

Qwest Corporation Technical Publication

Dark Fiber TRRO

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1. Introduction

1.1 General

This document provides a description of Qwest's Unbundled Dark Fiber. Included are fiber technical parameters and related design responsibilities. It furnishes sufficient technical detail to allow a customer to make decisions about choosing to use Unbundled Dark Fiber to incorporate into an end-to-end communications channel. It is not the intent of this document to provide specific ordering information, but to describe the technical features of this offering.

1.2 Reason for Reissue

Issued to reflect UDF product changes as provided upon implementation of the TRRO

1.3 Related Publications

This document contains references to other Qwest Technical Publications. These documents may be obtained from sources listed in Chapter 6.

One primary publication is PUB 77386, *Interconnection and Collocation for Transport and Switched Unbundled Network Elements and Finished Services*. This document describes the fiber entrance facilities and the InterConnection Distribution Frame (ICDF) used by Collocated Interconnectors.

1.4 Document Organization

This document is organized as follows:

<u>Chapter</u>	<u>Contents</u>
1	Introduction — General information about the document
2	Description of Dark Fiber offering including descriptions of cables, fiber distribution panels and related information
3	Network Channel and Network Channel Interface Codes, Descriptions of interfaces
4	Responsibilities; Qwest and customer
5	Glossary
6	Reference Section

1.5 Terminology

Customers who purchase various unbundled elements from Qwest are described by several terms including *Competitive Local Exchange Carriers (CLEC)*. This publication uses this term.

1.6 Tariffs, Catalogs and Contracts

Further information about Unbundled Dark Fiber may be found in tariffs, catalogs, contracts or regulatory orders. Such jurisdiction or customer-specific descriptions supersede information in this publication.

Some contracts and state regulatory orders may require that Qwest place the jumpers on the ICDF. The jumpers will be placed when the CLEC orders the InterConnect Tie Pairs. The text in this technical publication may not always reflect this situation.

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2. Description

2.1 General Description

Unbundled Dark Fiber (UDF) is a deployed, strand(s) or unlit pair of fiber optic cable that connects two points within Qwest's network. UDF is a single transmission path between two Qwest Wire Centers, or . UDF provides a pair(s) of optical fibers (i.e., two fibers) on which no electronic terminating equipment is provided by Qwest. UDF is able as single optical fiber strands. UDF is available to Competitive Local Exchange Carriers (CLECs) registered with the appropriate state utility commission or equivalent. UDF has 2 distinct forms:

- 1) **UDF Interoffice Facility (UDF-IOF)** which constitutes a deployed route between two Qwest Wire Centers.
- 2) **UDF MTE Sub-Loop** which is a fractional portion of an existing Loop. UDF MTE Sub-loop is available at or near an MTE to provide access to MTE premises fiber.

CLEC must have established Collocation or other technically feasible means of network demarcation at both terminating points of the UDF-IOF No Collocation is required in intermediate central offices within a UDF or at central offices where CLEC's UDFs are cross connected. CLEC has no access to UDF at those intermediate central offices. Collocation may be Physical, Virtual or InterConnection Distribution Frame (ICDF) Collocation as described in PUB 77386.

The fibers are terminated at a Fiber Distribution Panel (FDP) or a functional equivalent in the wire centers or customer locations and, if required, cross-connected to tie cables going to the Network Interface (NI) if the NI is a different FDP. The FDP in the wire center that serves as the NI may be called the Fiber ICDF of PUB 77386 or a previously installed FDP. PUB 77386 provides additional information.

The CLEC must have previously ordered terminations on the Fiber ICDF. The Fiber ICDF (or Dedicated Fiber ICDF) will function as the optical or fiber NI between the CLEC and Qwest in the Qwest wire center.

The interoffice fibers, along with fiber tie cables (if any) within the wire center, make up UDF - Interoffice. UDF - Interoffice extends between Fiber ICDFs in two different Qwest wire centers.

