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1. Introduction

1.1 General

This document describes Qwest Self-Healing Alternate Route Protection Service offered by Qwest Corporation. It covers distinguishing service features, technical specifications, and defines valid interfaces.

The purpose of this document is to describe Qwest Self-Healing Alternate Route Protection Service appropriate for the majority of applications. Sufficient technical detail is furnished to allow a customer, such as an Interexchange Carrier (IC) or End-User (EU), to select a service that may be incorporated 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 service offering.

1.2 Reason For Reissue

- Change the Qwest default optical connector from FC to SC
- Add an LC connector option for customer premises locations

1.3 End-User and Carrier Customer Premises - Mandated DS1 Differences

Both End-Users and Carriers may purchase 1.544 Mbit/s (DS1) channels with a number of optional enhancements.

Federal Regulations mandate certain technical differences between interfaces provided at End-User premises and at Carrier premises, and these differences are explained in Qwest Technical Publication 77375, 1.544 Mbit/s Channel Interfaces, Issue G, June 2008. The differences have no qualitative affect on the service being provided.

When a Carrier orders services, not for resale but for their own internal use, the appropriate End-User interface(s) should be ordered.

1.4 Special Information about the End-user DSX-1 Interface

Qwest has developed a new interface to meet DS1 customer needs at end-user customer premises where the customer location is served by fiber facilities with associated multiplexer. This new interface eliminates the requirement for a customer provided Channel Service Unit. If copper facilities are the only access into your building, fiber facilities must be requested; however, Special Construction Charges will be assessed before the fiber construction can begin.

In order to determine whether this interface is an alternative for your location, please contact your Qwest Marketing Representative or call the Qwest Business Office. For further technical description please refer to Qwest Technical Publication 77375.
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</table>
2. Description of Service

2.1 Applicability of Technical Specifications

The technical specifications presented in this document are applicable to Qwest Self-Healing Alternate Route Protection (SHARP) Service only. It does not attempt to describe the various types of transmission equipment used to provide this service.

2.2 Description of Service

Self-Healing Alternate Route Protection (SHARP) is an optional service that improves the reliability of DS1 or DS3 services that are transported over fiber optic facilities. This feature provides a separate facility path for the protection system between the Serving Wire Center (SWC) and the Qwest Point of Termination (POT) located in the same building as the customer designated premises.

This added protection is provided by ensuring that backup electronics and two physically separate facility paths are used in the provisioning of the service. One primary (or working) service path is established between the SWC and the customer designated premises. In addition, a protect path is provisioned between the customer designated premises and the SWC via a Qwest designated Alternate Wire Center (AWC) where available.

All SHARP Plus options as described in this document that were previously available have been grandfathered and are limited to existing SHARP Plus contract customers. SHARP Interoffice Facility Protection, SHARP Plus, extends the local loop protection provided by the basic SHARP option to include protection of Transport Channel (interoffice) facilities between SWCs. This option, coupled with the SHARP option on each end of the circuit, will provide end-to-end service protection for DS1 and DS3 services.

SHARP PLUS Interoffice Facility Protection Only will provide an alternate path, in addition to a primary DS3 private line, on an "Interoffice Only" basis. SHARP PLUS Interoffice Facility Protection Only is available on DS3 services only. The primary and the alternate paths will be provided on fiber optic facilities and will require a minimum separation (25 feet) between the primary and alternate paths of transmission.

Transport Alternate Path Protection is also available on DS3 services only. Transport Alternate Path Protection will provide an alternate path for the DS3 circuit, in addition to the primary DS3 fiber optic private line, on an interoffice basis only. The alternate path will be provided on microwave radio facilities.
2.3 Service Configurations

The Qwest Self-Healing Alternate Route Protection Service may utilize both interoffice and local loop facilities. It will interface at an electrical DS3 or DS1 level. An optical interface will also be offered on fiber optic systems dedicated to single customers. In the event that an optical interface is selected, the standard service interval offered for this service may not apply due to the incompatibility between the customer’s equipment and equipment pre-provisioned by Qwest at the SWC.

When DS3 or DS1 Service is normally provided over fiber optic facilities, the working and protection systems are in the same cable as shown in Figure 2-1.

Customers electing SHARP will have their DS3 or DS1 Service routed to a protection system that takes a completely separate route back to the SWC. This configuration provides protection for the local loop or channel termination and is shown in Figure 2-2.

Equipment located on the customer’s premises will have a single cable entrance unless the building owner elects to provide two physically separated cable entrances to the building.

SHARP Interoffice Facility Protection will consist of SHARP protection for the local loop portion of the circuit, SWC protection and protection of the Transport Channel Facilities used to connect each SWC. This option may be ordered to provide end-to-end circuit protection (SHARP Plus) as shown in Figure 2-3 and is no longer available. Partial, or one-end facilities protection, terminating in a Qwest Serving Wire Center may also be ordered and is shown in Figure 2-4. This option is no longer available.

SHARP Interoffice Facility Protection Only will consist of SHARP protection for the DS3 Transport Channel Facilities used to connect each SWC. This option is shown in Figure 2-5 and is no longer available.

