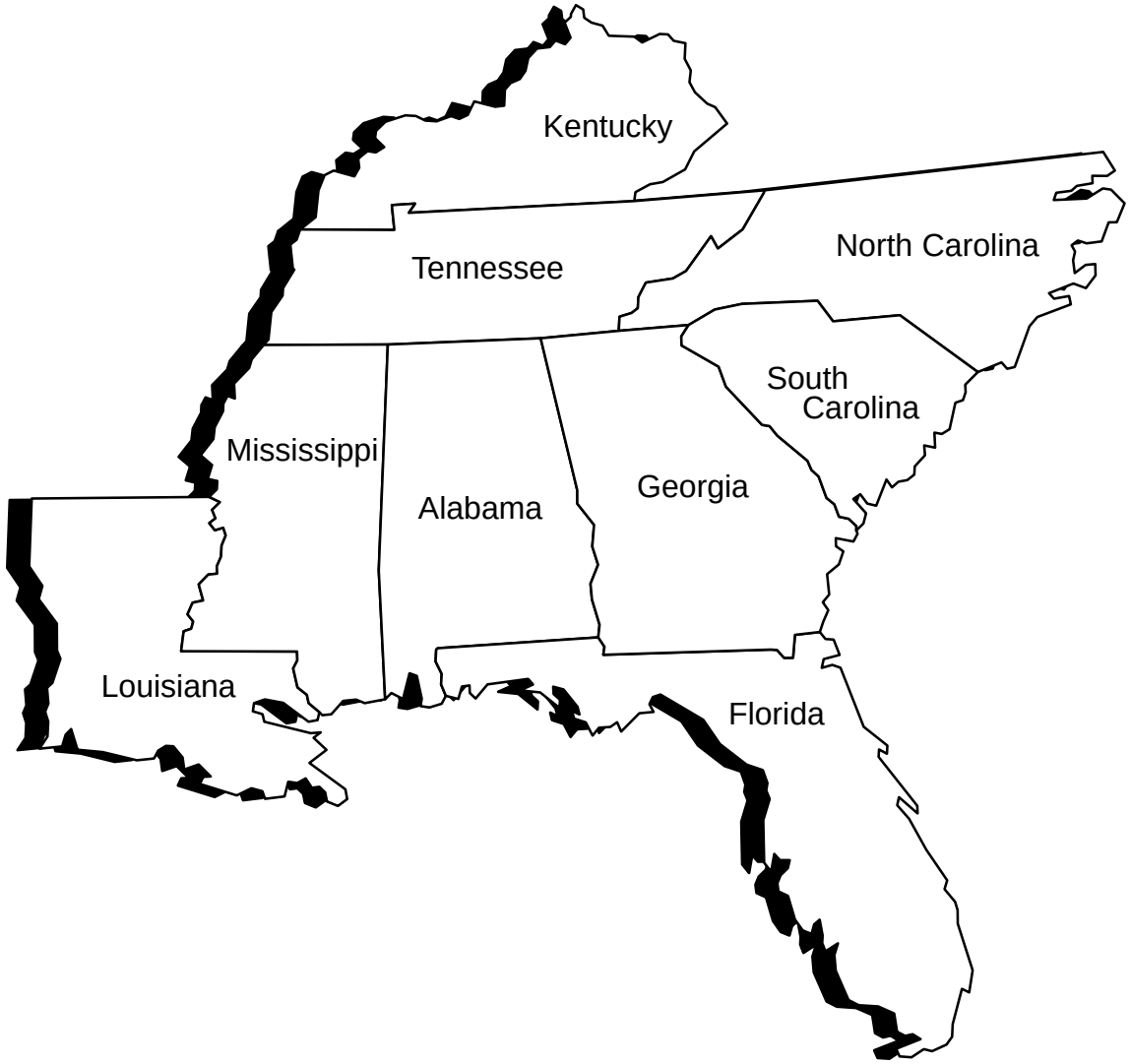

UNBUNDLED LOCAL LOOP – TECHNICAL SPECIFICATIONS

Technical Reference

April, 2001

NOTICE

This Technical Reference describes Unbundled Local Loops provided by BellSouth Telecommunications (BST), Inc. An Unbundled Local Loop provides a transmission path between a BST central office and an end−user location. This document describes the signals as they appear at the associated interfaces. It also describes some aspects of the performance of the channel.

BST 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.

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UNBUNDLED LOCAL LOOP − TECHNICAL SPECIFICATIONS

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UNBUNDLED LOCAL LOOP – TECHNICAL SPECIFICATIONS

1. General

1.1 Scope

This document provides the technical specifications for the Unbundled Local Loops offered by BellSouth Telecommunications (BST). Unbundled Local Loops enable a Competitive Local Exchange Carrier (CLEC) to provide services to an end-user location. While Unbundled Local Loops supporting a wide variety of signaling schemes are available, the widespread use of Digital Loop Carrier (DLC) in the BST network requires that a particular signaling scheme be specified when an Unbundled Local Loop is ordered.

A CLEC may utilize an unbundled loop to provide any telecommunications service it wishes. However, BST will only provision, maintain, and repair the loops to the standards that are consistent with the type of loop ordered. For example, if a CLEC orders an ISDN-capable loop but wants to use the loop for a service other than ISDN, BST will only support that the loop is capable of providing ISDN service.

BST will not make modifications to any loop to make it perform at a particular service level if it was not ordered as such. For example, if a loop was ordered as a Unbundled Voice Loop, but intended to be used for ADSL, BST will not remove any existing load coils from the loop.

1.2 Availability

Unbundled Local Loops are provided subject to availability on a first-come first-served basis.

1.3 Revisions

This revision is issued to make the content of this document consistent with the Unbundled Network Element services currently being offered to the CLECs by BellSouth.

The changes to Issue 4 are summarized below:

- Added reference to ANSI T1.417
- Added bridged tap description to HDSL-Capable loop.
- Added bridged tap description to ADSL-Capable loop.
- Added Unbundled Copper Loop - Non-Designed description.
- Added section describing the Basic Rate ISDN UDC channel

As services are added or modified by work efforts surrounding the FCC's UNE (Rule 319) Remand Order, BST will update this document accordingly. The most current version of this document can be found on the BellSouth Interconnection website at http://www.interconnection.bellsouth.com/guides/html/tech_ref.html#UNE.

2. References

The following documents are referenced:

(1) ANSI T1.102−1993, *Telecommunications − Digital Hierarchy − Electrical Interfaces*

(2) ANSI T1.401−1993, *Telecommunications − Interface Between Carriers and Customer Installations − Analog Voicegrade Switched Access Lines Using Loop−Start and Ground−Start Signaling*

(3) ANSI T1.403−1999, *Telecommunications − Network and Customer Installation Interfaces − DS1 Electrical Interface*

(4) ANSI T1.405−1996, *Telecommunications − Interface Between Carriers and Customer Installation Interfaces, Direct−Inward−Dialing Analog Voicegrade Switched Access Using Loop Reverse−Battery Signaling*

(5) ANSI T1.407−1997, *Telecommunications − Interface Between Carriers and Customer Installations − Analog Voicegrade Special Access Lines Using Customer−Installation−Provided Loop−Start Supervision*

(6) ANSI T1.410−1992, *Telecommunications − Carrier−to−Customer Metallic Interface − Digital Data at 64 kbit/s and Subrates*

(7) ANSI T1.413−1998, *Telecommunications − Network and Customer Installation Interfaces − Asymmetric Digital Subscriber Line (ADSL) Metallic Interface*

(8) ANSI T1.417−2001, *Telecommunications − Spectrum Management for Loop Transmission Systems*

(9) ANSI T1.601−1996, *Telecommunications − ISDN Basic Access Interface for use on Metallic Loops for Application on the Network Side of the NT*

(10) ANSI/IEEE 455−1985, *Standard Test Procedure for Measuring Longitudinal Balance of Telephone Equipment Operating in the Voice Band*

(11) ANSI/IEEE 743−1995, *Standard Equipment Requirements and Measurement Techniques for Analog Transmission Parameters for Telecommunications*

(12) Code of Federal Regulations, Title 47, FCC Rules and Regulations, Part 68, *Connection of Terminal Equipment to the Telephone Network.* Washington, D.C.: Federal Communications Commission.