UDF MTE Sub-Loop is a fractional portion of an existing Loop. Access to UDF MTE Sub-loop is made available at or near an MTE to provide access to MTE premises fiber.

The customer will provide all optical and electronic equipment required to make the fiber(s) usable. This may include terminating equipment, protection switching equipment, multiplexers, alarm and performance monitoring equipment and other similar equipment. Qwest may provide existing regenerators or optical amplifiers as described in Section 2.2. Customer provided optical equipment will be the light source for testing optical continuity with Qwest provided light detecting equipment.

Further information about UDF and Fiber ICDFs may be found in the Qwest Technical Publication 77386 and in the appropriate tariff, catalog or contract.

Qwest will provide jumpers for any FDP located in the wire center. The CLEC will provide jumpers for the Fiber ICDF unless otherwise specified.

2.2 Regenerators and Optical Amplifiers

Some longer fiber spans may have regenerators or optical amplifiers already installed. When necessary, the CLEC shall be responsible for obtaining and connecting electronic equipment, whether light generating or light terminating equipment. The CLEC is responsible to use compatible equipment to work with existing Qwest optical amplifiers and regenerators. Qwest will not remove, and CLEC shall be permitted to use, regenerating equipment that already exists. Qwest will not place new regenerators or optical amplifiers.

2.3 Fiber Characteristics

2.3.1 General

Typical fiber cables placed by Qwest starting in about 1984, contain single mode fibers and meet the optical requirements described in GR-20-CORE, *Generic Requirements for Optical Fiber and Fiber Optic Cable*. Cables can operate at both the 1310 nm and 1550 nm wavelength bands.

Total loss from Fiber ICDF to Fiber ICDF, splice or FDP is a function of the cable and splice losses. Additional losses must be accounted for to include the loss of the jumpers used on the FDP, Fiber ICDF, splices and connectors. CLEC design must also include any losses added by their cable and equipment to the loss of UDF.

2.3.2 Fiber Parameters

Fiber cables were purchased with the expectation that they conform to the optical parameters and optical requirements of Telcordia's GR-20-CORE, *Generic Requirements for Optical Fiber and Fiber Optic Cable*. The condition of a particular fiber may have changed over time. Qwest considers a fiber as good when there is optical continuity.

2.3.3 Fiber Jumpers and Connectors

Qwest will provide single mode fiber jumpers in lengths of between three and ten meters (3 and 10 m) for use on any FDP in the wire center. The type of connectors will be selected by Qwest to match the type used in the FDP.

Qwest's current standard connector type is the "FC" type of Physical Connector (PC), i.e., FC-PC. Some FDPs in some sites use other types of connectors, e.g., Biconic, D4, etc. The Fiber ICDF uses FC-PC connectors.

The CLEC must provide the appropriate type of jumper for the fiber ICDF.

2.4 Fiber Distribution Panel Arrangements in Wire Centers

All UDFs available are terminated in the wire center at a Fiber FDP or a functional equivalent. The size and type may vary depending on the wire center.

A Fiber Splicing Facility is also found in wire centers within fifty sheath feet of the Outside Plant sheath penetrations. This limitation is to conform to current National Exchange Carrier Association limits intended to decrease fire fuel load in the wire centers. This facility may be a stand-alone bay(s) or enclosure or may be a shelf in the FDP.

All cabling must conform to National Electric Code® articles 770-50 and 770-51.

The FDP usage may vary depending on the location and application.

See PUB 77386 for further information about collocation and interconnection at fiber interfaces.

More details of the optical Network Interface may be found in Chapter 3.

Figure 2-1 illustrates a typical arrangement where the Interconnector is collocated in the Wire Center. The dark fibers may be cross-connected to the Interconnector Designated Equipment (IDE) fiber terminals, etc. inside the Interconnector Space.