Transport Alternate Path Protection will consist of SHARP protection for the DS3 Transport Channel Facilities used to connect each Wire Center (WC) with the protection channel provided on radio facilities. This option is shown in Figure 2-6.
Figure 2-1  Standard DS3 Service Configuration
Figure 2-2 Self-Healing Alternate Route Protection (SHARP)
Figure 2-3  End-To-End Circuit Protection (SHARP PLUS)
LEGEND

AWC  = ALTERNATE WIRE CENTER
DSX  = DIGITAL SIGNAL CROSS-CONNECT
INE  = INTELLIGENT NETWORK ELEMENT
NI   = NETWORK INTERFACE
P    = PROTECTION TERMINAL
SWC  = SERVING WIRE CENTER
W    = WORKING TERMINAL

= FIBER FACILITIES

Figure 2-4  Partial/One-End Only Facilities Protection (SHARP PLUS)
**Figure 2-5** SHARP PLUS Interoffice Facility Protection Only
ALTERNATE ROUTE

PRIMARY ROUTE

CUSTOMER PREM #1

CUSTOMER PREM #2

NI

AWC = ALTERNATE WIRE CENTER
INE = INTELLIGENT NETWORK ELEMENT
NI = NETWORK INTERFACE
P = PROTECTION TERMINAL
WC = WIRE CENTER
W = WORKING TERMINAL

= FIBER FACILITIES

= MICROWAVE RADIO FACILITIES

Figure 2-6 Transport Alternate Path Protection
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3. Network Interfaces (NIs)

3.1 Description of Interface

The allowable interface for Qwest Self-Healing Alternate Route Protection Service will be at the electrical DS3 level or DS1 level. An optical interface at the system level will also be available for customers with Synchronous Service Transport (SST).

Qwest Tech Pub 77368, CUSTOMER PREMISES ENVIRONMENTAL SPECIFICATIONS AND INSTALLATION GUIDE, describes the environmental and installation requirements as well as the powering and grounding options for Qwest telecommunications equipment placed on customer premises.

Qwest Tech Pub 77419, SPECIFICATIONS FOR THE PLACEMENT OF QWEST EQUIPMENT IN CUSTOMER-OWNED OUTDOOR CABINETS, describes the environmental (including electromagnetic compatibility), power, and grounding requirements for customer-owned outdoor cabinets (if provided) in order to allow the placement of Qwest-owned equipment inside these cabinets for the provisioning of SHARP to the customer.

3.1.1 DS3 Interface

DS3 channels are provided to Carriers and to End-Users (EUs) premises.

The NI to a Carrier customer will be at the end of a DSX-3 jumper with signal characteristics described in Qwest Technical Publication 77324, issue F. The NI to an EU customer will be SJA44 connectors with signal characteristics described in Qwest Technical Publication 77324, issue F.

Permissible frame formats for Carriers and EUs are described in ANSI T1.107-2002 "Telecommunication - Digital Hierarchy - Format Specifications." and ANSI T1.404-2002 (see Reference Section) for the DS3 rate.

3.1.2 DS1 Interface

DS1 channels are provided to Carriers and to End-Users (EUs) premises.

The Network Interface (NI) at a Carrier premises will be at the end of a DSX-1 jumper wire or cable with signal characteristics described in Qwest Technical Publication 77375. Qwest Technical Publication 77375, issue F, provides additional information pertaining to the DS1 NI configuration.

The NI at an EU customer premises may be either a Conventional Interface or a DSX-1 interface. Signal characteristics, limitations, and the physical means of connection at the NI for each interface are described in Qwest Technical Publication 77375, issue F, which should be studied before a selection is made. The Conventional Interface uses one of the Registration Jacks described by the three Universal Service Ordering Codes (USOC) RJ48C, RJ48M and RJ48H. The selection of one of these jacks is a customer option or that of their Vendor.
Permissible frame formats for Carriers and EUs are described in ANSI T1.107-2002 "Telecommunication - Digital Hierarchy - Format Specifications" and in ANSI T1.403-1999 (see Reference Section) for the DS1 rate.

### 3.1.3 Optical Interface

The NI for this option will be at a Qwest-provided Fiber Distribution Panel (FDP) at the customer's location. The fiber optic cable shall be equipped to terminate SC, FC or LC UPC duplex connectors. SC/UPC (with Ultra Physical Contact polish) is the Qwest default connector for new SHARP optical interfaces whereas FC and LC are customer-specified options, where available at premises locations only. The customer will provide the fiber optic patch cords to connect their equipment to the NI. The customer's equipment will be cross-connected at the Qwest provided FDP as shown in Figure 3-1.

Qwest will use Synchronous Optical Network (SONET) compliant equipment to provision this service. When ordered in conjunction with SST optical meets, consultation between Qwest Transmission Engineers and the Customer's Transmission Engineer will be required to ensure compatible equipment at both ends of the system. The transmission standard employed will be the SONET as defined in the ANSI T1.105.2001 which defines the North American version of the Synchronous Digital Hierarchy (SDH). This interface is also in accordance with ANSI T1.106-1988, the American National Standard for Optical Interface Specifications. This technology allows Qwest to transport, provision and deliver the DS1 and DS3 interfaces over SONET transport.
Figure 3-1 Electrical/Optical Network Interface

3.2 NCI Code Form and Components

The full NCI code format has fields not used for digital services. Only those fields relevant to digital interfaces are discussed here.

An NCI code has the form 04DS6.44. The period between the numbers is a delimiter, which is used for improved clarity. It causes the Protocol Option Code, discussed later, to stand out. An NCI code has no dashes (-).

Digital NCI Codes have four components. Table 3-1 provides an example of an electrical DS3 interface NCI code. For complete information on DS1, refer to Technical Publication 77375, 1.544 Mbit/s (DS1) Channels. For complete DS3 information, refer to Technical Publication 77324, Technical Specifications for 44.736 Mbit/s (DS3) Electrical, Optical and Radio Interfaces.
The following example, 04DS6.44, is the DS3 M23 multiplex application without C-Bit Parity.

