

# **Qwest Communications International Inc. Technical Publication**

## **Qwest DS3 Service**

- **Technical Specifications For DS3 Electrical Network Channel Interfaces**
- **Network Channel and Network Channel Interface Codes Describing Interfaces at Customer Premises and at Qwest Central Offices, including Radio Interfaces**
- **Central Office Multiplexer Options**

## NOTICE

The purpose of this document is to describe Qwest DS3 service. Sufficient technical detail is furnished to enable a customer to select options and channel interfaces suitable for their application needs. This document describes the technical features of the offering. It's not the intent of this document to provide ordering information beyond specific, available Network Channel and Network Channel Interface Codes.

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## **1. Introduction**

### **1.1 Purpose**

This document describes Qwest DS3 Service, its technical interface specifications, Network Channel (NC) and Network Channel Interface (NCI) code combinations. This Technical Publication provides sufficient technical details for a customer to select a service for incorporation into an end-to-end communications channel.

### **1.2 Scope**

This document provides the electrical DS3 interface specifications, and their NC and NCI code combinations. Also, it provides code combinations permitting DS3 service to be ordered using higher bit rate channels with Central Office (CO) multiplexing down to the DS3 rate. The latter includes Radio Network Interfaces. The document describes:

- Required characteristics of DS3 signals at the interface with customers at End-User (EU) and Carrier premises.
- NCI codes used to describe the signal characteristics of the interfaces.
- NC codes used to order DS3 service.

### **1.3 Reason for Reissue**

- Add DS3 Network Interface Unit (NIU) Carrier Remote Loopback Capability.

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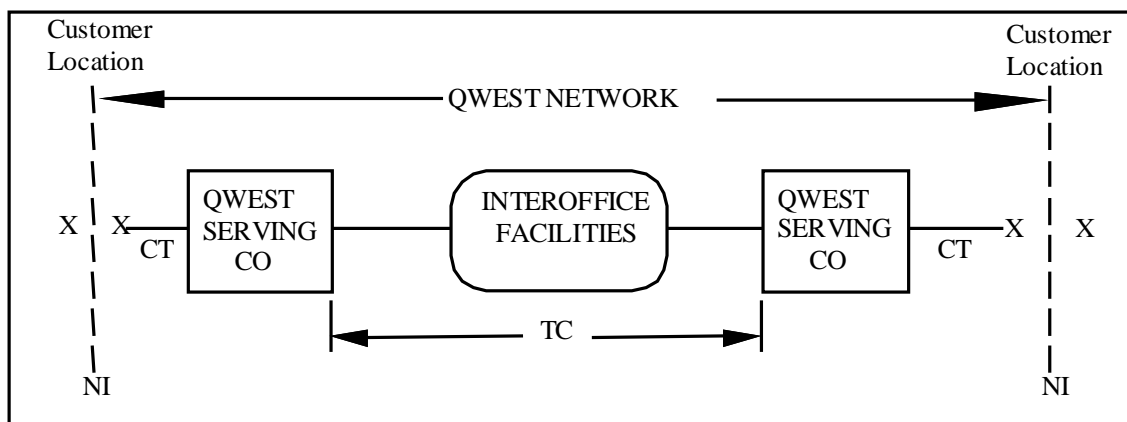
## 2. Description of Service

Qwest DS3 service consist of a high capacity channel for the transmission of 44.736 Mbit/s isochronous serial data having a line code of Bipolar Three Zero Substitution (B3ZS). Qwest DS3 service is offered to Carrier and End-User (EU) customers in the following configurations and multiplexing arrangements:

- Customer Premises-to-Customer Premises DS3 Channel
- Customer Premises-to-Qwest Central Office (CO) Hub DS3 Channel
- Qwest CO Hub-to-Qwest CO Hub DS3 Channel
- Qwest CO DS3 Multiplexing to DS1

### 2.1 DS3 Channel Elements

DS3 Channel Elements may consist of one or more of the elements shown in Figure 2-1 below:



**Figure 2-1:** DS3 Channel Elements

Where:

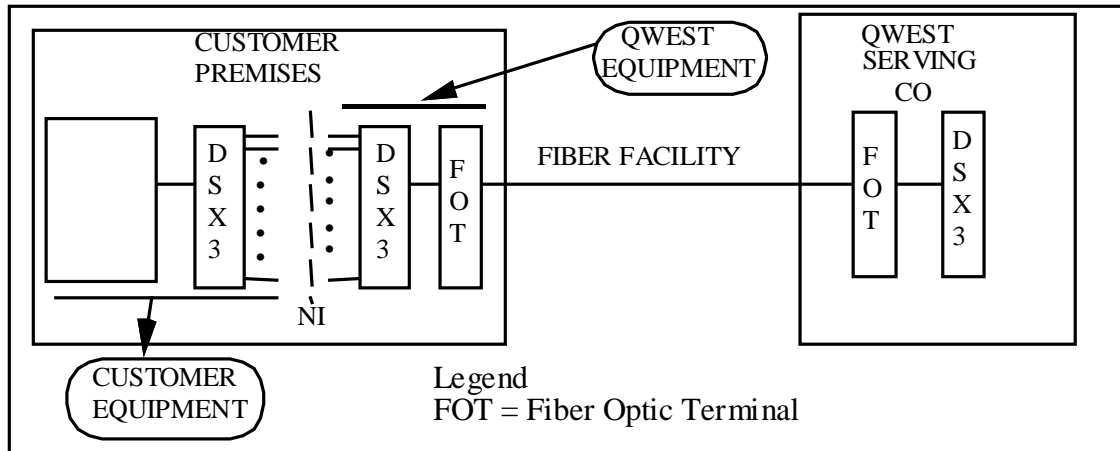
- CO = Central Office
- NI = Network Interface
- CT = Channel Termination (NI to serving CO link)
- TC = Transport Channel (Transmission facilities between serving COs, between a serving CO and a Qwest CO Hub, or between Telephone Company Hubs)

Network Interface (NI) signals may be electrical or radio, as selected by the customer. The electrical interface CT element provides for one DS3 channel. Radio interface CT elements, however, include CO multiplexing of as few as 3, and as many as 12, DS3 signals to a higher bit-rate signal that will be present in the radio signal at the NI. Each DS3 CT element will terminate on a DSX-3 Cross-connect panel in the serving CO, in a capacity reserved status.

The TCs, and the various DS3 channel configurations and options are described in the following paragraphs.