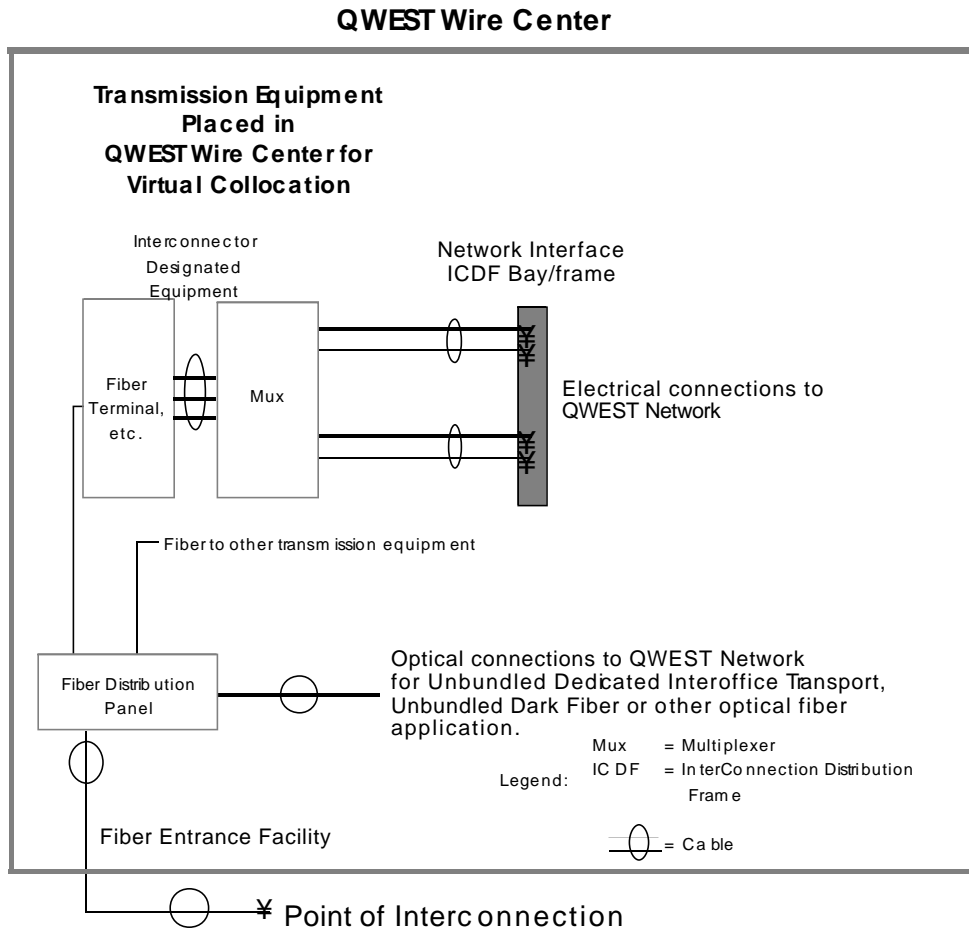


Figure 2-1 Dark Fiber Arrangement -- Collocation in Wire Center

2.5 Fiber ICDF and Tie Cable Arrangements

The fiber ICDF and the tie cable arrangements are described in PUB 77386. These terminations must be ordered prior to ordering any UDF. Tie cables may be required if the fiber cable is terminated on an FDP that is not the Fiber ICDF.

2.6 Arrangements at a MTE Customer Location

Customers located in multiple tenant buildings will use an arrangement as illustrated in Figure 2-6. Customers will have access only to their own FDP. The customer's FDP, and the jumpers to connect it to Qwest's FDP, may be provided either by the customer or by Qwest as described by the appropriate tariff, catalog or contract. Qwest will specify the type of connector for their FDP.