Table 3-1 Electrical DS3 NCI Code Example

<table>
<thead>
<tr>
<th>DS3 Electrical Interface:</th>
</tr>
</thead>
<tbody>
<tr>
<td>04 = 4 Conductors - Number of wires at the interface. For DS3, the code is always 04 denoting a 4-wire interface.</td>
</tr>
<tr>
<td>DS = Digital Hierarchy Interface - Protocol Code. This code is always DS for electrical DS3 interfaces.</td>
</tr>
<tr>
<td>6 = 75 Ohm Impedance - Impedance. For DS3 interfaces, the code is always 6 denoting 75 Ohms. The period following the 6 is a delimiter for clarity.</td>
</tr>
<tr>
<td>44 = 44.736 Mbit/s (DS3) Format per ANSI T1.102-1987 - Protocol Option Code. This code is a variable. 44 denotes the DS3 rate of 44.736 Mbit/s, and it denotes the application. A suffix may denote an application option or Capacity.</td>
</tr>
</tbody>
</table>

The compatible DS3 Network Channel Interface (NCI) codes for Qwest Self-Healing Alternate Route Protection Service are listed in Table 3-2. This is a partial list consisting of what is viewed as the interface most likely to be used with this service. Refer to Qwest Technical Publication 77324 - DS3 Electrical Interface for additional information as well as Technical Publication 77346, Qwest Synchronous Service Transport (SST) for SONET optical interface NCI codes.
Table 3-2 DS3 Compatible Network Channel Interface (NCI) Code Combinations

<table>
<thead>
<tr>
<th>Electrical Interface</th>
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<tbody>
<tr>
<td>NCI</td>
</tr>
<tr>
<td>04DS6.44</td>
</tr>
</tbody>
</table>

The compatible DS1 NCI codes for Qwest Self-Healing Alternate Route Protection Service are listed in Table 3-2. This is a partial list consisting of what is viewed as the interfaces most likely to be used with this service. Refer to Qwest Technical Publication 77200 for additional information on the DS1 interface.

(Partial List - See Publication 77200, Qwest DS1 Service, for complete DS1 Electrical Interface Information)

Table 3-3 DS1 Compatible Network Channel Interface (NCI) Code Combinations

<table>
<thead>
<tr>
<th>Carrier To Carrier</th>
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<tbody>
<tr>
<td>NCI</td>
</tr>
<tr>
<td>04DS9.15</td>
</tr>
<tr>
<td>04DS9.15K</td>
</tr>
<tr>
<td>04DS9.15S</td>
</tr>
<tr>
<td>04DS9.15Z</td>
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</tbody>
</table>

** Provides Clear Channel Capability

Table 3-3 continues to next page
### Table 3-3  DS1 Compatible Network Channel Interface (NCI) Code Combinations

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<thead>
<tr>
<th>NCI</th>
<th>SECNCI</th>
<th>Description</th>
</tr>
</thead>
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<tr>
<td>04DS9.15</td>
<td>04DU9.B</td>
<td>DS1 Access (End-User Premises) Interface, SF/AMI, with Line Power</td>
</tr>
<tr>
<td></td>
<td>04DU9.BN</td>
<td>DS1 Access (End-User Premises) Interface, SF/AMI, without Line Power</td>
</tr>
<tr>
<td></td>
<td>04DU9.BX</td>
<td>DS1 Access (End-User Premises) Interface; SF/AMI/DSX-1 Interface</td>
</tr>
<tr>
<td>04DS9.15K</td>
<td>04DU9.C</td>
<td>DS1 Access (End-User Premises) Interface, non-ANSI ESF/AMI, with Line Power</td>
</tr>
<tr>
<td></td>
<td>04DU9.CN</td>
<td>DS1 Access (End-User Premises) Interface, non-ANSI ESF/AMI, without Line Power</td>
</tr>
<tr>
<td></td>
<td>04DU9.CX</td>
<td>DS1 Access (End-User Premises) Interface; non-ANSI ESF/AMI/DSX-1 Interface</td>
</tr>
<tr>
<td>04DS9.15S</td>
<td>04DU9.S</td>
<td>DS1 Access (End-User Premises) Interface, B8ZS/Non-ANSI ESF, with Line Power**</td>
</tr>
<tr>
<td></td>
<td>04DU9.SN</td>
<td>DS1 Access (End-User Premises) Interface, B8ZS/Non-ANSI ESF, without Line Power**</td>
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<tr>
<td></td>
<td>04DU9.SX</td>
<td>DS1 Access (End-User Premises) Interface, B8ZS/Non-ANSI ESF/DSX-1 Interface**</td>
</tr>
<tr>
<td>04DS9.15Z</td>
<td>04DU9.Z</td>
<td>DS1 Access (End-User Premises) Interface, ZBTSI/ESF, with Line Power**</td>
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<tr>
<td></td>
<td>04DU9.ZN</td>
<td>DS1 Access (End-User Premises) Interface, ZBTSI/ESF, without Line Power**</td>
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<tr>
<td></td>
<td>04DU9.ZX</td>
<td>DS1 Access (End-User Premises) Interface, ZBTSI/ESF/DSX-1 Interface**</td>
</tr>
</tbody>
</table>

** Provides Clear Channel Capability

Table 3-3 continues to next page
## Table 3-3  DS1 Compatible Network Channel Interface (NCI) Code Combinations

<table>
<thead>
<tr>
<th>NCI</th>
<th>SECNCI</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>04DU9.BN</td>
<td>04DU9.BN</td>
<td>DS1 Access (End-User Premises) Interface, SF/AMI, without Line Power</td>
</tr>
<tr>
<td>04DU9.BX</td>
<td>04DU9.BX</td>
<td>DS1 Access (End-User Premises) Interface; SF/AMI/DSX-1 Interface</td>
</tr>
<tr>
<td>04DU9.C</td>
<td>04DU9.C</td>
<td>DS1 Access (End-User Premises) Interface, non-ANSI ESF/AMI, with Line Power</td>
</tr>
<tr>
<td>04DU9.CN</td>
<td>04DU9.CN</td>
<td>DS1 Access (End-User Premises) Interface, non-ANSI ESF/AMI, without Line Power</td>
</tr>
<tr>
<td>04DU9.CX</td>
<td>04DU9.CX</td>
<td>DS1 Access (End-User Premises) Interface; non-ANSI ESF/AMI/DSX-1 Interface</td>
</tr>
<tr>
<td>04DU9.S</td>
<td>04DU9.S</td>
<td>DS1 Access (End-User Premises) Interface, B8ZS/Non-ANSI ESF, with Line Power**</td>
</tr>
<tr>
<td>04DU9.SN</td>
<td>04DU9.SN</td>
<td>DS1 Access (End-User Premises) Interface, ANSI ESF/B8ZS without Line Power</td>
</tr>
<tr>
<td>04DU9.SX</td>
<td>04DU9.SX</td>
<td>DS1 Access (End-User Premises) Interface, ANSI ESF/B8ZS/DSX-1 Interface</td>
</tr>
<tr>
<td>04DU9.ZN</td>
<td>04DU9.ZN</td>
<td>DS1 Access (End-User Premises) Interface; non-ANSI ESF/ZBTSI/AMI without Line Power**</td>
</tr>
<tr>
<td>04DU9.ZX</td>
<td>04DU9.ZX</td>
<td>DS1 Access (End-User Premises) Interface; non-ANSI ESF/ZBTSI/AMI 1/DSX-1 Interface**</td>
</tr>
</tbody>
</table>