### 2.1.1 Electrical Interface CT Capacity

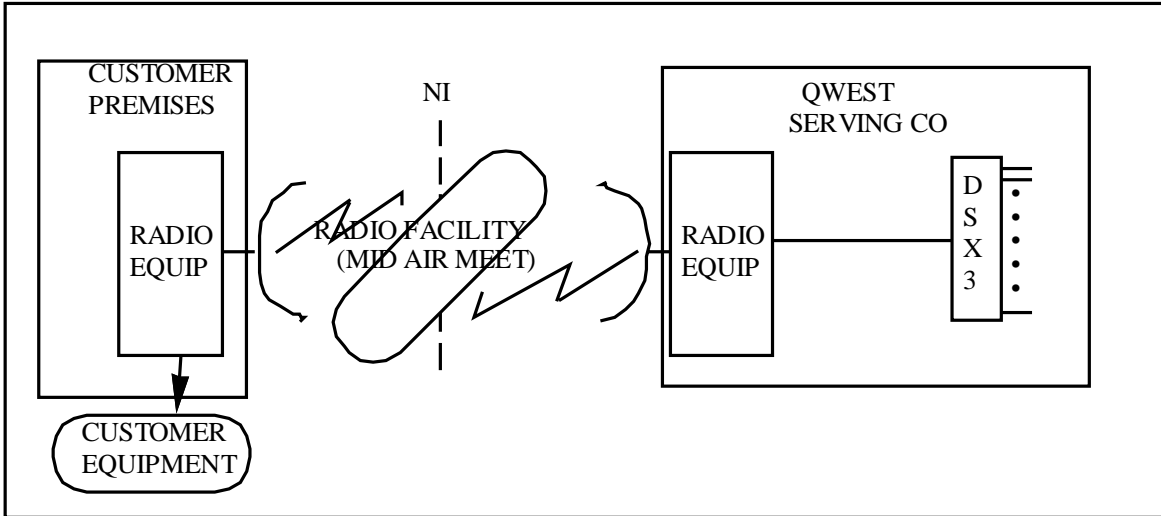
For the Electrical Interface CT Capacity Figure 2-2, demultiplexing to the DS3 level is provided by Qwest at both ends of the element. This differs from radio interface CT's where Qwest demultiplexing is only provided at the CO end.



**Figure 2-2:** Electrical Interface CT

### 2.1.2 Radio Interface CT Capacity

The radio Interface CT Capacity shown in Figure 2-3 (commonly called mid-air meet), interfaces at the faceplate of each transmit/receive antenna.

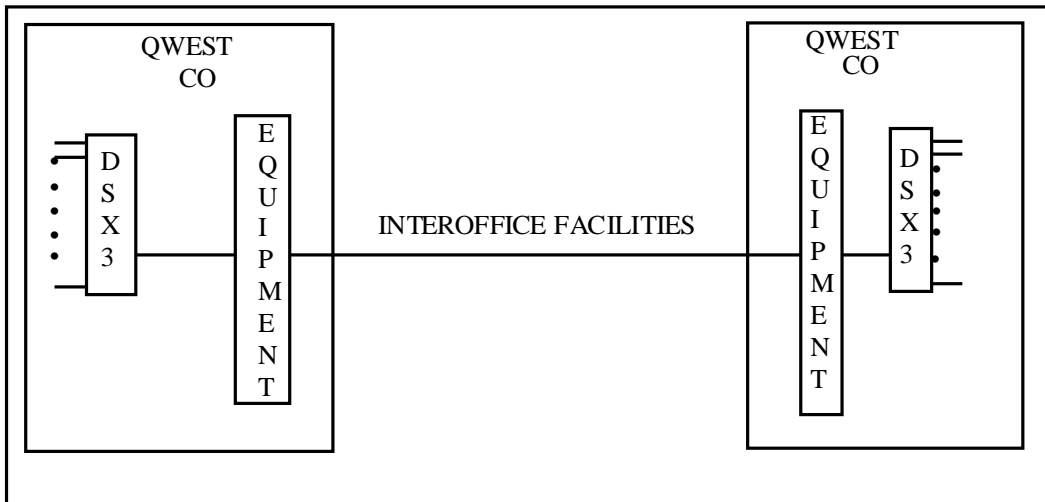


**Figure 2-3:** Radio Interface Capacity CT

Currently, national standards do not exist for radio interfaces; therefore, joint design between Qwest and the customer is required when establishing this interface.

### 2.1.3 TC Element

The TC element, the network transport medium, is chosen by Qwest. As shown in Figure 2-4, it originates at a DSX-3 panel in one CO and terminates on a DSX-3 panel in another CO. It may transit one or more COs between ends.



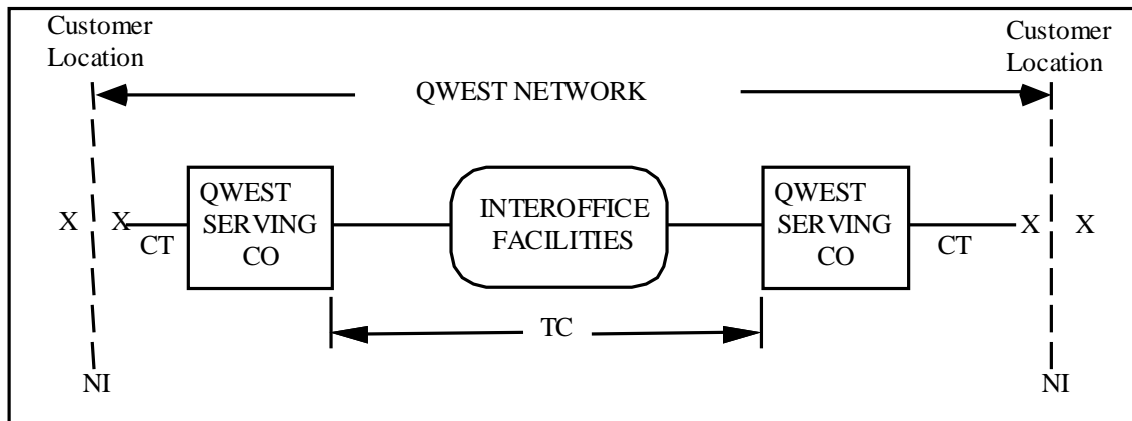
**Figure 2-4:** Transport Channel Element

## 2.2 DS3 Service Configurations

### 2.2.1 Customer Premises-to-Customer Premises Channel

This channel configuration shown in Figure 2-5 will terminate in a NI provided by Qwest at each customer premises location. The NCI, selected by the customer, may be either electrical or radio (at either end) as previously described in the paragraphs under subheadings 2.1.1 and 2.1.2. Once the DS3 channel reaches the serving CO, Qwest will chose the TC medium through its network as described in the paragraph under subheading 2.1.3. Qwest will be responsible for maintaining service between NIs.