(13) Committee T1 Technical Report No. 28, A *Technical Report on High−Bit−Rate Digital Subscriber Lines*

(14) Telcordia TA−TSY−000077, *Digital Channel Banks − Requirements for Dataport Channel Unit Functions, April 1986*

(15) Telcordia SR−TSV−002275, *BOC Notes on the LEC Networks* − 1994

(16) Telcordia GR−1089−CORE, *Electromagnetic Compatibility and Electrical Safety − Generic Criteria for Network Telecommunications Equipment − Issue 2, Revised Feb 99.*

(17) Telcordia TR−NWT−000397, *ISDN Basic Access Transport System Requirements*, Issue 3, December 1993

3. Overview and Generic Requirements

3.1 Loop Topology

Unbundled Local Loops extend from the Main Distributing Frame (MDF) in BST's Central Office (CO) to the End User Network Interface. They may be composed in either of the following arrangements:

- entirely of paired metallic conductors, or
- the concatenation of a universal DLC channel with paired metallic conductors.

3.2 Digital Loop Carrier

The use of DLC brings up the following two considerations.

- Some technologies, such as High Bit-rate Digital Subscriber Line (HDSL), cannot be transported via DLC due to the bandwidth employed. When a customer is served by DLC, an Unbundled Local Loop providing such a wide bandwidth will not typically be available.
- Many dedicated voiceband circuits employ signaling that requires unique DLC line cards.

3.3 Inductive Loading

Of the loops employing only metallic facilities, significant percentages are loaded. Loading involves the placement of inductors, typically every 6000 feet, in the loop. These inductors introduce attenuation at frequencies above the voiceband, making wide bandwidth services unavailable.

3.4 Types of Unbundled Local Loops

Due to the above considerations, a number of types of Unbundled Local Loops have been developed in order to simplify the ordering and provisioning process. The different types of loops can be placed into the following categories:

- Unbundled Voice Loop (UVL)
- Unbundled Digital Loop (UDL)
- Unbundled Copper Loop (UCL)

Unbundled Voice Loops provide a two-wire or four-wire voiceband transmission channel with various signaling options.

Unbundled Digital Loops provide a channel that can support one of a described set of digital transmission schemes.

Unbundled Copper Loops provide an all-metallic, unloaded copper path to CLECs for use with any telecommunications service that can use this type of facility.

This document also covers some technical aspects of Unbundled Sub-Loops (USLs), Unbundled Network Terminating Wire (UNTW), Unbundled Sub-Loop Concentration (USLC) and Unbundled Loop Concentration (ULC).

3.5 Interfaces

Unbundled Local Loops are available with two-wire and four-wire interfaces, depending on the particular type. The same number of wires will be provided at both the MDF and the End User Interface. For two-wire interfaces, one conductor is denoted Tip and the other is denoted Ring. For four-wire interfaces, the conductors of one pair are denoted Tip and Ring; the conductors of the other pair are denoted Tip 1 and Ring 1.

The interface at the MDF is not accessible by the CLEC. Instead, it is connected to other BST unbundled elements, or it is connected-via tie cabling-to collocated CLEC equipment. The tie cabling is not part of the unbundled loop.

3.6 CLEC Equipment Requirements

Since a CLEC may utilize an Unbundled Local Loop to provide any telecommunications service it wishes and BST does not know what type of service is actually placed on the loop, regardless of how it was ordered, generic precautions must be specified for all local loop offerings.

Physical Requirements

In addition to applicable FCC, NEC, and UL requirements and orders, CLEC equipment shall also meet the following requirements:

- The dc voltage applied to either conductor shall be negative with respect to ground.
- The open-circuit dc voltage applied to any conductor shall be less than 80 Vdc when measured to ground or any other conductor.
- The power delivered to a load via BST facilities shall not exceed 2.5 watts.
- The current provided, via BST facilities, shall not exceed 150 mA.
- AC voltages, other than those used for ringing, shall not be applied to BST facilities. The intent here is to preclude the use of BST facilities for carrying AC power (at any level). This is not intended to limit voiceband or DSL signals.

Spectrum Considerations

On any unbundled loop that a CLEC chooses to employ any Digital Subscriber Line (DSL) technology, crosstalk into other cable facilities is a concern. Accordingly, the CLEC is responsible for ensuring that the DSL product – in concert with the loop over which the DSL technology is deployed – is in compliance with ANSI T1.417.

3.7 Copper Connectivity

As described in Sections 7.5, 7.6, and 8, BST provides loops that meet the characteristics of ADSL/HDSL industry standards with the Unbundled Digital Loops UDL-2W ADSL, UDL-2W/4W HDSL and the Unbundled Copper Loop service offerings. BellSouth also offers a non-designed copper loop, UCL-ND, which is a copper only loop**.** However, a CLEC can attempt to run ADSL on any UNE loop, even though BellSouth does not support it. Copper connectivity cannot be assured on any UNE loop except on the four mentioned above. For example, if ADSL is placed on a UVL loop, copper connectivity cannot be assured.

3.8 Right to Disconnect

BST reserves the right to disconnect a service or equipment connected to an unbundled local loop that either: (a) fails to meet the requirements of this document, or (b) is shown to be causing harm to other services or systems.

3.9 Foreign Voltage

The foreign voltage, when measured with a high impedance voltmeter on any UNE pair, shall be less than 6 Vdc between conductors or between either conductor to ground and 50 Vac_{rms} between either conductor to ground.

3.10 Noise

Due to the lack of a common means of testing for noise on facilities at higher frequencies, BST has chosen a common noise measurement requirement that is indicative of the power influence and balance of a facility. When the unbundled loop is terminated appropriately, i.e., 600 Ω at the end-user's end, and 900 Ω at the CO, the idle channel noise on any unbundled loop shall not exceed 20dBrnC.

4. Unbundled Voice Loop - Description

Unbundled Voice Loops provide a two-wire or four-wire voiceband transmission channel with various signaling options. UVLs are offered in a single non-design version and several design versions. Copper continuity is not assured with this service.

4.1 Non-Design UVL 2-Wire/Service Level 1

This Unbundled Voice Loop provides a voice grade transmission channel suitable for loop-start signaling and the transport of analog voice grade signals. This loop, which is typically used to provide switched access telephone service, is non-designed. This offering does not have test points and does not come with Order Coordination.

This loop provides loop-start signaling, arranged-for battery-feed by the CLEC and loop closure by the end-user. This loop is only available via a 2-wire, loop-start interface.