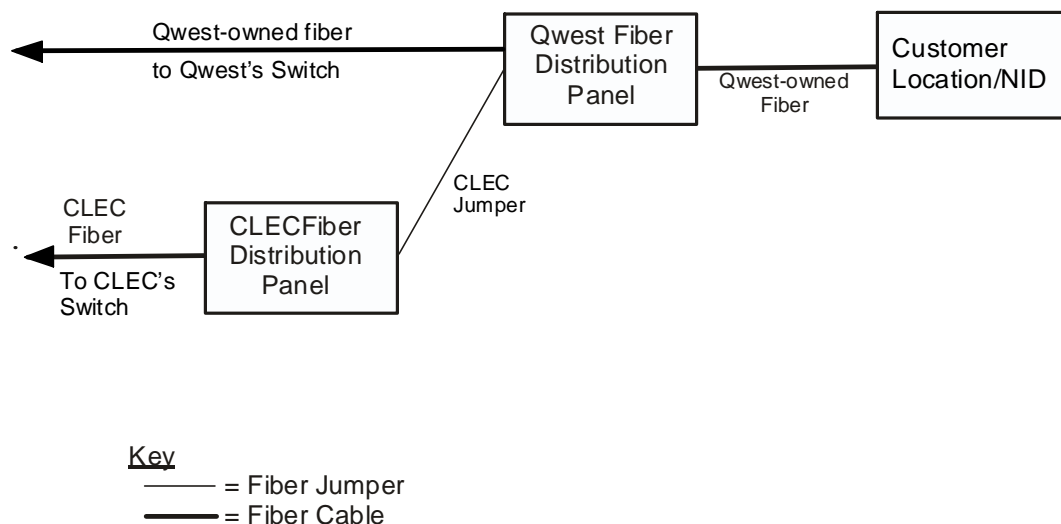


Figure 2-2 Typical Multiple Tenant Building

The CLEC would provide a Fiber Distribution Panel (FDP). Qwest will supply the jumper and connect one end to the Qwest FDP. Jumpers will be ten meters in length and as characterized in Section 2.3.3.

The CLEC-placed cable may be used to serve customers either inside or outside the customer premises. The CLEC must arrange with the building owner to enter the premises and place all cables and equipment.

2.7 Initial Tests

Qwest will test for continuity of the dark fiber.

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3. Network Channel/Network Channel Interface Codes

3.1 Network Channel (NC) Codes

3.1.1 General

Network Channel (NC) codes are a part of the Telcordia COMMON LANGUAGE® code set. The NC code is used to identify a channel used with the service. This section identifies the available channels and their NC codes.

3.1.2 Format

An NC code is a four-character code with two data elements:

- Channel Code
- Optional Feature Code

The format is illustrated in Figure 3-1.

Network Channel Code				
Data Element	Channel Code		Optional Feature Code	
Character Position	1	2	3	4
Character Key	X	X	X or -	X or -

- X = Alphanumeric
- = Hyphen

Figure 3-1 Format Structure for NC Codes

The **Channel Code** (character positions 1 and 2) is a two character alpha or alphanumeric code that describes the channel service in an abbreviated form. The channel code will frequently, but not always, be specified as the service code of the special service circuits or the transmission grade of the message trunk circuit. The NC channel code field is always filled.

The **Optional Feature Code** (character positions 3 and 4) is a two-character alpha or alphanumeric or hyphen code that represents the option codes available for each channel code. Varying combinations of this code will allow the customer to enhance the technical performance of the requested channel, or to further identify the type of service. It is also used to specify options such as conditioning, effective 4-wire, multiplexing, etc. The NC optional code field is always filled.

Further information about NC Codes may be found in ANSI T1.223-1997, *Information Interchange — Structure and Representation of Network Channel (NC) and Network Channel Interface (NCI) Codes for the North American Telecommunications System*.

3.1.3 Available Network Channel Codes

Table 3-1 lists the available NC codes for Unbundled Dark Fiber.

Table 3-1 Available Network Channel Codes — Unbundled Dark Fiber

Network Channel Code	Description
LX--	Dedicated Facility (Without Equipment)

3.2 Network Channel Interface (NCI) Codes

3.2.1 General

Network Channel Interface (NCI) codes are a part of the COMMON LANGUAGE® code set. The NCI code is used to identify a network interface of a service in our mechanized systems. This chapter defines the NCI codes used with voice grade services.