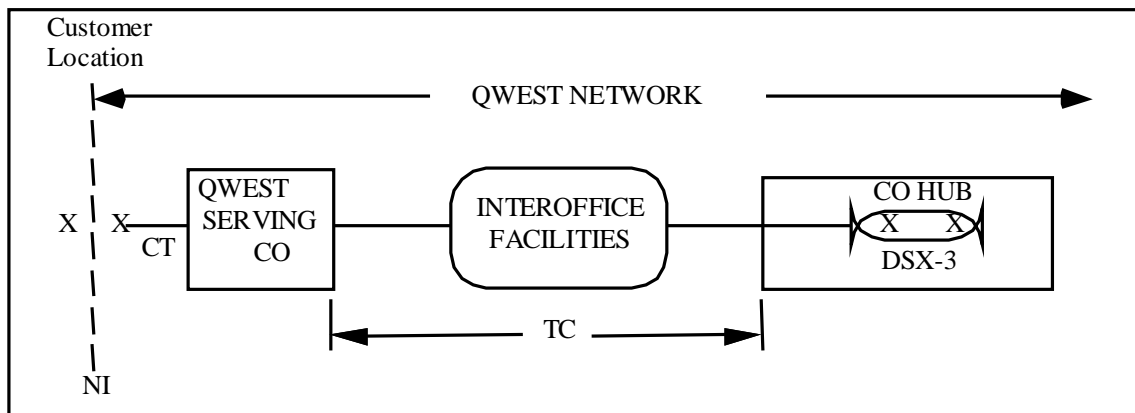




**Figure 2-5:** Customer Premises-to-Customer Premises Channel

**2.2.2 Customer Premises-to-CO Hub Channel**

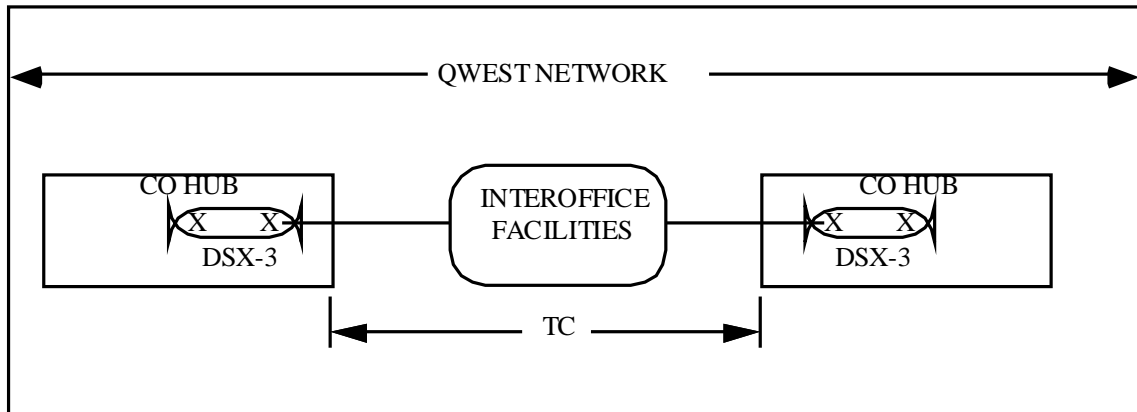
This channel configuration shown in Figure 2-6 will terminate in a NI provided by Qwest at the customer premises location and a DSX-3 panel or equivalent in a Qwest CO Hub. The NI, selected by the customer, may be either electrical or radio (at either end) as previously described in the paragraphs under subheadings 2.1.1 and 2.1.2. Once the DS3 channel reaches the serving CO, Qwest will choose the TC medium through its network as described in the paragraph under subheading 2.1.3. Qwest will be responsible for maintaining the service from the NI at the customer location to the DSX-3 Cross-connect panel or equivalent in the CO Hub.



**Figure 2-6:** Customer Premises-to-CO Hub Channel

### 2.2.3 CO Hub-to-CO Hub Channel

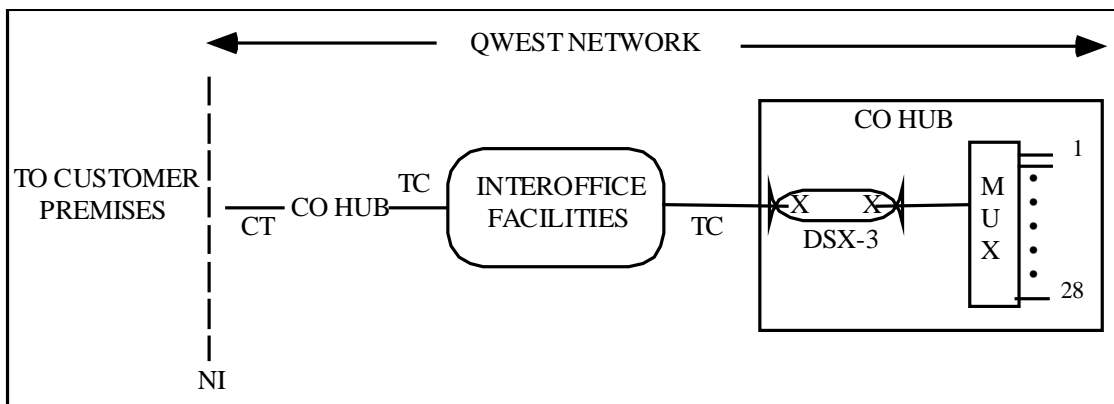
This channel configuration shown in Figure 2-7 will terminate at both ends on a DSX-3 panel, or equivalent, in a Qwest CO Hub. Qwest will be responsible for maintaining service between the DSX-3 Cross-connect panels or equivalent.



**Figure 2-7:** CO Hub-to-CO Hub Channel

### 2.2.4 Hub Multiplexing Feature (CO Multiplexing)

Figure 2-8 depicts an example of Hub Multiplexing Feature. Customers may request DS3 to DS1 multiplexing on DS3 channels that terminate at CO Hubs (Premises-to-CO Hub, and CO Hub-to-CO Hub configuration). The customer may order multiplexing at one or both ends of CO Hub.