** Provides Clear Channel Capability
Definitions of NCI Code Components

02 = 2 Conductors
04 = 4 Conductors
DS = Digital Hierarchy Interface
DU = Digital Access Interface
FC = Fiber Optic Interface
F = Fiber
6 = 75 Ohm Impedance
9 = 100 Ohm Impedance
15 = 1.544 Mbit/s (DS1) Superframe (SF) Format per Technical Reference
   TR-INS-000342 *
44 = 44.736 Mbit/s (DS3) Format per ANSI T1.102-1993

3.3 NC Code Function and Format

Primarily, service considerations are encoded into Network Channel (NC) codes. The 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. The NC code is specified by the customer to advise Qwest of the required service connection of the channel.

An NC code consists of four alpha/numeric characters, which may include a dash (-). There are neither spaces nor delimiters between the characters.

- For electrical channel DS1 interfaces, the first two characters are HC. For additional information, see Technical Publication 77200.
- For electrical channel DS3 interfaces, the first two characters are HF. For additional information, see Technical Publication 77324.

The third and fourth characters are variable to denote additional protocols and service features as described in the following sections.

The NC codes for the service desired must be specified by the customer when ordering High Capacity Digital Special Access services. This section describes the NC codes which apply specifically to SHARP.

3.4 SPEC Code Function and Format

Service and Product Enhancement Codes (SPEC) will be used in conjunction with NC and NCI codes to order Transport Alternate Protection Path service. The SPEC code will be used to indicate a mixed technology situation. SPEC codes will be used to identify product features and options other than those identifiable by the NC and NCI codes. Figure 3-2 depicts the basic SPEC Format.
Figure 3-2 SPEC Code Format

- The format of the SPEC consists of five, six, or seven alpha and/or numeric characters. To eliminate confusion, the letter 'O' is used, but the number '0' is not. The number '1' is used, but the letter 'l' is not.

- The first through third characters (positions 1-3) identify the base product. The fourth through seventh characters (positions 4-7) identify the features, options and/or rating elements of the base product.

- Character positions 1-5 are always populated. When positions 6 and/or 7 are not used, these positions should be left blank.

- The following SPEC code shall be used with the ordering of Transport Alternate Path Protection in conjunction with the applicable NC Code:

  SRAMRG
The compatible DS1 Network Channel (NC) codes for Qwest Self-Healing Alternate Route Protections Service are listed in Table 3-4

**HC-1 SERVICES**

**Table 3-4 DS1 Compatible Network Channel (NC) Codes**

<table>
<thead>
<tr>
<th>NC CODE</th>
<th>OPTION BR 795-403-100</th>
<th>OPTION Qwest</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCHA</td>
<td>Self-Healing and Disaster Recovery-Loop Protection--One End Only</td>
<td>Self-Healing Protection (One End Only)</td>
</tr>
<tr>
<td>HCHE</td>
<td>Self-Healing and Disaster Recovery-Loop and Facility Protection with DS1-DS0/Subrate Mux (e.g. D4 Format)</td>
<td>DS1-DS0 or Subrate Multiplexing and Self-Healing Protection and Disaster Recovery (SHARP) (One End Only)</td>
</tr>
<tr>
<td>HCHC</td>
<td>Self-Healing and Disaster Recovery-Route Protection--DS1-DS0/Subrate Mux (e.g. D4 Format)</td>
<td>DS1-Voice to Digital Data Multiplexing and Self-Healing Protection and Disaster Recovery (SHARP) (One End Only)</td>
</tr>
<tr>
<td>HCHS</td>
<td>Self-Healing and Disaster Recovery-Loop and Facilities Protection (i.e. SWC Protection) with DS1 Voice Mux</td>
<td>DS1-Voice Multiplexing and Self-Healing Protection and Disaster Recovery (SHARP) (One End Only), Including Interoffice Protection</td>
</tr>
<tr>
<td>HCHD</td>
<td>Self-Healing and Disaster Recovery-Loop (One End) and Facilities Protection (i.e. SWC Protection)</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) (One End Only) Including Interoffice Protection</td>
</tr>
<tr>
<td>HCHI</td>
<td>Self-Healing and Disaster Recovery-Loop Facilities Protection, i.e. SWC Protection with DS1-DS0 Mux (e.g. T1DM e/w Secondary Channel)</td>
<td>DS1-DS0 or Subrate Multiplexing and Self-Healing Protection and Disaster Recovery (SHARP) (One End Only), Including Interoffice Protection</td>
</tr>
<tr>
<td>HCH-</td>
<td>Self-Healing and Disaster Recovery-Loop Protection Both Ends of Circuit (w/o Switch Protection)</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) (Both Ends)</td>
</tr>
<tr>
<td>HCHK</td>
<td>Self-Healing and Disaster Recovery-Loop and Facilities Protection, i.e. SWC Protection</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) (Both Ends), Including Interoffice Protection</td>
</tr>
<tr>
<td>HCHL</td>
<td>Self-Healing and Disaster Recovery-Loop Protection Thru Connect Circuit (i.e. CO DSX-1 Term)</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) (One End Only) and CO Cross-connect at the DS1 Rate</td>
</tr>
<tr>
<td>HCHN</td>
<td>Self-Healing and Disaster Recovery-Loop and Facilities Protection (i.e. SWC Protection) for Thru Connect Circuit (i.e. DSX-1 term.)</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) (One End Only) and CO Cross-connect at the DS1 Rate Including Interoffice Protection</td>
</tr>
</tbody>
</table>
The compatible DS3 NC codes for Qwest Self-Healing Alternate Route Protections Service are listed in Table 3.5.