3.2.2 Format

An NCI code is a maximum twelve-character code that consists of five (5) data elements:

- Total Conductors
- Protocol
- Impedance
- Protocol Options
- Transmission Level Point(s) (TLP)

The first three fields are required; the last two are optional. The format is illustrated in Figure 3-2. In this particular application, the first four fields will be required.

Network Channel Interface Code

Total Conductors		Protocol		I m p e d a n c e	D e l i m e t e r	Protocol Options			D e l i m i t e r	TLP Level	
										T r a n s m i t	R e c e i v e
1	2	3	4	5	6	7	8	9	10	11	12
N	N	A	A	X	•	X	X	X	•	X or -	X or -

- A = Alpha
- N = Numeric
- X = Alphanumeric
- = Delimiter (normally a period)
- = Hyphen

Figure 3-2 Format Structure for NCI Codes

Total Conductors (character positions 1 and 2) is a two-character numeric code that represents the total number of physical conductors (e.g., wires or fibers) required at the interface.

Protocol (character position 3 and 4) is a two-character alpha code that defines requirements for the interface regarding signaling/transmission.

Impedance (character position 5) is a one-character alpha or numeric code representing the nominal reference impedance that will terminate the channel for the purpose of evaluating transmission performance. Valid values for Dark Fiber are listed in Table 3-2

Table 3-2 NCI Impedance Values

Impedance in Ohms (Character Position 5)			
Data Value	Code	Data Value	Code
Fiber	F		

Protocol Options (character positions 7, 8, and 9) is a one to three-character alpha, numeric, or alphanumeric code that describes additional features (e.g., bit rate or bandwidth) on the Protocol to be used. It is an optional field that is always left justified when less than three characters are specified.

Transmission Level Point(s) (character positions 8 through 12) are not used in this application.

Further information about NCI Codes may be found in ANSI T1.223-1997, *Information Interchange — Structure and Representation of Network Channel (NC) and Network Channel Interface (NCI) Codes for the North American Telecommunications System*.

3.2.3 Available Network Channel Interface Codes

Table 3-3 defines the NCI codes available for Dark Fiber. The valid NCI codes are listed in Section 3.3.

Table 3-3 Available NCI Codes

Protocol		Definition
Code 3 4	Option 7 8 9	
FC	X	Fiber Optic Interface Dark Fiber
QB	LLX	Central Office Manual Cross-Connect Termination With No Subrating Capability Fiber Cross-Connect or Fiber Distribution Bay or Panel — Dark Fiber
QE	X	Field Location Manual Cross-Connect Termination With No Subrating Capability Dark Fiber

3.3 Valid Network Channel/Network Channel Interface Combinations

Table 3-4 describes valid combinations of NC and NCI codes for Dark Fiber. NCI codes on the same line are compatible. Customers shall stipulate an NC and two NCI codes in specifying each requested UDF.

Table 3-4 Dark Fiber Compatible NC/NCI Codes

NC / NCI Combinations			
NC = LX-- Dedicated Facility (No Equipment)			
Qwest Central Office Building	Terminating CO Building (3)	Mid-Span NI	End-User NI
CO A NI	CO Z NI		
Interoffice			
Single Fiber Strand			
01QBF.LLX	01QBF.LLX		
Fiber Pair			
02QBF.LLX	02QBF.LLX		
MTE Sub-Loop			
Single Fiber Strand			
01QBF.LLX		01FCF.X (Splice)	
		01FCF.X (Splice)	01QEF.X
Fiber Pair			
02QBF.LLX		02FCF.X (Splice)	
		02FCF.X (Splice)	02QEF.X

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4. Responsibilities

4.1 Design Responsibilities

The Competitive Local Exchange Carrier (CLEC) is responsible for all equipment and cable on the CLEC side of the Fiber InterConnection Distribution Frame (ICDF).

At End-User premises, the CLEC and the End-User must decide their respective responsibilities on their side of the NI.

Qwest is responsible for all equipment and cable between the Qwest Central Office Fiber ICDFs.