4.2 Designed Unbundled Voice Loops

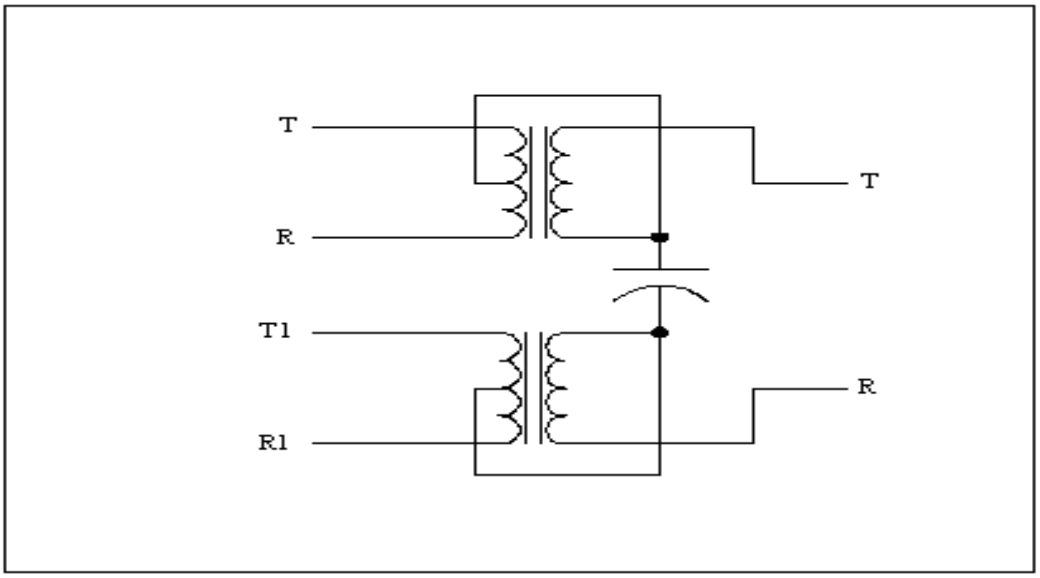
The following signaling and interface combinations are supported on Designed Unbundled Voice Loops:

Number of Wires	Signaling Options	Service Abbreviation
2	Loop-start signaling - office end at MDF	UVL-2W/SL2 (loop)
2	Ground-start signaling - office end at MDF	UVL-2W/SL2 (ground)
2	Reverse-Battery - originating end at MDF	UVL-2W/ (reverse battery)
4	Loop-start signaling - station end at MDF	UVL-4W (loop)
4	Ground-start signaling - office end at MDF	UVL-4W (ground)

These types of signaling are described briefly below. Telcordia SR-TSV-002275 contains a more thorough discussion. Section 5 contains detailed requirements for these types of signaling at both interfaces of each Designed Unbundled Voice Loop.

4.2.1 Two-wire and Four-wire Signaling

In the discussion below, a two-wire circuit is assumed. Four-wire circuits employ similar signaling, except that the dc signaling - instead of being applied directly to the tip and ring conductors - is applied to a center-taps of coupling transformer, so that the dc signals appear in the common-mode across both conductors of each of the four-wire pairs. A circuit suitable for the conversion of four-wire to two-wire is shown below.



4.2.2 Loop Start

The two ends of a loop-start circuit are denoted the office end and the station end. The office end provides a voltage across Tip and Ring. In the idle state, the station presents a high resistance across Tip and Ring. To request service, the station presents a low resistance between the conductors. The resultant current flow is detected by the office end. To alert an idle station of an incoming call, the office end applies ringing voltage, relative to ground, to the Ring.

Loop-start circuits arranged with the office end at the MDF interface are commonly used to provide exchange access service. Section 5.2 contains signaling requirements for both the MDF and End User interfaces.

4.2.3 Ground Start

Ground-start signaling is similar to loop-start, except that in the idle state, the office doesn't apply a voltage across Tip and Ring. Instead it applies a voltage, relative to ground, on only the Ring. This results in the following differences, relative to loop-start service:

- In order to request service, the station provides a low resistance from Tip to ground. Sensing current flow in the Ring, the office provides a (differential) voltage across both Tip and Ring. Upon the application of the differential voltage, the station places a low resistance across the Tip and Ring, and removes the shunt to ground.
- Upon alerting the station, the office applies differential voltage, even between bursts of ringing. If suitably arranged, the station can sense this differential voltage and detect the alerting signal, even before a ringing burst is sent by the office.

Ground-start circuits arranged with the office end at the MDF interface are often used to provide two-way trunks to a PBX. Section 5.3 contains signaling requirements for both the MDF and End User Interface in such an arrangement.

4.2.4 Reverse Battery

Reverse-Battery signaling is typically used on trunks, rather than lines. There is no "office end" or "station end" convention. Ringing is not employed. Reverse-battery signaling accommodates only one-way trunks[1]. For this reason, the ends of the circuit are usually denoted the originating and terminating end.

The terminating end of the circuit provides a voltage across Tip and Ring. In the idle state, the originating end presents a high resistance across Tip and Ring. To request service, the originating end places a low resistance across the conductors. The terminating end senses the resultant loop current. To signal that toward the originating that, for instance, it is ready to accept address digits, the terminating end reverses the polarity across Tip and Ring.

[1] The term "one-way" indicates that a trunk can only be originated from one end. The voice-frequency capability is bi-directional.

The originating end can return to idle by removing the low resistance across Tip and Ring. If properly equipped, the originating end can sense a reversal of polarity as an indication of return to idle by the terminating end.

Reverse-Battery circuits, with the originating end at the MDF, are often used to provide Direct Inward Dialing (DID) trunks to PBX's located behind the End User Interface. Section 5.4 contains signaling requirements for such an arrangement.

4.3 Signaling Requirements

In practically all cases employing metallic facilities, the loop resistance (the sum of the resistance of both tip and ring) is less than 1500Ω

In those cases where loop resistance exceeds 1500 Ω, it will never exceed 2800 Ω. In these cases, BST cannot meet the prescribed signaling requirements at the End User Interface unless the CLEC provides sufficient voltage at the office end of the circuit. The open circuit tip-to-ring dc voltage provided by the CLEC equipment shall be less than 80 Vdc.

4.4 Transmission Requirements

In those rare cases where the loop resistance exceeds 1500 Ω, the insertion loss at 1 kHz, measured with a 900 Ω termination at the MDF and a 600 Ω termination at the End User Interface will never exceed 15 dB.

5. Unbundled Voice Loop - Signaling Requirements

5.1 General

When metallic facilities are employed, signaling and supervision is dependent, of course, on the source voltage (provided by either the CLEC equipment or BST equipment to which the loop is connected), and the total circuit resistance. For all service offerings, in practically all cases, the loop resistance (the sum of the resistance of both tip and ring) shall be less than 1500 Ω. For some UVL loops, loop resistance may exceed 1500 Ω, but will never exceed 2800Ω. In these cases, BST cannot meet the prescribed signaling requirements at the End User Interface unless the CLEC provides sufficient voltage at the office end of the circuit. The open circuit tip-ring dc voltage provided by the CLEC equipment shall be less than 80 Vdc. For all service offerings, the dc resistance between the tip conductor and ground and the ring conductor and ground shall each be greater than 100 kΩ.

Except for instances within ringing burst (as described below), the CLEC shall not apply voltages to either conductor that are positive with respect to ground. Current supplied by CLEC equipment shall be less than 150 mA. Voltages from either conductor to ground shall be more positive than -80 Vdc.

When DLC is employed, both the DLC system and the CLEC must employ compatible signaling. The following requirements are intended to ensure such compatibility, both when the loop is provided via DLC and via metallic facilities.

The following requirements apply to both two-wire and four-wire interfaces. For purposes of clarity, the requirements are based on two-wire interfaces. When four-wire

interfaces are employed, references and/or measurements to Tip apply to the common mode (simplex) path via both Tip and Ring. Similarly, references and/or measurements to Ring apply to the common mode (simplex) path via Tip 1 and Ring 1.

5.2 Loop-Start - Office End at MDF

5.2.1 General

A small percentage of Designed Unbundled Voice Loops provided via DLC may not be able to support the distinctive ringing or forward disconnect features.

5.2.2 MDF Interface - Idle State

In the idle state, the CLEC equipment shall provide an open circuit Tip-to-Ring voltage between 42.5 and 80 Vdc. The Ring shall be negative, relative to the Tip. No positive voltage - relative to ground - shall be applied to either conductor.