**Figure 2-8:** Hub Multiplexing Feature

When customers request Hub multiplexing, they sometimes require that the DS1 channels be capable of clear channel operation (for a more detailed explanation of DS1 Clear Channel; consult Qwest Technical Publication 77375). Since Qwest DS1 to DS3 multiplexing equipment is comprised of various vendors' products with a variety of vintages, clear channel optioning capability may vary from one vendor's equipment to the next.

### **2.3 Bipolar With 8-Zero Substitution (B8ZS) Impact on DS3 Multiplex Channel signal**

DS1 Clear Channel (DS1 CC) operation is enabled through the use of the B8ZS line code. DS1 circuit packs in DS3 to DS1 multiplexers may or may not be capable of B8ZS. Those that are capable will allow B8ZS selection in-groups of either 7, 4, or 1 DS1 channel(s) at a time. This is also true for the equipment used by most customers served by Qwest. For this reason in Table 4-2 in Chapter 4, a series of Network Channel (NC) codes provide NC code options permitting the customer to describe the type of clear Channel optioning capability desired (DS1 channel port B8ZS optional in groups of 7, 4, or 1). For technical and administrative reasons, it is important that the customer multiplexer and the Qwest CO multiplexer should have a matching DS1 CC optioning capability. A multiplexer that can have DS1 ports optioned one-at-a-time, is compatible with one that options in-groups of 4 or 7.

#### **2.3.1 Customer Responsibility When Ordering DS1 CC Hub Multiplexing Feature**

The customer is responsible when placing an order involving transport of DS1 CC on DS3 to indicate by their selection of the appropriate NC (provided in Chapter 4 of this document), the capability of their multiplexer. This will ensure that Qwest will adequately provide for the ordered feature requested by the customer.

Customer requested change to B8ZS, of an existing channel service, will require a new service order.

#### **2.3.2 Qwest Responsibility for Ordered DS1 CC Hub Multiplexing Feature**

Qwest will provide either a multiplexer matching that of the customer, or one that will provide for transport of DS1 CC on a one-to-one basis.

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### 3. Description of Interfaces

#### 3.1 DS3 Electrical Interface and Frame Format Applications

DS3 channels are provided to Carrier and End-User (EU) customers. The Network Interface (NI) at a Carrier premises will be at a DSX-3 Cross-connect panel or equivalent with signal characteristics as described in ANSI T1.102-1987, and with the Frame structure as described in ANSI T1.107-1988. Specifically, Qwest supports the M23 Multiplex Format described in Paragraph 8.2 of ANSI T1.107-1988 and its supplement ANSI T1.107a-1990. The NI at an EU premises will be at a SJA44 connector with signal characteristics as described in ANSI T1.404-1989.

The physical electrical DS3 NI configurations are shown in Figures 3-1 and 3-2 for Carrier premises and EU premises respectively. Carriers have two options at their premises:

- Carrier customers may elect to terminate their cables on the Qwest DSX-3 Cross-connect panel in the space provided for Qwest transmission equipment (Figure 3-1, option A).
- They may elect to have Qwest terminate Qwest cable on the customer's DSX-3 Cross-connect panel located in the customer's workspace (Figure 3-1, option B).

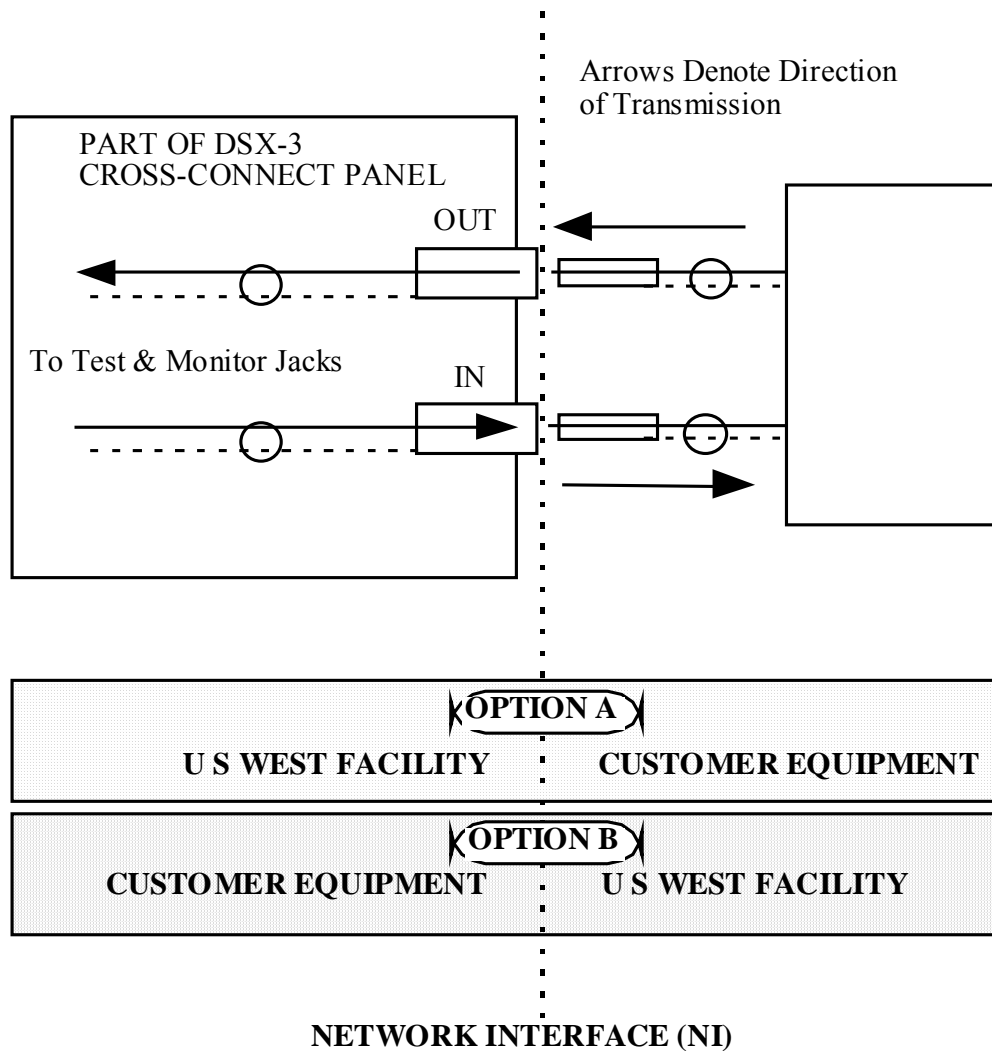
If Asynchronous M23 multiplex applications and C-Bit Parity applications meet at a network-to-network or network-to-customer premises interface, Qwest will require an M23 Multiplex format that conforms to the signal characteristics described in the first paragraph above under subsection 3.1.