4.1.1 Qwest Responsibilities

Qwest is responsible for all equipment and cable on the Qwest side of the NI at the customer locations and for maintaining the transmission facility between NIs.

Qwest will provide technical parameters of the selected fibers to the CLEC based on Qwest's records so that the CLEC can design their optical span. This information includes the fiber tie cables (if any) in the wire centers.

Qwest will provide light-detecting equipment to verify optic continuity with a customer provided light source.

4.1.2 Customer Responsibilities

The CLEC and/or End-User are responsible for obtaining and providing equipment compatible with Unbundled Dark Fiber. The CLEC is responsible for end-to-end design of any such systems.

The CLEC must order fiber tie pairs and/or terminations between the Fiber ICDF and the wire center FDP as illustrated in Figure 2-1 and as described in PUB 77386.

CLEC's meeting Qwest on a customer premises must arrange with the property owner for any required access.

Customer will provide light-generating equipment to verify optic continuity with Qwest provided detecting equipment.

4.2 Maintenance Responsibilities

Joint testing between the CLEC and Qwest may occasionally be necessary to isolate trouble. Such testing would be done as specified in the appropriate tariff, catalog or contract.

4.2.1 Qwest Responsibilities

Qwest will furnish the CLEC a trouble reporting telephone number.

Upon receipt of a trouble report, Qwest will initiate actions as specified in the Service Interval Guide to clear the trouble.

Qwest cannot monitor Unbundled Dark Fiber. Such monitoring is normally done using the electronic equipment connected to the fiber that, in this application, is provided by the CLEC. However, in the case of a major cable failure affecting the entire cable, Qwest would normally detect problems on their fibers.

Fiber restoration will be non-discriminatory.

4.2.2 Customer Responsibilities

The CLEC or their responsible agent must sectionalize trouble conditions and verify that the trouble is not in CLEC-owned equipment or cabling before calling the applicable Qwest Repair Center. The CLEC must provide Qwest with this information before Qwest will dispatch to repair.

If the trouble is isolated to End-User owned equipment or cable, the CLEC or End-User is responsible for clearing the trouble and restoring the service to normal based on their joint agreement.

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5. Definitions

5.1 Acronyms

ANSI	America National Standards Institute
CEV	Controlled Environmental Vault
CLEC	Competitive Local Exchange Carrier
CO	Central Office
CPE	Customer Premises Equipment
dB	Decibel
FDP	Fiber Distribution Panel
ICDF	InterConnection Distribution Frame
ITP	InterConnect Tie Pairs
MUX	Multiplexer
NC	Network Channel
NCI	Network Channel Interface
NI	Network Interface
RT	Remote Terminal

5.2 Glossary

American National Standards Institute (ANSI)

An organization supported by the telecommunications industry to establish performance and interface standards.

Carrier

An organization whose function is to provide telecommunications services. Examples are: Local Exchange Carriers, Interexchange Carriers, Cellular Carriers, etc.

Channel

An electrical or photonic, in the case of fiber optic based transmission systems, communications path between two or more points of termination.

Competitive Local Exchange Carrier (CLEC)

A Local Exchange Carrier certified to do business in a state.

Central Office (CO)

A local switching system (or a portion thereof) and its associated equipment located at a wire center. It is also commonly used to refer to the building that houses the equipment. See Wire Center.

Customer Interface

The interface with a customer at a point of termination.

Decibel (dB)

A unit measurement of transmission loss, gain, or relative level. It is the logarithmic unit of signal power ratio most commonly used in telephony. It is used to express the relationship between two signal powers, usually between two acoustical, electrical, or optical signals; it is equal to ten times the common logarithm of the ratio of the two signal powers.

Digital Loop Carrier (DLC)

A digital transport facility used to carry circuits or channels on part of the loop between the serving wire center and the customer's location. Copper or fiber is normally used as the transport medium.