Table 3-5 DS3 Compatible Network Channel (NC) Codes HC-3 Services

<table>
<thead>
<tr>
<th>NC CODE</th>
<th>OPTION BR 795-403-100</th>
<th>OPTION Qwest</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFHA</td>
<td>Self-Healing Disaster Recovery--Loop Protection--One End Only</td>
<td>Self-Healing Protection and Disaster Recover (SHARP) (One End Only)</td>
</tr>
<tr>
<td>HFHB</td>
<td>Self-Healing Disaster Recovery--Loop Protection and B8ZS Compatible CO Mux</td>
<td>B8ZS Compatible CO Multiplexing and Self-Healing Protection and Disaster Recovery (SHARP) (One End Only)</td>
</tr>
<tr>
<td>HFHM</td>
<td>Self-Healing Disaster Recovery--Loop Protection and CO Mux</td>
<td>Central Office Multiplexing and Self-Healing Protection and Disaster Recovery (SHARP) (One End Only)</td>
</tr>
<tr>
<td>HFH-</td>
<td>Self-Healing Disaster Recovery--Loop and Facility Protection, i.e. SWC Protection</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) (One End Only), Including Interoffice Protection</td>
</tr>
<tr>
<td>HFHI</td>
<td>Self-Healing Disaster Recovery--Loop and Facility Protection (i.e. SWC Protection) with B8ZS Compatible CO Mux</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) (One End Only), Including Interoffice Protection, CO Multiplexing and B8ZS Compatible</td>
</tr>
<tr>
<td>HFHJ</td>
<td>Self-Healing Disaster Recovery--Loop and Facility Protection (i.e. SWC Protection) with CO Mux</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) (One End Only), Including Interoffice Protection and CO Multiplexing</td>
</tr>
<tr>
<td>HFHL</td>
<td>Self-Healing Disaster Recovery--Facility Protection (w/o Loop Protection) Thru Connect Circuit (i.e. CO DSX-3 Term) and Auto Hub Protection</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) (One End Only) and CO Cross-connect at the DS3 Rate</td>
</tr>
<tr>
<td>HFHC</td>
<td>Self-Healing Disaster Recovery--Loop and Facilities Protection (i.e. SWC Protection) for Thru Connect Circuit (i.e. DSX-1)</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) (One End Only) and CO Cross-connect at the DS3 Rate Including Interoffice Protection</td>
</tr>
<tr>
<td>HFHD</td>
<td>Self-Healing Disaster Recovery--Loop Protection Both Ends of Circuit w/o SWC Protection</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) (Both Ends)</td>
</tr>
<tr>
<td>HFHE</td>
<td>Self-Healing Disaster Recovery--Loop (Both Ends) and Facilities Protection (i.e. SWC)</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) (Both Ends), Including Interoffice Protection</td>
</tr>
</tbody>
</table>

Table 3-5 continues on the following page
Table 3-5  DS3 Compatible Network Channel (NC) Codes
HC-3 Services  (continued)

<table>
<thead>
<tr>
<th>NC CODE</th>
<th>OPTION BR 795-403-100</th>
<th>OPTION Qwest</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFHK</td>
<td>Self-Healing Disaster Recovery--CO to CO Mux Both Ends</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) Interoffice Protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Only, Central Office Multiplexing Both Ends</td>
</tr>
<tr>
<td>HFHN</td>
<td>Self-Healing Disaster Recovery--CO to CO Mux Both Ends and</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) Interoffice Protection</td>
</tr>
<tr>
<td></td>
<td>B8ZS Compatible</td>
<td>Only, Central Office Multiplexing and B8ZS Compatible Both Ends</td>
</tr>
<tr>
<td>HFHT</td>
<td>Self-Healing Disaster Recovery--Facility Protection</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) Interoffice Protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Only</td>
</tr>
<tr>
<td>HFHV</td>
<td>Self-Healing Disaster Recovery--Facility Protection and B8ZS</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) Interoffice Protection</td>
</tr>
<tr>
<td></td>
<td>Compatible</td>
<td>Only, B8ZS Compatible</td>
</tr>
<tr>
<td>HFHW</td>
<td>Self-Healing Disaster Recovery--B8ZS Compatible CO Mux</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) Interoffice Protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Only, Central Office Multiplexing and B8ZS Compatible One End</td>
</tr>
<tr>
<td>HFHX</td>
<td>Self-Healing Disaster Recovery--Cross Connect</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) Interoffice Protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Only, Central Office Cross Connect</td>
</tr>
<tr>
<td>HFHY</td>
<td>Self-Healing Disaster Recovery--W + X--B8ZS Compatible and</td>
<td>Self-Healing Protection and Disaster Recovery (SHARP) Interoffice Protection</td>
</tr>
<tr>
<td></td>
<td>Cross Connect</td>
<td>Only, Central Office Multiplexing and B8ZS Compatible One End and Central Office Cross Connect</td>
</tr>
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<td>4.5 Protection Switching</td>
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</tbody>
</table>
4. **Performance Specifications**

4.1 **Error Performance Parameters**

The parameters for which performance is specified are as follows:

- **Bit Error Rate (BER)** - The BER is the ratio of the number of bits in error to the total number of bits transmitted during a measurement period.