In the idle state, the loop shall provide a dc resistance at the MDF meeting either of the following requirements:

- A dc resistance between Tip and Ring $\geq$ 10,000 Ω (loop provided via DLC), or
- A dc resistance between Tip and Ring $\geq$ the parallel combination of the following:
    - the series combination of the on-hook dc resistance of connected equipment at the End User Interface and the dc resistance of the loop, and
    - a leakage resistance of 100,000 Ω

5.2.3 MDF Interface - Alerting State

In the alerting state, the CLEC equipment shall alternately apply a ringing signal and the normal idle-state potential. The ringing signal shall be applied to the Ring conductor. The voltage on the Tip conductor, relative to Ground shall be between 0.0 and -5.0 Vdc. In any six-second period, there shall be at least three continuous seconds of the normal idle-state voltage. The ringing signal shall consist of an ac signal superimposed on a dc signal.

The requirements of the ac component are as follows:

- The frequency shall be 20 $\pm$ 3 Hz.
- The magnitude shall be between 84 and 104 V_{rms}.
- The waveform shall have a peak-to-rms ratio between 1.35 and 1.45.
- The ac current into a line shall be limited to less than 220 mA.

The potential of the dc component shall be between -36 and 56.6 Vdc, relative to ground.

The ringing signal (ac component + dc component) shall be applied to the Ring, with a source impedance $\leq$ 500 Ω. Ground shall be applied to the Tip, with a source impedance of $\leq$ 500 Ω.

The ringing signal shall be removed within 200 milliseconds after the line has gone off-hook, as defined below. The ringing signal shall not be 'tripped' when ringing into the parallel combination of the following:

- 10,000 Ω of dc resistance
- a 2 μF capacitor and the series combination of 1386 Ω and 20 μF (simulating 5 bridged ringers)
- the series combination of 1386 Ω and 20 μF (simulating 5 bridged ringers)

5.2.4 MDF Interface - Off-Hook State

The CLEC equipment shall recognize a resistance of 1900 Ω applied between Tip and Ring at the MDF as off-hook. For interoperability with loops with resistance greater than 1500 Ω, the CLEC equipment shall recognize a resistance of 3200 Ω applied between Tip and Ring at the MDF as off-hook. In either case, the CLEC must provide at least 20 mA through the limiting resistance.

The CLEC shall also meet the following requirements:

- The power delivered to any load via Tip and/or Ring shall not exceed 2.5 W.
- The current provided, via Tip and/or Ring, shall not exceed 150 mA.

In the off-hook state, the loop shall provide a dc resistance at the MDF meeting one of the following requirements:

- A dc resistance between Tip and Ring $\leq$ 1150 Ω (loop provided via DLC), or
- A dc resistance between Tip and Ring $\leq$ the series combination of the off-hook dc resistance of connected equipment at the End User Interface and the dc resistance of the loop.

5.2.5 End-User Interface

Signaling provided by connecting equipment at the End User Interface shall meet the Customer Installation requirements in ANSI T1.401-1993. The loop shall meet the network requirements in ANSI T1.401-1993.

5.3 Ground-Start - Office End at MDF

5.3.1 General

This arrangement is commonly used to support two-way trunks providing switched access to PBX's.

A small percentage of Designed Unbundled Voice Loops provided via DLC may not be able to support the distinctive ringing or forward disconnect features.

5.3.2 MDF Interface - Idle State

In the idle state, the CLEC equipment shall provide an open circuit Ring-to-ground voltage between 16 and 55 Vdc. The Ring shall be negative, relative to ground. The dc resistance from Tip to ground shall be $\geq$ 50,000 Ω.

In the idle state, the loop shall provide a dc resistance at the MDF meeting one of the following requirements:

- A dc resistance from Ring to Ground $\geq$ 10,000 Ω (loop provided via DLC), or
- A dc resistance from Ring to Ground $\geq$ the parallel combination of the following:
    - the series combination of the dc resistance from Ring to Ground at the End User Interface and ½ of the dc resistance of the loop, and
    - a leakage resistance of 100,000 Ω.

5.3.3 MDF Interface - Alerting State

The CLEC shall meet the requirements of 5.2.3.

5.3.4 MDF Interface - Service Request State

When the end user initiates a call by placing a low resistance ($\leq$ 580 Ω) from Ring to Ground, the loop shall provide a dc resistance at the MDF meeting one of the following requirements:

- A dc resistance from Ring to Ground $\leq$ 900 Ω (loop provided via DLC), or
- A dc resistance from Ring to Ground $\leq$ the series combination of the dc resistance from Ring to Ground at the End User Interface and ½ of the dc resistance of the loop.

5.3.5 MDF Interface - Off-Hook State

Upon application of the Ring ground in the Service-Request State, the CLEC equipment shall provide a current-feed interface meeting the requirements of 5.2.4.

The loop shall present a dc resistance across Tip and Ring meeting the requirements of 5.2.4.

5.3.6 End-User Interface

Signaling provided by connecting equipment at the End User Interface shall meet the Customer Installation requirements in ANSI T1.401-1993. The loop shall meet the network requirements in ANSI T1.401-1993.

5.4 Reverse-Battery - Originating End at the MDF

5.4.1 MDF Interface - Idle State

In the idle state, the CLEC equipment shall maintain a dc resistance from Tip to Ring, Tip to Ground, and Ring to Ground $\geq$ 22,500 Ω.

If the loop is provided via Digital Loop Carrier, the loop shall provide at least 36 Vdc between Tip and Ring, with the Tip positive with respect to the Ring, in the idle state.

5.4.2 MDF Interface - Seizure

The Originating end signals an off-hook (seizure) by placing a low resistance between Tip and Ring. In this state, the CLEC equipment shall provide a dc resistance between Tip and Ring $\leq$ 670 Ω.

The current provided by the loop (with CLEC equipment attached that meets the above requirement) shall meet the following requirement:

- If the absolute value of the Tip to Ring voltage is $\geq$ 33.8 Vdc, the current shall be at least that produced by a 36 Vdc source in series with 135 Ω
- If the absolute value of the Tip to Ring voltage $\geq$ 29.5 Vdc, but < 33.8 Vdc, the current shall be at least that produced by a 41.7 Vdc source in series with 489 Ω
- If the absolute value of the Tip to Ring voltage < 29.5 Vdc, the current may be as low as 0 mA.

5.4.3 MDF Interface - Reverse-Battery State

The Terminating end signals an off-hook by reversing the polarity of the voltage applied across Tip and Ring. In this state, the CLEC equipment shall maintain a dc resistance of $\leq$ 670 Ω across Tip and Ring. In this state, the loop shall meet the requirements of 5.4.2.

5.4.4 End User Interface

Signaling provided by connecting equipment at the End User Interface shall meet the Customer Installation requirements in ANSI T1.405-1996. The loop shall meet the network requirements in ANSI T1.405-1996.

6. Unbundled Voice Loop - Voice-Frequency Transmission Requirements

6.1 General

When Loop-Start or Ground-Start signaling is employed, the following specifications are supported only during the off-hook state. These specifications apply to all Designed Unbundled Voice Loops, regardless of the signaling state, except where specified. ANSI/IEEE 743-1995 contains requirements for instrumentation necessary to measure compliance with the following requirements.

6.2 Insertion Loss

The following specifications apply to all Unbundled Voice Loops when measured with a 900 Ω ac impedance at the MDF and a 600 Ω ac impedance at the End User Interface:

- The actual measured insertion loss at 1 kHz shall be 10 dB or less. (See note below.)
- The actual measured insertion loss at 2.8 kHz shall be no greater than 9 dB above that at 1 kHz.

BST does not support transmission on any Designed Unbundled Voice Loop at frequencies below 300 Hz, or above 3.0 kHz.