Qwest does not support DS1 to DS3 CO multiplexing on M23 Multiplex signals with the C-Bit Parity application. Also, Qwest does not support either DS3-M13 framing format or "DS3 Clear Channel" interfaces.

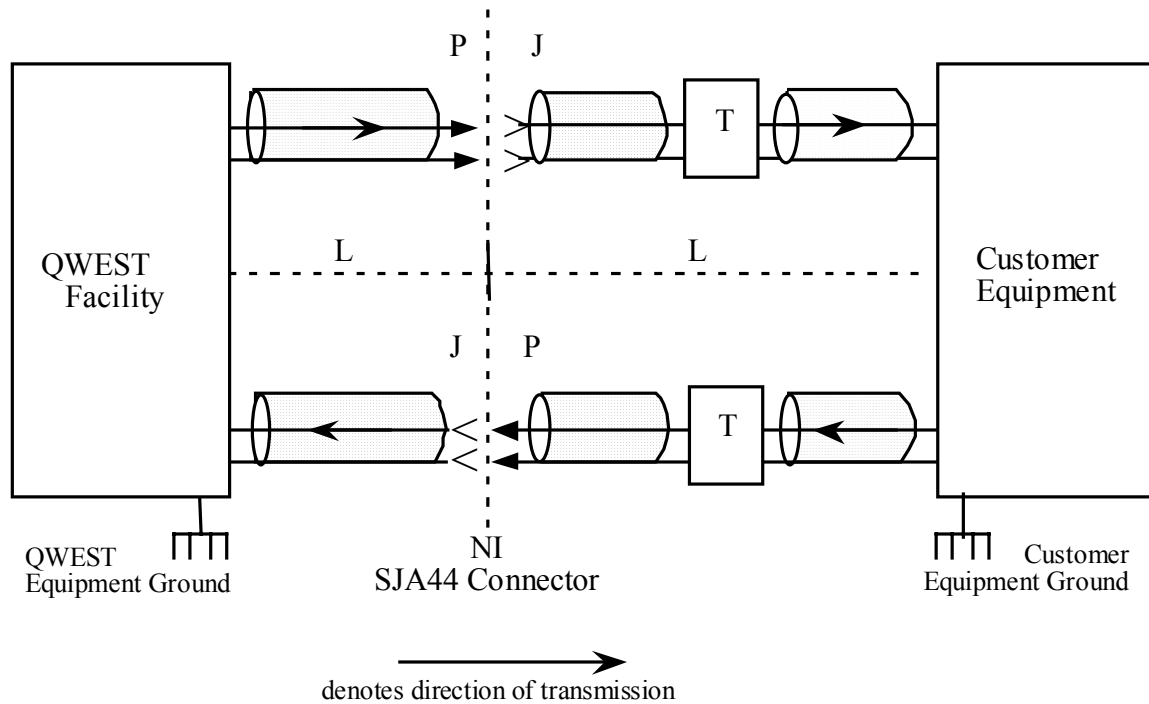
### 3.2 Radio Frequency Interface for Multiplexed DS3s

The Radio Frequency (RF) Interface (commonly called a mid-air meet) for a DS3 channel will be at the faceplate of each transmit/receive antenna. Multiplexed Asynchronous DS3s may be transported to an RF interface.

Due to different protocols in use on the line overhead of the radio system, the same type of radio equipment must be used at both ends of the system. Qwest will identify the equipment types available and the customer will select and provide compatible equipment at their location.



**Figure 3-1:** Carrier Premises - DSX-3 Cross-connect Panel Interface



Legend:

- T - Optional wideband transformers to mitigate ground currents.
- P - TNC connector plug
- J - TNC connector jack
- L - Maximum cable length to NI - 450 feet of 75 $\Omega$  coaxial cable.

Note 1: This diagram indicates signal continuity arrangements and maximum allowable cable lengths.

Note 2: Equipment grounding should follow recommended Carrier / customer installation practices consistent with existing safety standards.

Note 3: If the maximum distance between the DSX-3 Cross-connect panel and the customer equipment exceeds 450 feet a DS3 Regenerator will be required.

**Figure 3-2:** EU Premises Electrical DS3 - SJA44 Network Interface Connector



### **3.3 DS3 Network Interface Unit**

It is a general Qwest Local Network policy to establish a DS3 Network Interface Unit (NIU) demarcation point at customer premises locations for DS3 services. The NIU will be located on the Qwest-side of the Network Interface.

A DS3 NIU is not a customer-specified or orderable item, but will be placed solely as determined by Qwest. An NIU is also not guaranteed to be used on any or all DS3 circuits, including new service orders. Existing customer DS3 circuits will only be moved onto an NIU on an 'as needed' basis.

#### **3.3.1 Carrier Loopback Capability**

Carriers such as Interexchange Carriers (ICs) or Competitive Local Exchange Carriers (CLECs) will be able to perform maintenance loopbacks to the Qwest NIU for their DS3 customers. This loopback capability will be limited to Carriers whose End-User customers are Qwest DS3 service customers with a DS3 NIU located at their premises.

The Carrier must have physical access to the other end of the Qwest DS3 circuit whereas the loopback capability can be initiated from within the Carrier's own network or equipment without having to contact Qwest.

Loopbacks can be used during maintenance and circuit troubleshooting to verify the integrity of the DS3 facility. Testing can be performed with a standard DS3 test set or test head conforming to ANSI T1.102, *Digital Hierarchy - Electrical Interfaces* and ANSI T1.107, *Digital Hierarchy - Formats Specifications* DS3 interface specifications. Two types of loopback conditions are supported, network and dual.

A network loopback takes the Carrier's DS3 signal received at the Qwest NIU and loops it through the unit back towards the Carrier's network. The unit loops back the signal at the metallic Customer Provided Equipment (CPE) interface to ensure that all components of the NIU are included in the path. In this loopback mode, the End-User customer's DS3 signal is terminated.

A dual loopback takes the Carrier's DS3 signal received at the Qwest NIU and loops it back (logic loopback) towards the Carrier's network. At the same time, the signal received from the End-User is looped back towards their CPE.

#### **3.3.2 Remote Loopback Operation**

When in C-Bit parity format, Carrier's can use the Far-End Alarm and Control (FEAC) codes below to send loop-up and loop-down commands to the Qwest DS3 NIU. FEAC codes are sent through an embedded communication channel within the DS3 C-Bit framing. The NIU responds to 10 consecutive repetitions of the FEAC code to activate or deactivate a network loopback.