- **Errored Seconds** - An Errored Second is any one second interval containing at least one error.

- **Burst Errored Seconds** - A Burst Errored Second is any Errored Second containing at least 100 errors.

4.2 **Error Performance Requirements**

The requirements given in this section are for all one-way system options and apply at the maximum short-haul design length of 250 miles. For shorter systems, the numerical values are to be reduced in direct proportion to route mileage. A measurement period consists of a series of one-second intervals.

The BER at the DS1 and DS3 interface levels will be $< 1 \times 10^{-9}$ excluding all Burst Errored Seconds in the measurement period. During a Burst Errored Second, neither the number of bit errors nor the number of bits is counted. This requirement applies in a normal operating environment, and should be met by every channel in each protection switching section.

The frequency of Burst Errored Seconds, other than those caused by protection switching induced by hard equipment failures, should average no more than 4 per day at the interface levels of DS1 and DS3. This requirement applies in a normal operating environment, and should be met by every channel in each protection switching section.

For systems interfacing at the DS3 level, the long-term percentage of Errored Seconds should not exceed 1.0%. This is equivalent to 99.0% Error Free Seconds (EFS). This requirement applies in a normal operating environment, and it is also an acceptance criterion. It equates to no more than 72 Errored Seconds during a two-hour one-way (loopback) test.

For systems interfacing at the DS1 level, the long-term percentage of Errored Seconds should not exceed 0.14%. This is equivalent to 99.86% EFS. This requirement applies in a normal operating environment, and it is also an acceptance criterion. It equates to no more than 10 Errored Seconds during a two-hour one-way (loopback) test.

Loopback acceptance tests should be made using the one-way limits because one direction is likely to be controlling. If these fail, then appropriate one-way tests should be made.
4.3 Service Availability

The availability requirement for Qwest Self-Healing Alternate Route Protection Service (SHARP and SHARP Plus) is 99.99 percent. Unavailability is defined as any one second interval with a line BER worse than $1 \times 10^{-3}$. The corresponding outage equates to 52 minutes per year.

The availability requirement of 99.99% only applies to the portion of a circuit protected by Qwest Self-Healing Alternate Route Protection Service. The standard availability requirement will apply for any portion of the circuit transported over non-SHARP circuits.

4.4 Jitter Performance

4.4.1 Definition Of Timing Jitter

Timing jitter is defined as the short term variations of the significant instances of a digital signal from their ideal positions in time, where short term implies phase oscillations of frequency greater than or equal to 10 Hertz.

4.4.2 Network Interface Timing Jitter Specifications

The limits given in Telcordia GR-499-CORE, "Transport Systems Generic Requirements (TSGR): Common Requirements (A Module of TSGR, FR-NWT-000440)" represent the maximum permissible levels of output jitter for Carrier-to-Carrier Network Interfaces. The Carrier-to-End User Network Interface jitter requirements are addressed in ANSI T1.404-2002. The purpose of these limits is to limit broadband jitter appearing anywhere in the Qwest Corporation Network.

4.5 Protection Switching

Automatic protection switching is used to improve the availability and reliability performance of Qwest Self-Healing Alternate Route Protection Service by substituting standby equipment or alternate channels when failure occurs.

The protection switch will operate and switch the Qwest DS3 or DS1 channel to the protection system when the BER on the transport system reaches $1 \times 10^{-6}$ and operates at that BER for 10 consecutive seconds.

Once a decision is made to switch to a protection system, the additional time required to complete the switch will not exceed 50 milliseconds.
## Chapter 5: Maintenance

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<td>5.2 Qwest Responsibilities</td>
<td>5-1</td>
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5. Maintenance

5.1 Customer Responsibilities
The customer is responsible for all equipment and cable on the customer side of the NI at their location.

The customers or their responsible agent must sectionalize the trouble and verify that the trouble is not in the customer owned equipment or cable before calling the Qwest Customer Service Center (CSC).

If the trouble is isolated to the customer owned equipment or cable, the customer is responsible for clearing the trouble and restoring the service to normal.

Joint testing between the customer location and a Qwest may sometimes be necessary to isolate the trouble.

5.2 Qwest Responsibilities
Qwest is responsible for all equipment and cable on the Qwest side of the NI at the customer’s location.

Qwest is responsible for maintaining the transmission facility between customer locations and between the Central Office Hub and the customer location.

Qwest will furnish the customer a trouble reporting telephone number.

Upon receipt of a trouble report, Qwest Corporation will initiate action within twenty minutes to clear the trouble.

Qwest is committed to 30 minute restoral in the event of a service interruption on Self-Healing Alternate Route Protection (SHARP) Services with the following two exceptions:

• Two (2) hours maximum restoral time in the event that the working or protection path fails as a result of an electronics failure.

• Eight (8) hours maximum restoral time if the path failure is a result of a cable failure.
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6. Definitions

6.1 Acronyms

<table>
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<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>AWC</td>
<td>Alternate Wire Center</td>
</tr>
<tr>
<td>B8ZS</td>
<td>Bipolar with 8 Zero Substitution</td>
</tr>
</tbody>
</table>
| BER     | 1) Basic Encoding Rules for ASN.1  
          2) Bit Errored Ratio  
          3) Bit Error Rate |
| CPE     | Customer Provided Equipment |
| CO      | Central Office |
| CSC     | Customer Service Center |
| EU      | End User |
| FC      | Fiber Connector |
| FDP     | Fiber Distribution Panel |
| IEC     | Interexchange Carrier (or IC)  
          Interexchange Common Carrier |
| INE     | Intelligent Network Element or Equipment |
| ITU-T   | International Telecommunication Union - Telecommunication Standardization Sector |
| LC      | Lucent or Local Connector |
| LEC     | Local Exchange Carrier |
| NC      | Network Channel |
| NCI     | Network Channel Interface |
| NI      | Network Interface |
| POP     | Point Of Presence |
| POT     | Point Of Termination |
| SC      | Subscriber Connector |
| SHARP   | Self-Healing Alternate Route Protection |
| SHNS    | Self-Healing Network Services |
| SHS     | Self-Healing Services |
| SONET   | Synchronous Optical Network |
SOT  SONET Optical Terminal
SWC  Serving Wire Center
TIA/EIA  Telecommunications Industry Association/Electronic Industries Alliance
µm  Micron
UPC  Ultra Physical Contact

6.2 Glossary

Alternate Mark Inversion (AMI)
A one (mark) pulse which is the opposite polarity as its predecessor.