NOTE: In those rare cases where a UVL loop resistance exceeds 1500 Ω, the insertion loss at 1 kHz will never exceed 15 dB.

6.3 Noise

The idle-channel noise shall be less than 20 dBrnC.

The Signal to C-Notched Noise Ratio shall be at least 32 dB, when measured with a -13 dBm holding tone.

6.4 Noise-to-Ground

The Noise-to-Ground parameter has two specifications. When measured with a C-message weighting filter, it should be less than 90 dBrnC. When measured with a high-impedance voltmeter, it shall not exceed 50 V (126 dBrn).

Note: While dBrn is in units of power, both of these requirements involve voltage measurement, with results displayed in units of power, assuming that the voltage is across a 600 Ω resistor.

The longitudinal balance (longitudinal to metallic conversion loss) of any metallic component of the loop shall be at least 50 dB for frequencies up to 1 kHz. The longitudinal balance of interconnected CLEC equipment shall exceed 60 dB at any frequency up to 1 kHz. This parameter may be measured using ANSI/IEEE 455-1985.

6.5 Voiceband Data

BST does not guarantee that an Unbundled Voice Loop (non-designed or designed) will be suitable for analog data or Facsimile transmission. If a customer is able to send and receive data, BST does not guarantee a data rate.

6.6 Signal Power

The power of the voiceband signal, at either the End User Interface or the MDF, shall not exceed -9 dBm, when averaged over any 3-second period.

The out-of-band signal power shall meet the out-of-band signal power limits in Section 68.308 of FCC Part 68 requirements. In the event that connected equipment is not registered under Part 68, this requirement shall still apply.

7. Unbundled Digital Loop

7.1 General

An Unbundled Digital Loop provides a channel intended to support one of a described set of digital transmission schemes. These schemes include the following:

- Digital Baseband at 2.4, 4.8, 9.6, 19.2, 56 and 64 kbps
- Basic Rate Access ISDN
- Basic Rate Access UDC
- High-Bit-Rate Digital Subscriber Line (HDSL)
- Asymmetrical Digital Subscriber Line (ADSL)
- DS1

Requirements for each of these services are described below.

7.2 Digital Baseband at 2.4, 4.8, 9.6, 19.2, 56 and 64 kbps

7.2.1 Interfaces

The interface at the MDF is a 4-wire interface, described as a DS-0A interface in Telcordia TA-TSY-000077. The End User Interface is a 4-wire interface described in ANSI T1.410-1992. Signals applied at either interface shall meet the requirements of these documents.

7.2.2 Transport

The loop facility may be provided via metallic facilities, DLC, or both. Where metallic facilities are employed, loops measuring less than the insertion loss specified for each service in Table 7.2 will be served directly on copper. This loss should be measured between 135 Ω terminations at the insertion loss frequency specified for each service in Table 7.2. Loops measuring over the specified limit in Table 7.2 but less than 50 dB at 13.3 kHz may be served with range extension devices. Loops measuring more than this second limit will be considered out of range for metallic-only service but may be served if DLC exists in the area. Where spare DLC facilities exist, only the length of the copper extension from the DLC to the customer is an issue. DC signaling, in the simplex path, is only supported to the extent necessary to provide maintenance functions as described in Telcordia TA-TSY-000077 and ANSI T1.410-1992.

Table 7.2 Maximum Allowable Digital Baseband Service Insertion Losses

Service	Insertion Loss Frequency	Max Allowable Insertion Loss
2.4 kbps	1.2 kHz	34
4.8 kbps	2.4 kHz	34
9.6 kbps	4.8 kHz	34
19.2 kbps	9.6 kHz	40
56 kbps	28.0 kHz	40
64 kbps	36.0 kHz	40

7.3 Basic Rate Access ISDN

This unbundled loop provides for the transport of two 64 kbps (B) channels and one 16 kbps (D) channel. Time Slot Sequence Integrity is not ensured. If this unbundled loop is provisioned over DLC, the CLEC's data must be synchronous with the timing employed by BST.

7.3.1 Interfaces

The interface at both the CLEC (collocated or elsewhere) and the End User Interface is a 2-wire interface as defined in ANSI T1.601-1996. The supported arrangement involves an NT at the end-user and an LT provided by the CLEC. No other arrangements are supported. Signals applied at either interface shall meet the requirements of this document.

7.3.2 Transport

The loop facility may be provided via metallic facilities, DLC, or both. Where metallic facilities are employed, loops measuring less than 42 dB at 40 kHz will be served directly on copper. Loops measuring over this limit but less than 52 dB at 20 kHz may be served with range extension devices. Loops measuring more than this second limit will be considered out of range for metallic-only service but may be served if DLC exists in the area. Where spare DLC facilities exist, only the length of the copper extension from the DLC to the customer is an issue. No dc specifications are supported. Sealing current - even if not provided by the CLEC equipment (LT) - may be provided, but is not guaranteed. The noise requirements in Sections 6.3 and 6.4 apply to this service.

7.4 Basic Rate ISDN UDC

UDC loops are ISDN loops that are configured for data-only applications such as IDSL. UDC loops are intended to support a CLEC's IDSL service but are not guaranteed to do so.

UDC loops may be provisioned over metallic facilities, DLC, or both. When provisioned via a DLC system, the following applies:

- Transport for the 4 kb/s of the M-channel information plus the DSL superframe timing – as defined in Telcordia Technical Reference TR-NWT-000397 – will be provided in addition to the two 64 kbps (B) channels and one 16 kbps (D) channel.
- The CLEC's data shall be synchronous with the timing employed by BST.
- Time Slot Sequence Integrity will be ensured by BST.

7.4.1 Interfaces

The interface at both the CLEC (collocated or elsewhere) and the End User Interface is a 2-wire interface as defined in ANSI T1.601-1996. The supported arrangement involves an NT at the end-user and an LT provided by the CLEC. No other arrangements are supported. Signals applied at either interface shall meet the requirements of this document.

7.4.2 Transport

The loop facility may be provided via metallic facilities, DLC, or both. Where metallic facilities are employed, loops measuring less than 42 dB at 40 kHz will be served directly on copper. Loops measuring over this limit but less than 52 dB at 20 kHz may be served with range extension devices. Loops measuring more than this second limit will be considered out of range for metallic-only service but may be served if DLC exists in the area. Where spare DLC facilities exist, only the length of the copper extension from the DLC to the customer is an issue. No dc specifications are supported. Sealing current - even if not provided by the CLEC equipment (LT) - may be provided, but is not guaranteed. The noise requirements in Sections 6.3 and 6.4 apply to this service.

7.5 HDSL-capable

7.5.1 Availability

This channel is not available when DLC is employed. This channel is not available if the loop facilities do not meet Carrier Serving Area (CSA) guidelines as described in Committee T1 Technical Report No. 28.

7.5.2 Interfaces

At the CLEC's request, either a 2-wire or 4-wire channel will be provided.

7.5.3 Transport

The loop facility consists of only non−loaded metallic facilities meeting CSA design guidelines as documented in Committee T1 Technical Report No. 28. The dc resistance of a single wire pair should not exceed 850 Ω. The total bridged tap length may not exceed 2.5kf, with no single bridged tap exceeding 2.0kf. The insertion loss of a pair at 100 kHz, measured between 135 Ω terminations, shall not exceed 35 dB. No industry-wide standard exists for a designed loss maximum for HDSL. Different HDSL equipment vendors may use different design parameters. The loss specified above was developed through extensive modeling of CSA loops at BST and represents the worst-case CSA loop loss.

For a CLEC−requested loop facility that does not meet HDSL−capable loop specifications due to the existence of load coils or excessive brideged tap, the CLEC may request that BellSouth modify the loop. In these situations and as a chargeable option, BellSouth will use the Unbundled Loop Modification (ULM) process to modify the requested loop facility to HDSL−capable loop specifications. Additionally, the ULM product may be utilized by the CLEC to remove any bridged tap sections on loops already meeting the HDSL−capable loop specification.