After removing the Loopback Activate code for a minimum of 5 seconds, the code can be reapplied to remotely activate a dual loopback condition. The NIU returns to normal operation after the unit receives a Loopback Deactivate code from the Carrier regardless of whether the unit is in the network or dual loopback mode. FEAC codes used for remote loopback activation and deactivation are shown in Table 3-1.

**Table 3-1:** DS3 Loopback FEAC Codes

Loopback Activate	0 001001 0 11111111 sent >10 repetitions
Loopback Deactivate	0 010010 0 11111111 sent >10 repetitions

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## **4. Network Channel (NC) and Network Channel Interface (NCI) Codes**

NC and NCI codes convey service and technical parameters. This chapter explains the codes in a general manner and then it provides specific code combinations to aid in ordering DS3 service. NC and NCI codes are provided by the customer to the Qwest Service Representative at the time a request for DS3 service is initiated.

### **4.1 NCI Code Function**

Signal specifications information at an interface is encoded into *NCI codes*. For DS3 service, the NCI code will convey capacity for radio interfaces. Customers provide an NCI code to Qwest to advise the Engineer of the specific technical customer requirements at a Network Interface.

DS3 NCI options include:

#### **4.1.1 Electrical DS3 Interface NCI Code Options**

NCI coding for DS3 interfaces identifies two applications:

- M23 multiplex
- M23 multiplex with C-Bit Parity

As noted in an earlier chapter, Qwest provides an option for DS3 to DS1 Central Office (CO) multiplexing with the M23 multiplex application.

#### **4.1.2 Radio Interface NCI Code Option**

Multiple Asynchronous DS3 channels may be ordered multiplexed and transported within a higher bit-rate bandwidth on a microwave radio channel. The "interface" exists within the radio signal transmission path. NCI coding permits a choice of reserved DS3 capacity and of radio frequency band.

## 4.2 NCI Code Form and Components

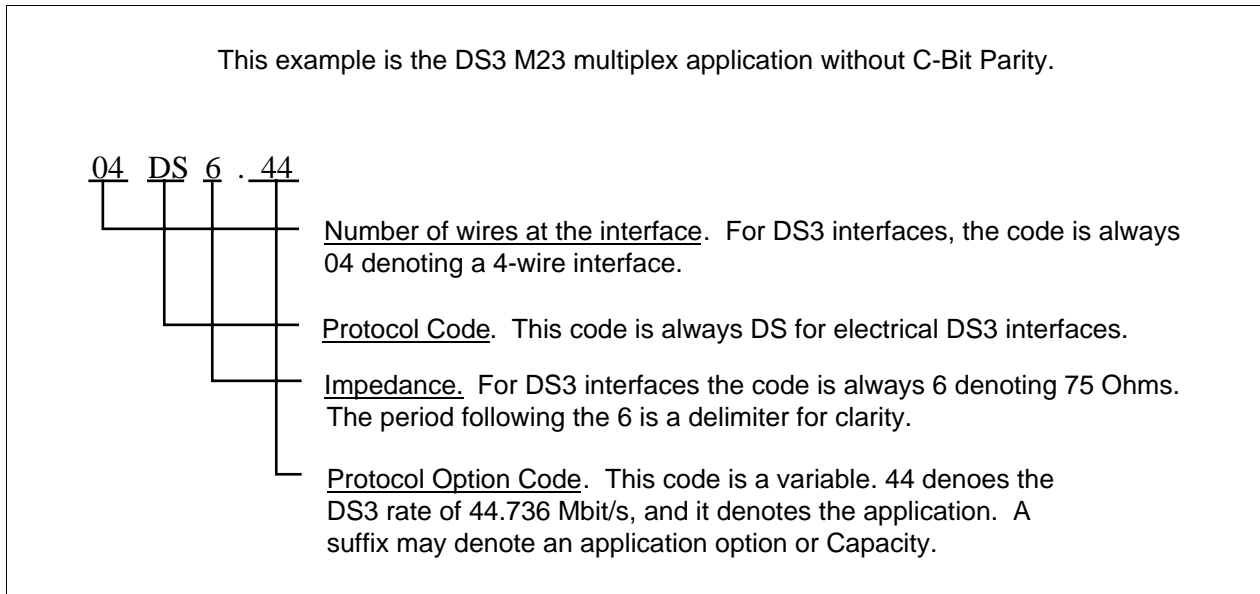
The full NCI code format has fields not used for digital services. Only those fields relevant to DS3 interfaces are discussed here.

### 4.2.1 NCI Code Form

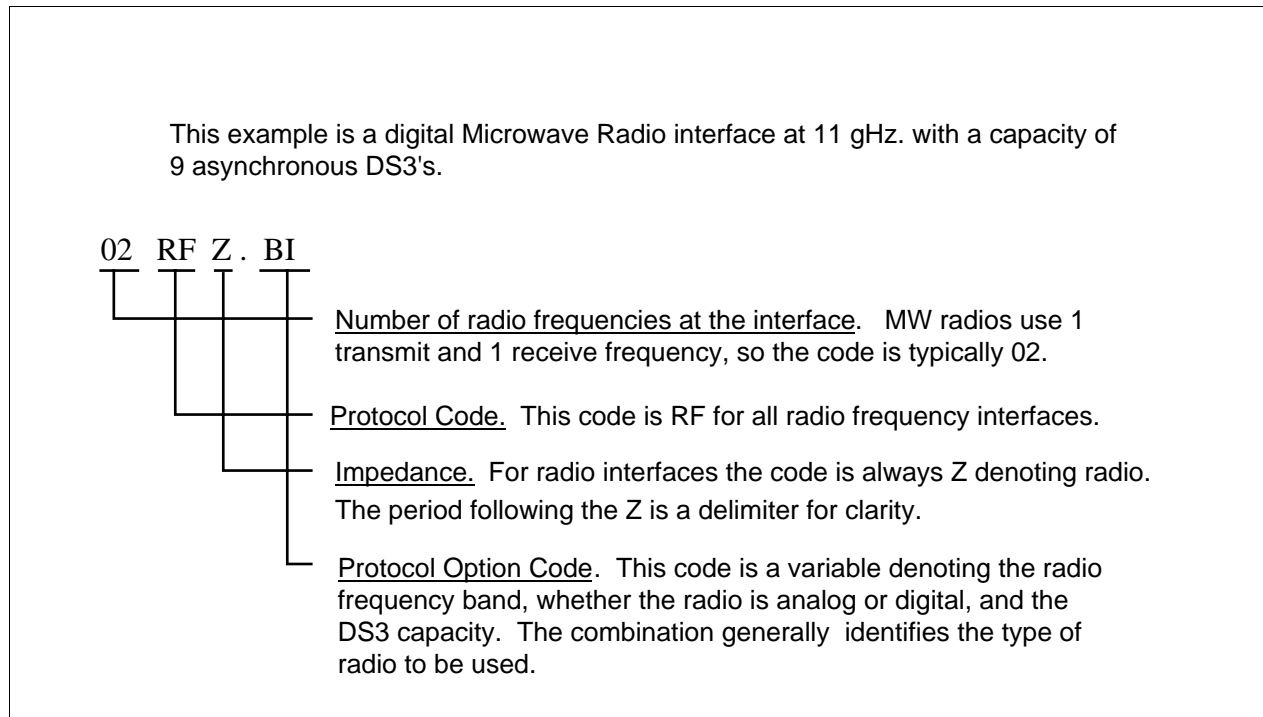
An NCI code has the form *04DS6.44*. The period between the numbers is a delimiter, which is used for improved clarity. It causes the *Protocol Option Code*, discussed later, to stand-out. An NCI code has no dashes (-).