End-User (EU)

The term "End-User" denotes any customer of telecommunications service that is not a carrier, except that a carrier shall be deemed to be an "End-User" to the extent that such carrier uses a telecommunications service for administrative purposes without making such service available to others, directly or indirectly. The term is frequently used to denote the difference between a Carrier interface and an interface subject to unique regulatory requirements at non-Carrier customer premises (FCC Part 68, etc.)

Exchange

A unit established by Qwest for the administration of communications service in a specified geographic area that usually embraces a city, town, or village and its environs.

Facilities

Facilities are the transmission paths between the demarcation points serving customer locations, a demarcation point serving a customer location and a Qwest Central Office, or two Qwest offices.

InterConnection Distribution Frame (ICDF)

The cross-connect frame that serves as the Network Interface in the Qwest Wire Center between the Certified Local Exchange Carrier and Qwest for Unbundled

Network Elements. ICDF frames are configured for DS0/voice, DS1, DS3 or optical interfaces.

Loop

The facility which connects the Local Wire Center to the customer's location.

Multiplexer (Mux)

An equipment unit to multiplex, or do multiplexing: Multiplexing is a technique of modulating (analog) or interleaving (digital) multiple, relatively narrow bandwidth channels into a single channel having a wider bandwidth (analog) or higher bit-rate (digital). The term Multiplexer implies the demultiplexing function is present to reverse the process so it is not usually stated.

Network Channel (NC) Code

The Network Channel (NC) code is an encoded representation used to identify both switched and non-switched channel services. Included in this code set are customer options associated with individual channel services, or feature groups and other switched services.

Network Channel Interface (NCI) Code

The Network Channel Interface (NCI) code is an encoded representation used to identify five (5) interface elements located at a Point of Termination (POT) at a central office or at the Network Interface at a customer location. The Interface code elements are: Total Conductors, Protocol, Impedances, Protocol Options, and Transmission Level Points (TLP). (At a digital interface, the TLP element of the NCI code is not used.)

Network Interface (NI)

The point of demarcation on the customer's premises at which Qwest's responsibility for the provision of service ends.

Premises

Denotes a building or portion(s) of a building occupied by a single customer or End-User either as a place of business or residence.

Wire Center

A building in which one or more central offices, used for the provision of local exchange services, are located. Sometimes, the building is also referred to as the Central Office or CO.

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6. References

6.1 American National Standards Institute Documents

ANSI T1.223-1997 *Information Interchange — Structure and Representation of Network Channel (NC) and Network Channel Interface (NCI) Codes for the North American Telecommunications System.*

6.2 Telcordia Documents

GR-20-CORE *Generic Requirements for Optical Fiber and Fiber Optic Cable. Issue 2, July 1998.*

ISI-SR-STS 000307 *Telcordia, NC/NCI Code Dictionary Industry Support Interface. Published each year.*

6.3 Qwest Technical Publications

Pub 77386 *Interconnection and Collocation for Transport and Switched Unbundled Network Elements and Finished Services. Issue I, August, 2003.*

Service Interval Updated twice yearly. Available through the Interconnect
Services Guide Center

6.4 National Electric Code®

Articles 770-50 and 770-51.

6.5 Ordering Information

All documents are subject to change and their citation in this document reflects the most current information available at the time of printing. Readers should check status and availability of all documents.

Qwest documents from: <http://www.qwest.com/techpub/>

American National Standards Institute (ANSI) documents from:

American National Standards Institute
Attn: Customer Service
11 West 42nd Street
New York, NY 10036
Phone: (212) 642-4900
Fax: (212) 302-1286
Web: web.ansi.org/public/search.asp

ANSI has a catalog available that describes their publications.

Telcordia documents from:

Telcordia Customer Relations
8 Corporate Place, PYA 3A-184
Piscataway, NJ 08854-4156
Fax: (732) 699-2559
Phone: (800) 521-CORE (2673) (U.S. and Canada)
Phone: (908) 699-5800 (Others)
Web: www.telcordia.com

National Electrical Code® information may be ordered from:

National Fire Protection Association
1 Battery March Park
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