BellSouth does not guarantee a particular bit−rate associated with these loops. The transmission amd bit−rate speed of HDSL−type services are dependent on the CLEC's equipment.

7.6 ADSL-capable

7.6.1 Availability

This channel is not available when DLC is employed. This channel is not available if the loop facilities do not meet Revised Resistance Design (RRD) guidelines as defined in Telcordia SR−TSV−002275.

7.6.2 Interfaces

This offering is available as a 2-wire channel only.

7.6.3 Transport

The loop facility consists of only non−loaded metallic facilities meeting RRD design guidelines. RRD guidelines limit non-loaded loops to 18kf in length or less, including bridged tap, and 1300 Ω of resistance or less. RRD further limits total bridged tap to 6kf. The dc resistance of a single wire pair should not exceed 1300 Ω. The insertion loss of a pair at 40 kHz, measured between 135 Ω terminations, shall not exceed 42 dB, as specified in ANSI T1.601.

For a CLEC−requested loop facility that does not meet ADSL−capable loop specifications due to the existence of load coils or excessive brideged tap, the CLEC may request that BellSouth modify the loop. In these situations and as a chargeable option, BellSouth will use the Unbundled Loop Modification (ULM) process to modify the

BellSouth will use the Unbundled Loop Modification (ULM) process to modify the requested loop facility to ADSL−capable loop specifications. Additionally, the ULM product may be utilized by the CLEC to remove any bridged tap sections on loops already meeting the ADSL−capable loop specification.

BellSouth does not guarantee a particular bit−rate associated with these loops. The transmission and bit−rate speed of ADSL−type services are dependent on the CLEC's equipment.

7.7 DS1

7.7.1 Availability

This channel is available where DS1-capable facilities exist.

7.7.2 Interfaces

One balanced twisted pair shall be used for each direction of transmission.

The physical layer of the DS1 NI is consistent with the interface requirements delineated in the following specifications:

TR 73572 *Expanded Interconnection Service DS1 and DS3 Level Network Interface*

ANSI T1.403 *Network-and-Customer Installation - DS1 Metallic Interface*

TR 73572 defines the central office interface for Collocated transmission equipment with BST services. CLEC equipment that is connected to this offering shall meet the DSX-1 signal power limits specified in ANSI T1.102. BST will designate a meet point location within the central office where BST DS1 services will be terminated at the NI for interconnection to the CLEC transmission equipment.

ANSI T1.403 applies to end-user interfaces. End-user CPE that is connected to this offering shall meet the DS1 signal power limits in ANSI T1.403 and Part 68 of the FCC Rules. Interconnection at the DS1 End-User NI is through one of four Universal Service Order Code (USOC) connectors, RJ48C, RJ48X, RJ48M, RJ48H, as shown in ANSI T1.403 and Part 68 of the FCC Rules and Regulations as revised by Public Notice Numbers 4609 (September 21, 1988) and 4572 (October 3, 1988). The RJ48C or RJ48X jack is used for single DS1 line installations, and the RJ48M (8 DS1s) or RJ48H (12 DS1s) may be used for multiple circuit installations. These have a jack to the network and a plug from the CI installation. Alternatively, an appropriate DS1 rate digital cross connect panel may function as the interconnection arrangement at the NI.

7.7.3 Transport

This service enables full duplex 1.544 Mbps digital transmission and supports either Superframe (SF) or Extended Superframe (ESF) framing formats as specified in ANSI T1.403-1999. The service is available with either the AMI or B8ZS line codes as specified in ANSI T1.403-1999. This DS1 offering may be provisioned via a variety of loop transmission technologies, including, but not limited to, metallic facilities without signal

regeneration, metallic facilities with signal regeneration, metallic facilities with HDSL-based technology or fiber optic transport systems. The technology used will be based upon existing capacities and distance from the central office.

BST will conduct short-term bit-error-rate stress testing, as outlined in ANSI T1.510-1999, on each DS1 circuit during installation to insure proper circuit performance.

8. Unbundled Copper Loop

An Unbundled Copper Loop provides a dedicated, non−loaded all-metallic transmission facility from the BST Serving Wire Center MDF to the end user. A UCL will consist of one or two copper pairs that BST records indicate are non−loaded. The UCL will be offered in two versions: UCL/S (Short) and UCL/L (Long). The UCL/S is any copper loop less than or equal to 18kf in length. In addition, up to 6kf of bridged tap may be included on the facility. The UCL/L is any copper loop longer than 18kf.

The loop is not intended to support any particular service and may be utilized by the CLEC to provide a wide-range of telecommunications services, so long as those services do not adversely affect BST's network.

8.1 Availability

This channel is not available when DLC is employed. This channel is not available if the loop facilities do not meet Resistance Design (RD) guidelines as defined in Telcordia SR-TSV-002275. With this service, metallic copper continuity is assured. BST will provide UCLs where they already exist in the BST network. BST is not obligated to provision UCL service in a non-copper area.

8.2 Interfaces

This service offering is available in a 2-wire or 4−wire interface.

8.3 Transport

For the UCL/S (Short) offering, the loop facility consists of only unloaded metallic facilities which BST records indicate meet Resistance Design guidelines. The loop resistance must not exceed 1300 Ω. The total allowable length of the loop is 18kf. An additional 6kf of bridged tap is allowed. BST will guarantee electrical continuity and capacitive balance.[2] The insertion loss of a pair meeting the RD guidelines shall not exceed 46 db at 40 kHZ, measured between 135 Ω terminations.

For the UCL/L (Long) offering, the loop facility consists of only non−loaded metallic facilities which BST records indicate are greater than 18kf. The loop resistance should not exceed 2800 Ω. In addition, up to 12kf of bridged tap may be included on the loop facility. On the UCL/L offering BST will only provide electrical continuity and balance.

[2] BST considers a capacitive unbalance as high as 5% to be acceptable.

Pairs of this length typically have load coils or other−extending equipment. For a CLEC−requested loop facility that does not meet the UCL loop specifications due to the existence of load coils or excessive bridged tap, the CLEC may request that BellSouth modify the loop. In these situations and as a chargeable option, BellSouth will use the Unbundled Loop Modification (ULM) process to modify the requested loop facility to UCL loop specifications. Additionally, the ULM product may be utilized by the CLEC to remove any bridged tap sections on loops already meeting the UCL specifications.

BellSouth does not guarantee a particular bit−rate associated with these loops. The transmission and bit−rate speed of xDSL−type services are dependent on the CLEC's equipment.

9. Unbundled Copper Loop Non-Designed

An Unbundled Copper Loop Non-Designed (UCL-ND) provides a dedicated 2-wire non-loaded all metallic transmission facility from BellSouth's Serving Wire Center (SWC) Main Distribution Frame (MDF) to the end user (including the NID).

An UCL-ND will consist of one copper pair that BellSouth records indicate is non-loaded with a resistance of 1300 Ω or less. The loop may have up to 6,000 feet of bridged tap between the end user's premises and the SWC. The exact resistance, length and bridged tap are not guaranteed due to the loop being non-designed. The UCL−ND will be assigned based on BellSouth's records indicating that the loop resistance will not be greater than 1300 Ω resistance and, in most cases, will not exceed 18,000 feet in length, although the UCL-ND will not have a specific length limitation. For loops less than 18,000 feet and with less that 1300 Ω resistance, the loop will provide a voice grade transmission channel typically suitable for acceptable transport of voice grade signals. Test points are not available with UCL-ND because this is a Non−Designed product.