American National Standard Institute (ANSI)
An organization supported by the telecommunications industry to establish performance and interface standards.

Automatic Protection Switch (APS)
A device which monitors a channel and automatically switches the channel to another facility whenever the channel fails or when specified parameters go beyond a specified threshold.

Availability
The relative amount of time that a service is "usable" by a customer, represented as a percentage over a consecutive 12 month period.

Bipolar With 8 Zero Substitution (B8ZS)
Bipolar 8 Zero Substitution is an application of BPRZ and is an exception to the Alternate Mark Inversion (AMI) line-code rule. It is one method of providing bit independence for digital transmission by providing a minimum 1s density of 1 in 8 bits.

Bit (Binary Digit)
A binary unit of information. It is represented by one of two possible conditions, such as the value 0 or 1, on or off, high potential or low potential, conducting or not conducting, magnetized or demagnetized. A Bit is the smallest unit of information, by definition.

Bits/second (bit/s)
Bits per second, e.g., 1200 bps. In data transmission, it is the number of binary zero and one bits transmitted in 1 second. Modern terminology uses "bit/s" e.g., 1200 bit/s.
**Bit Error Rate (BER)**
The ratio of the number of bit errors to the total number of bits transmitted in a given time interval.

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

**Central Office (CO)**
A local switching system (or a portion thereof) and its associated equipment located at a wire center.

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

**Channelize**
The process of multiplexing-demultiplexing channels using analog or digital techniques.

**Clear Channel Capability (CCC)**
A characteristic of a transmission path in which the bit positions allocated for customer data may represent any combination of zeroes and ones.

**Customers**
Denotes any individual, partnership or corporation who subscribes to the services provided by Qwest customers are divided into two distinct and separate categories: (1) carriers, who provide interexchange services for hire for others, and (2) end-users, who request services only for their own use.

**Customer Installation (CI)**
Equipment and wiring at the customer's location on the customer side of the Network Interface.

**Customer Interface**
The interface with a customer at a point of termination.
**Customer 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. Adjacent buildings and the buildings on the same continuous property occupied by the customer and not separated by a public thoroughfare, are also considered the customer's premises.

**Customer Premises Equipment (CPE)**

All telecommunication equipment located at a customers location.

**Customer Provided Equipment (CPE)**

Equipment owned and maintained by the customer and located on their side of the End-User Point of Termination (EU-POT) network interface. In the Qwest Digital Data Service application, CPE typically includes the DSU (CSU/DSU) and data terminal equipment which are connected to the channel.

**Demarcation Point**

See Network Interface

**Demultiplexing**

The opposite of multiplexing. That is, the multiplexer combines signals and the demultiplexer takes them apart again. Also see Multiplexing.

**Digital Transmission Facilities**

May include both loop and interoffice facilities which perform multiplexing, demultiplexing, and transport of digital signals between the SS Exchange Termination and the Subscriber Access Termination.

**DS1 Clear Channel**

Denotes that 1.535 Mbit/s of a 1.544 Mbit/s DS1 facility are available for customer information. The remaining 8 kilobits, or overhead, are for error correction, framing, and network performance/status/information.

**End Office**

A designation of a Qwest switching system that occupies the lowest level of the public switched network hierarchy. It is the designation of a switching system that connects lines to lines, and lines to trunks (a local switching system).
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.)

Error Free Second (EFS)

A one-second interval which does not contain any bit-errors. Usually expressed as a percent over a consecutive 24-hour period.

Errored Second (ES)

A one second interval with one or more bit errors.

Note - A period of no signal shall be considered a period of errored bits.

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.

Expected Measured Loss (EML)

The calculated value of loss at a given reference frequency that one would expect to measure between two specified test points with the proper terminating impedance.

Extended Superframe (ESF) Format

An Extended Superframe consists of twenty-four consecutive DS1 frames. Bit one of each frame (the F-bit) is time shared during the 24 frames to describe a 6 bit frame pattern, a 6 bit Cyclic Redundancy Check (CRC) remainder, and a 12 bit data link. The transfer rate of each is 2 kbit/s, 2 kbit/s, and 4 kbit/s respectively.

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.

Fiber Optic Terminal (FOT)

The terminating or originating portion of a fiber optic system that performs both an electrical to optical conversion and a multiplexing function.
**Intelligent Network Element (INE)**
A software programmable network component.

**Interexchange Carrier (IC)/(IEC) or Interexchange Common Carrier**
Any individual, partnership, association, joint-stock company, trust, governmental entity or corporation engaged for hire in interstate or foreign communication by wire or radio, between two LATAs.

**Interface Code**
See Network Channel Interface

**Isochronous Transmission**
A transmission process in which there is always an integral number of unit intervals between any two significant instants. The transmission is characterized by a constant pulse rate, a constant time interval, or multiples thereof between voltage or electromagnetic field intensity transitions, and a gating by a controlled clock.

**Jitter**
Random timing distortions of a digital signal, whereby the appearance of a pulse differs from where the pulse should occur relative to time.

**Kilobit/Second (kbit/s)**
One thousand (1000) bits/second

**Line**
The transport facility (cable pair or carrier channel) between the Central Office and Network Channel Interface.