### 4.2.2 NCI Code Components

Digital NCI Codes have four components as shown in Figures 4-1 and 4-2. Figure 4-1 provides an example of an electrical DS3 interface NCI code; Figure 4-2 is a radio frequency interface NCI code example.



**Figure 4-1:** Electrical DS3 NCI Code Example



**Figure 4-2:** Radio NCI Code Example

### 4.3 NC Code Function

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

### 4.4 NC Code Components and Form

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 DS3 channel interfaces the first two characters are HF. An example of the form is *HF - 4*.
- For radio interfaces the first two characters are LY. An example of the form is *LYDM*.

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

## 4.5 Codes Used to Order DS3 Service

### 4.5.1 NC and NCI Codes - General

NC and NCI codes used to order Qwest DS3 Services are listed in the following tables. Codes for the service desired must be specified by the customer when ordering High Capacity Digital Special Access services.

### 4.5.2 NC and NCI Code Combinations for Asynchronous DS3 Service

The NCI Codes listed in Tables 4-1 and 4-3 below are the codes customers will use when ordering Electrical DS3 Services. For information regarding other DS3 Services such as Qwest Self-Healing Network Service (SHNS) and Self Healing Alternate Route Protection (SHARP) refer to Technical Publications 77332 and 77340 respectively.

**Table 4-1: Multiplexed Asynchronous DS3  
 Radio Frequency Interfaces - NC and NCI Codes**

CAPACITY Asynchronous DS3s	NCI Codes for 6 GHz. Radio	NCI Codes for 11 GHz. radio	NC Code	NC Code char 1 - 2	Definition char 3-4
3 DS3	0 2 R F Z . A C	0 2 R F Z . B C	L Y D M	L Y	DM
6 DS3	0 2 R F Z . A F	0 2 R F Z . B F	L Y D M	Digital	Central Office
9 DS3	0 2 R F Z . A I	0 2 R F Z . B I	L Y D M	Radio	Multiplexer
12 DS3	0 2 R F Z . A L	0 2 R F Z . B L	L Y D M		



**Table 4-2:** NC Codes for Electrical DS3 Channels (1 of 2)

<b>NC Code Definition</b>	
<b>Characters 1-3</b>	<b>Character 4</b>
<b>HF-</b>  For individual DS3 Channels	<b>–</b> Unchannelized, Customer premises-to-customer premises channel, or customer premises-to-CO channel terminated on DSX-3 Cross-connect panel
	<b>M</b> Central Office Multiplexing, DS1 Clear Channel Capability optioning, capability not specified
	<b>Y</b> Central Office Multiplexing from DS3 to DS1 at both the A and Z Central Offices, DS1 Clear Channel Capability optioning, capability not specified
	<b>4</b> Central Office Multiplexing, Multiplexer can option <u>(4)</u> DS1 Clear Channels at a time using B8ZS line code.
	<b>7</b> Central Office Multiplexing, Multiplexer can option <u>(7)</u> DS1 Clear Channels at a time using B8ZS line code.

**Table 4-2:** NC Codes for Electrical DS3 Channels (2 of 2)

<p><b>H F C</b></p> <p>DS3 M-frame structured signal and C-Bit Parity application. It may or may not be channelized with a M23 Multiplexer.</p>	<p>– Unchannelized, customer premises-to-customer premises channel, or customer premises-to-CO channel terminated on DSX-3 Cross-connect panel</p>
	<p><b>M</b> Central Office Multiplexing, DS1 Clear Channel Capability optioning, capability not specified</p>
<p><b>HFX</b></p> <p>DS3 M-frame structured signal for CO Cross-connect. It may or may not be channelized with the M23 Multiplex format. It may or may not use the C-Bit Parity application.</p>	<p>– None, a cross-connect between two DS3s</p>
	<p><b>M</b> Central office Multiplexing, DS1 Clear Channel Capability optioning not specified, and Central Office Cross-connect, i.e. this service terminates at the DSX-3 panel, or equivalent, in a Qwest CO</p>
<p><b>HFZ</b></p> <p>DS3 M-frame structured signal. The DS3 channel is capable of providing DS1s with B8ZS.</p>	<p><b>M</b> Central Office Multiplexing, Multiplexer can option (1) DS1 Clear Channel at a time using B8ZS line code. This code replaces HF-1.</p>

The NCI codes listed in Table 4-3 are the valid coding iteration for the Asynchronous DS3 electrical interfaces Qwest provides. The codes in Table 4-3 are also used to order physical or virtual, Expanded Interconnect Channel Termination (EICT) for DS3 as documented in Qwest Service Publication 77201. Table 4-4 lists the valid NC and NCI code combinations.