9.1 Availability

This channel is not available when DLC or DAML is employed. This channel is not available if the loop records used for qualification shows a resistance greater than 1300 Ω and/or loaded facilities. With this service, metallic continuity is assured. BellSouth will provide UCL-NDs where they already exist in the BellSouth network. BellSouth is not obligated to provision UCL-ND service in a non-copper area.

9.2 Interfaces

This service offering is available in a 2-wire interface.

9.3 Transport

For the UCL-ND offering, the loop facility consists of only unloaded metallic facilities which BellSouth records indicate are 1300 Ω of resistance or less. There is no maximum loop length, however most loops inventoried as non-loaded 1300 Ω circuits will be less than 18,000 feet. An additional 6kft of bridged tap is allowed. BellSouth will guarantee electrical continuity and capacitive balance.

For a CLEC-requested loop facility that does not meet the UCL-ND loop specifications due to the existence of load coils or excessive bridged tap, the CLEC may request that

BellSouth modify the loop. In these situations and as a chargeable option, BellSouth will use the existing Unbundled Loop Modifications (ULM) process to modify the requested loop facility to UCL−ND loop specifications. Additionally, the ULM product may be utilized by the CLEC to remove any bridge tap sections on loops already meeting the UCL-ND specifications.

BellSouth does not guarantee a particular bit-rate associated with these loops. The transmission and bit-rate speed of xDSL type services are dependent on the CLEC's equipment.

10. Unbundled Sub-Loop

An Unbundled Sub-Loop (USL) is a non-design service providing a dedicated voice-frequency transmission facility from a customer's premise to a BST cross-connect device. The cross-connect device may be located within a remote terminal or a stand-alone cross-box in the field or in the equipment room of a building. This facility does include a Network Interface Device (NID) at the customer's location for the purpose of connecting the loop to the customer's inside wire. This facility, which may be loaded, will allow an end user to send and receive telecommunications traffic when it is properly connected to a CLEC loop/feeder facility. The CLEC must provide a cable from its feeder system to the BST cross-connect device.

10.1 Availability

This service is available anywhere a CLEC chooses to place a feeder facility and connecting cable in proximity to an existing BST cross-connect device.

10.2 Interfaces

This service offering is available as a 2-wire or 4-wire interface.

10.3 Transport

This service will provide a copper pair capable of voice-frequency transmission from the feeder/distribution interface to the customer. This pair may contain load coils. BST does not provide any specific telecommunications services associated with a Sub-Loop. The requirements in Sections 3.6 apply to these loops. The loop resistance shall be less than 2800 Ω.

11. Unbundled Network Terminating Wire

An Unbundled Network Terminating Wire (UNTW) is a dedicated transmission facility that BST provides from the Wiring Closet/Garden Terminal, or other cross-connect type, at the point of termination of BST's loop distribution facilities, to the end user premises.

When properly connected to the CLEC's loop distribution and CLEC's Network Interface Device facilities, the offering will provide a communication pathway from the CLEC to the end user's inside wire.

This service does not include a Network Interface Device (NID).

11.1 Availability

In the states where BST has been ordered to provide sub-loop unbundling, this service is available anywhere a CLEC chooses to place a feeder distribution cable in proximity to an existing customer served by BST.

11.2 Interfaces

This service offering is available as a 2-wire or 4-wire interface.

11.3 Transport

This service will provide a copper pair from the BST distribution terminal to the customer. BST does not provide any specific telecommunications services associated with the UNTW. BST will only provide electrical continuity and balance. The requirements in Sections 3.6 apply to these loops.

12. Network Interface Device (NID) Access

NID Access is designed to allow a CLEC the opportunity to connect its loop to the inside-wiring portion of BST's Network Interface Device (NID). It is expected that the CLEC will provision a loop and a NID to the customer's location. The CLEC will perform a physical cross-connect of the inside wire to its loop, through BST's NID.

In those states where the PSC has allowed the CLEC to remove the BST loop from a BST NID where no spare terminal capacity exists, it will be the CLEC's responsibility to ensure that there is no safety hazard and must hold BST harmless for any liablilty associated with the CLEC's removal of the BST loop from the BST NID. The BellSouth drop wire is terminated on a protector which provides over−voltage protection within the NID. Therefore, the CLEC will use the following procedures to insure that the BST drop wire, disconnected from the outside NID, is adequately protected:

1.) The CLEC shall disconnect the drop wire and reconnect it to a nationally−recognized−testing−laboratory−listed station protector, which has been grounded as per Article 800 of the National Electrical Code, or;

2.) If the CLEC does not wish to accept this responsibility, other options exist in which BST installs a NID for the CLEC as a chargeable service.

13. Unbundled Sub-Loop Concentration

Unbundled Sub-Loop Concentration (USLC) will allow a CLEC to concentrate loop distribution elements provided by the CLEC on to multiple DS1s for the purpose of connecting the loop distribution elements, at a concentrated level, to BST's feeder facilities. This concentration will take place at an existing BST remote terminal where spare capacity exists. BST will transport the DS1s carrying the distribution circuits back to the Serving Wire Center for termination on a BST DSX panel and will ultimately terminate to the CLEC's collocation space in that SWC.

13.1 Availability

BST will offer this capability in all locations where capacity is available. If no capacity exists in the BST RT or cross-box, BST will utilize its special construction process to determine if an additional RT or cross-box can be placed near the existing RT or cross-box for increased capacity. If this cannot be done, BST will not be able to provide USLC in that area.

13.2 Interfaces

This service can be provisioned with either a TR008 or a TR303 interface. Each USLC will be dedicated to a single CLEC.

13.3 Transport

In order for the BST loop concentration system to perform properly, certain interface requirements into the concentration system must be observed.

The interface requirements into a loop concentration system are service dependent. For each CLEC-requested service to be placed through the concentration system, BST will provision appropriate channel units. All dc voltage, current and signal powers applied to each channel unit by the CLEC shall comply with extant industry documents related to that service.

The optional test circuit, commonly referred to as a dc test pair, offered with this service shall comply with the appropriate system (TR008 or TR303) testing requirements. The maximum dc voltage allowed on the test pair is 120 Vdc, with a maximum resulting current of 15 mA. The maximum allowable ac voltage is 60 Vac. This test circuit will be emulated with Tollgrade channel units using two channels of the concentrated carrier system.

14. Unbundled Loop Concentration

Unbundled Loop Concentration (ULC) will be offered as an expandable unit that concentrates unbundled loops up to a DS1 level circuit within the BST Serving Wire Center where the loops terminate onto the MDF for transport to the CLEC's collocation space. BST will allow UVL and UDL loops to be combined onto the ULC offering.

14.1 Availability

BST will offer this capability in all locations.

14.2 Interfaces

This service can be provisioned with either a TR008 or a TR303 interface. Each ULC will be dedicated to a single CLEC.

14.3 Transport

In order for the BST loop concentration system to perform properly, certain interface requirements into the concentration system must be observed.

The interface requirements into a loop concentration system are service dependent. For each CLEC-requested service to be placed through the concentration system, BST will

provision appropriate channel units. All dc voltage, current and signal powers applied to each channel unit by the CLEC shall comply with extant industry documents related to that service.

The optional test circuit, commonly referred to as a dc test pair, offered with this service shall comply with the appropriate system (TR008 or TR303) testing requirements. The maximum dc voltage allowed on the test pair is 120 Vdc, with a maximum resulting current of 15 mA. The maximum allowable ac voltage is 60 Vac. This test circuit will be emulated with Tollgrade channel units using two channels of the concentrated carrier system.

15. Electrical Disturbances

Unbundled Local Loops may be exposed to electrical surges from lightning and commercial power system disturbances. Despite protective devices on the MDF, some of these disturbances are likely to reach CLEC equipment. CLEC equipment shall be designed to withstand certain surges without being damaged, and shall fail in a safe manner under infrequent high stress.