**Local Exchange Carrier (LEC)**
The regulated entity providing Access and Intra-LATA services.

**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.

Optical Carrier (OC)
Optical carrier, the nomenclature for the line rate of the optical transmission signal described in this document.

Optical Interface (OI)
The OI is the transmit point wherein light waves move away from the interface toward an optical receiver.

Phase Jitter
Intermittent, random displacements in time of digital bits, from their ideal placement in time.

Point of Presence (POP)
A physical location within a LATA at which an Interexchange Carrier (IC) establishes itself for the purpose of obtaining LATA access and to which Qwest provides access service.

Point of Termination (POT)
The physical telecommunications interface that establishes the technical interface, the test point(s), and the point(s) of operational responsibility. (See Network Interface).
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.

Protocol
The rules for communication system operation which must be followed if communication is to be effected; the complete interaction of all possible series of messages across an interface. Protocols may govern portions of a network, types of service, or administrative procedures.

Protocol Code
The Protocol (character positions 3 and 4 or the Network Channel Interface [NCI] Code) is a two-character alpha code that defines requirements for the interface regarding signaling and transmission.

Serving Wire Center
The term "Serving Wire Center" denotes a Qwest Central Office from which dial tone for the local Exchange Service would normally be provided to the demarcation point on the property at which the customer is served.

Severely Errored Second (SES)
A one second interval having a Bit Error Ratio of $10^{-3}$ or worse

SONET
Synchronous Optical Network (SONET): A standard providing electrical and optical specifications for the physical and higher layers, the first stage of which is at 51.84 Mbit/s, the Optical Channel 1 (OC1) level. Other rates, defined as OCn where n=3 through a number not yet firm, are possible.

SONET Optical Terminal (SOT)
A terminal which uses SONET multiplexing to interleave the lower rate payloads, thereby creating a high rate synchronous signal.

Superframe Format (SF)
A superframe consists of 12 consecutive DS1 frames. Bit one of each frame (the F-bit) is used to describe a 12-bit framing pattern during the 12 frames.

Synchronous Optical Network (SONET)
A standard providing electrical and optical specifications for the physical and higher layers, the first stage of which is at 51.84 Mbit/s, the Optical Channel 1 (OC-1) level. Other rates, defined as OC-n where n=3 through a number not yet firm, are possible.
Synchronous Test Line
An arrangement in a central office that performs marginal operational tests of supervisory and ring-tripping functions.

Synchronous Transmission
A transmission process such that between any two significant instants in the overall bit-stream there is always an integral number of unit intervals.

Transmission Path
Denotes a path capable of transporting signals within the range of the service offering. A transmission path is comprised of physical or derived facilities consisting of any form or configuration of plant typically used in the telecommunications industry.

Transmission Service Channel
A one-way transmission path between two designated points.

Trunk
A communications path connecting two switching systems in a network, used in the establishment of an end-to-end connection.

Wire Center
A building in which one or more central offices, used for the provision of local exchange services, are located.

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7. References

7.1 American National Standards Institute Documents

ANSI T1.102-1993 (R1999)  Digital Hierarchy – Electrical Interfaces

ANSI T1.105-2001  Synchronous Optical Network (SONET) - Basic Description including Multiplex Structure, Rates, and Formats


ANSI T1.223-2004  Structure and Representation of Network Channel (NC) and Network Channel Interface (NCI) Codes for information exchanges

ANSI T1.403-1999  Network and Customer Installation Interfaces – DS1 Electrical Interface

ANSI T1.403b-2002 (R2005)  Supplement to T1.403-1999


ANSI/TIA-492AAAA-B-2009  Detail Specification for 62.5-μm Core Diameter/125-μm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers


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7.2 Telcordia Documents

GR-20-CORE  Generic Requirements for Optical Fiber and Fiber Optical Cable

GR-342-CORE  High-Capacity Digital Special Access Service-Transmission Parameter Limits and Interface Combinations

GR-499-CORE  Transport Systems Generic Requirements (TSGR): Common Requirements
7.3 International Telecommunication Union - Telecommunication Standardization Sector (ITU-T) Recommendations

G.652 Characteristics of a single-mode optical fibre and cable

7.4 Qwest Technical Publications

PUB 77200 Qwest DS1 Service and Qwest DS1 Rate Synchronization Service, Network Channel and Network Channel Interface Code Combinations, Issue F, September 2001

PUB 77324 Qwest DS-3 Service, Issue F, January 2005

PUB 77346 Qwest Synchronous Service Transport(SST), Issue T, January 2011

PUB 77368 CUSTOMER PREMISES ENVIRONMENTAL SPECIFICATIONS AND INSTALLATION GUIDE, Issue F, July 2009

PUB 77375 Qwest 1.544 Mbit/s Channel Interfaces, Issue G, June 2008

PUB 77386 Interconnection and Collocation for Transport and Switched Unbundled Network Elements and Finished Services, Issue M, October 2007

PUB 77419 SPECIFICATIONS FOR THE PLACEMENT OF QWEST EQUIPMENT IN CUSTOMER-OWNED OUTDOOR CABINETS, Issue A, June 2010

7.5 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 are advised to check status and availability of all documents.

Those who are not Qwest employees may obtain;

- 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: http://www.ansi.org/

  ANSI has a catalog available which describes their publications.
• Telcordia documents from:
  Telcordia Customer Relations
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  Fax:  (732) 699-2559
  Phone:  (800) 521-CORE (2673) (U.S. and Canada)
  Phone:  (908) 699-5800 (Others)
  Web:  http://www.telcordia.com

• ITU-T Recommendations from:
  International Telecommunications Union
  General Secretariat
  Place des Nations, CH-1211
  Geneva 20, Switzerland
  Web:  http://www.itu.int/home/

• Qwest Technical Publications from:
  http://www.qwest.com/techpub/

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