The prevalent voltage-limiting device available for CO use is the 3-mil carbon block. The performance of these devices can best be characterized by a normal distribution function. The upper 3σ firing voltage is 1000 volts peak under surge conditions. The protector may also limit - to about 350 mA over extended periods - the current that is permitted to flow to equipment. In addition, a protective fuse cable located outside the CO incorporating 24 or 26 AWG conductors to coordinate with the protector, serves to limit current to safe levels in the event of prolonged operation of the protector during power fault conditions.

16. ANNEX A - Characteristics of Tie Cable(s) And/or Wiring Component

The cabling and/or wire between the MDF interface and the collocated CLEC equipment (if any) is not a component of the Unbundled Local Loop. It is an unbundled element. The following specifications apply:

- The total length should be less than 1500 feet.
- The dc resistance should be less than 80 Ω.
- The insertion loss, measured between 900 Ω terminations at 1 kHz, should be 0.5 dB or less.
- The noise shall be 15 dBrnC or less.

DSX-1 Cross-connect

- The total length of all DSX-1 cross-connect wiring should be less than 85 feet of 22-gauge cable.
- The cabling between the equipment and the DSX-1 panels shall be built-out in each direction of transmission such that the overall cabling and build-out is the equivalent of 655 feet of 22-gauge ABAM cable.

17. ANNEX B - NC/NCI Codes

Network Channel (NC) and Network Channel Interface (NCI) codes are used to supplement ordering. These codes provide a shorthand notation of the interface and performance characteristics described in this document. This section may be used as a reference for NC and NCI codes to be used when ordering the services described in this document, which are services covered under the BellSouth Special Access Tariff.

17.1 Network Channel (NC) Codes

The Network Channel code is a representation used to identify non-switched channel services and to designate the channel parameters. Table 16.1 shows the format of the NC code. It is a four-character code that consists of a Channel Service Code and an Optional Feature Code. The Channel Service Code is a two-character code that indicates the channel service. This code is always filled in. The Optional Feature Code is a two-character code that indicates service options available for each channel service code. A hyphen (-) is used in positions 3 and 4 of the NC code to indicate the absence of features or options.

Table 17.1 Network Channel (NC) code format.

Field Identity	Channel Service Code		Optional Feature Code	
Character Position	1	2	3	4
Character Type	Alpha	alpha	Alphanumeric	Alphanumeric

17.2 Network Channel Interface (NCI) Codes

The Network Channel Interface (NCI) code designates five interface elements located at the Point of Termination (POT) or customer location. The interface elements are described below:

- **Total Conductors** is a two character numeric code (the first two characters of the NCI) that represents the total number of physical conductors required at the interface. This field is always filled.

- **Protocol** is a two character alpha code (positions 3 & 4) that indicates the transmission requirements. The protocols specified at either end of a circuit do not have to be the same, but they do have to be technically compatible. This field is always filled.

- **Impedanc**e is a one character alpha code (position 5) indicating the nominal impedance that terminates the channel. This field is always filled.

- **Delimiter** is either a period (.) or virgule (/) in position 6 that indicates the start of the protocol option code. If the option field is not coded, a double delimiter will be placed in character positions 6 and 7.

- **Protocol Options** is a one-to three−character alphanumeric code (positions 7 to 9) that indicates additional features of the protocol to be used. Protocol option codes are left justified in the field when fewer than three characters are used.

- **Delimiter** is either a period (.) or virgule (/) in position 10 if a three character protocol option code is used, or position 9 if a two character protocol option code is used, or position 8 if a single character protocol option code is used.

- **Transmission Level Point** (TLP) (last two positions after the second delimiter) is not used for unbundled loops at this time but may be used to indicate direction of service by some Local Transport Providers.

The following table illustrates the NCI code format:

Table 17.2 Network Channel Interface Code Format.

Field Identifier	Total Conductors	Protocol	Impedance	Delimiter	Protocol Options	Delimiter	TLP Level TX/RX
Character Position	1&2	3&4	5	6	7 to 9, left justified	8 or 9 or 10	last two positions
Code Type	Numeric	Alpha	Alpha	. or /	Alpha-Numeric	. or /	Alpha-Numeric

The following table provides the NC and NCI codes that apply to the services covered in this document.

Table 17.3 Network Channel/Network Channel Interface Code Format.

Service	NC	NCI At CLEC	SEC NCI at End User	Related TR73600 Section(s)
UVL−2W/SL1 (Loop Start)	TY−−	N/A	N/A	4.1, 5.1, 6
UVL−2W/SL2 (Loop Start)	LY−−	02QC3.OOD	02LS2	4.2, 5.2, 6
UVL−4W (Loop Start)	LY−−	04QC2.OOD	04LS2	4.2, 5.2, 6
UVL−2W/SL2 (Grnd Start)	LY−−	02QC3.OOB	02GS2	4.2, 5.3, 6
UVL−4W (Ground Start)	LY−−	04QC2.OOB	04GS2	4.2, 5.3, 6
UVL−2W (Rev Batt)	LY−−	02QC3.RVO	02RV2.T	4.2, 5.4, 6
UDL−4W/D0 (2.4 Kbs)	LY−−	04QC5.OOJ	04DU5.24	7.2
UDL−4W/D0 (4.8 Kbs)	LY−−	04QC5.OOK	04DU5.48	7.2
UDL−4W/D0 (9.6 Kbs)	LY−−	04QC5.OOL	04DU5.96	7.2
UDL−4W/D0 (19.2Kbs)	LY−−	04QC5.OOM	04DU5.19	7.2
UDL−4W/D0 (56 Kbs)	LY−−	04QC5.OOP	04DU5.56	7.2
UDL−4W/D0 (64 Kbs)	LY−−	04QC5.OOQ	04DU5.64	7.2
UDL−2W/I (BR ISDN)	LY−−	02QC5.OOS	02IS5	7.3
UDL−2W/UDC	LXT−	02QC5.OOS	02IS5	7.4
UDL−2W HDSL	LXC−	02QB9.00H	02DU9.00H	7.5
UDL−4W HDSL	LXC−	04QB9.00H	04DU9.00H	7.5
UDL−2W ADSL	LXR−	02QB9.00A	02DU9.00A	7.6
UCL/S−2W	LX−N	02QC3.OOF	02NO2	8
UCL/S−4W	LX−N	04QC3.OOF	04NO2	8
UCL/L−2W	LX−−	02QC3.OOF	02NO2	8
UCL/L−4W	LX−−	04QC3.OOF	04NO2	8
UCL−ND	LXT−	N/A	N/A	9
UDL−4W/DS1/ISDN	HC−− (AMI−SF) HCD− (AMIESF) HCZ− (B8ZS−SF) HCE− (B8ZS−ESF)	04QB9.11	04DU9.BN (AMI−SF) 04DU9.1KN (AMI−ESF) 04DU9.DN (B8ZS−SF) 04DU9.1SN (B8ZS−ESF)	7.7
UCL−2W	LY−−	02QC3.OOF	02NO2	8
USL−2W	TX−−	N/A	N/A	10
USL−4W	TX−−	N/A	N/A	10
UNTW−2W	TX−−	N/A	N/A	11
Unbundled Loop Concentration (ULC)/ Unbundled Sub−Loop Concentration (USLC)	HCKA (TR008 Non−Con AMI/SF) HCKB (TR008 Non−Con B8ZS/SF) HCKC (TR008 Non−Con B8ZS/ESF) HCKD (TR008 Concent. AMI/SF) HCKE (TR008 Concent. B8ZS/SF) HCKF (TR008 Concent. B8ZS/ESF) HCLA (TR303 B8ZS/ESF)	04QB9.11	N/A	13, 14
ULC/USLC Test Ckt	LY−−	04QB9.11	02DC2	13, 14

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