**Table 4-3: DS3 Electrical Interface NCI Codes**

NCI	Description
04DS6.44	DS3 M-frame structured signal with M23 Multiplex format application
04DS6.44A	DS3 M-frame structured signal with C-Bit Parity application. It is an unchannelized signal application, supporting a user payload of 44.210 Mbit/s.
04DS6.44R	DS3 M-frame structured signal. It is an unchannelized signal application, supporting a user payload of 44.210 Mbit/s.
04DS6.44I	DS3 M-frame structured signal with M23 Multiplex format and C-Bit Parity application

**Table 4-4: NC and NCI Code Combinations**

DS3 Type	NC Code	NCI Code
Unchannelized	HF- -	04DS6.44R
Channelized	HF-M	04DS6.44
Channelized	HF-Y	04DS6.44
Channelized	HF-4	04DS6.44
Channelized	HF-7	04DS6.44
Channelized	HFZM	04DS6.44
Unchannelized with C-bit Parity	HFC-	04DS6.44A
Channelized with C-bit Parity	HFCM	04DS6.44I
Any	HFX-	04DS6.44 04DS6.44A 04DS6.44I 04DS6.44R
Channelized	HFXM	04DS6.44 04DS6.44I

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## **5. Performance Specifications**

### **5.1 Origin of End-to-End Objectives**

Because performance varies, objectives must be determined with consideration for the statistical distribution of the components in the individual provider portions. Generally, error performance distributions have two components:

- A Poisson-like distributed background bit error rate
- Episodes of clustered error events superimposed on the above

The majority of modern digital systems have been engineered such that the poison components is low relative to objectives. The episodic component is difficult to model, but for today's architecture, facilities and equipment, certain statistical properties are observed.

There are large fractions of days, which are error free and a wide variation in the number of Errored Seconds (ES) or Severely Errored Seconds (SES) on days with errors. The probability that all provider portions would simultaneously operate at the worst end of their individual performance distribution is low, it follows that the end-to-end performance objectives will be greater than the largest objective among the carrier portions, but less than the linear sum of the objectives of all portions.

### **5.2 Performance Objectives**

Accuracy and availability performance objectives are used as an aid in designing, developing, and maintaining the Qwest networks providing digital services. For long term performance objectives parameters for dedicated digital services consults ANSI T1. 503-1989. Factors such as technology mix, geographic factors isolated events, etc., may impact individual circuit performance.

#### **5.2.1 Accuracy Objectives**

Accuracy performance objectives are established in terms of the parameters provided in Table 5-1 below. It is important to note that long term accuracy objective is stated in 30 days or more. ES and SES characterize the transmission quality of the service and are used to derive the test limits.

**Table 5-1: Long Term Accuracy Objectives**

SEGMENT	PARAMETER	44.736 MBIT/S
END-TO-END	%ES	1.000
	%SES	0.035
Transit	%ES	0.500
	%SES	0.025
Access	%ES	0.500
	%SES	0.010
NOTE - Actual performance may not meet objectives at all times.		

### 5.2.2 Availability Objectives

Availability objectives are established in terms of the parameters provided in Table 5-2. Short Interruption Event Count (SIEC) and Percent (%) Availability characterize the usability of the service over time.

A service is assumed to be in the Available state unless a transition to the Unavailable state is observed without a subsequent transition to the available state. The transition between the Available and Unavailable states are:

- Transition to the Unavailable state occurs either at the beginning of 10 consecutive SESs.
- Transition to the Available state occurs at the beginning of 10 consecutive seconds, none of which is SES.

**Table 5-2: Availability Objectives**

SEGMENT	PARAMETER	44.736 MBIT/S
END-TO-END	% Service Availability (Annual)	99.830
	% SIEC (Monthly)	Note
Transit	% Service Availability (Annual)	99.930
	% SIEC (Monthly)	Note
Access	% Service Availability (Annual)	99.950
	% SIEC (Monthly)	Note
NOTE - Short Interruption Event (SIE) is a new parameter. These objectives are under study.		

### **5.3 Acceptance Tests**

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.

### **5.4 Service Availability**

The availability requirement for Qwest DS3 Service is 99.93 percent. Unavailability or outage is defined as any one-second interval with a line BER equal to or worse than  $1 \times 10^{-3}$  BER. The corresponding outage equates to 79 minutes a year.

### **5.5 Jitter Performance**

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 (Hz).

### **5.6 Network Interface Timing Jitter Specifications**

The limits given in Bellcore Technical Reference TR-NWT-000499 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 T1.404-1989. The purpose of these limits is to limit broadband jitter appearing anywhere in the Qwest Network.

### **5.7 Automatic Protection Switching**

Automatic protection switching is used to improve the availability and reliability performance of Qwest DS3 service by substituting standby equipment or alternate channels when failure occurs.

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

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



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## **6. Maintenance**

### **6.1 Customer Responsibilities**

The customer is responsible for all equipment and cable on the customer side of the Network Interface (NI) at their location. This will be at a DSX-3 Cross-connect panel or a SJA44 connector if the service is terminated in an electrical interface. The NI for a radio channel will be at the faceplate of the transmit/receive antenna.

The customer or their 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.

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 CO may sometimes be necessary to isolate the trouble.

### **6.2 Qwest Responsibilities**

Qwest is responsible for all equipment and cable on their side of the NI at the customer location.

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

Qwest will furnish the customer a trouble reporting telephone number.

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

Qwest will commit to a four hours maximum service restoral time in the event of a service interruption due to an electronic component failure. If the trouble is caused by a cable failure, the maximum service restoral time will be eight hours.

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## 7. Definitions

### 7.1 Acronyms

ASR	Access Service Request
B8ZS	Bipolar With 8-Zero Substitution
CO	Central Office
CT	Channel Termination
EICT	Expanded Interconnect Channel Termination
ES	Errored Second
EU	End-User
FDP	Fiber Distribution Panel
LATA	Local Access and Transport Area
NC	Network Channel
NCI	Network Channel Interface
NI	Network Interface
POT	Point Of Termination
RF	Radio Frequency
SES	Severely Errored Second
SHARP	Self-Healing Alternate Route Protection
SHNS	Self-Healing Network Service
SIE	Short Interruption Event
SIEC	Short Interruption Event Count
SYNTRAN	Synchronous Transmission
TC	Transport Channel

## 7.2 Glossary

The following provides the meaning of the glossary terms used in this Publication.

### **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.

### **B8ZS (Bipolar With 8-Zero Substitution)**

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 for providing bit independence for digital transmission by providing a minimum 1s density of 1 in 8 bits

### **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.

### **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.).

### **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.

### **Facilities**

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

### **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.

### **Loopback**

An out-of-service test procedure applied to a full duplex channel that causes a received signal to be returned to the source.

### **Multiplex**

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 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.



### **Protocol Code**

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

### **Severely Errored Second (SES)**

A one second interval having a Bit Error Ratio of  $10^{-3}$  or worse

### **Short Interruption Event (SIE)**

An event beginning with the occurrence of a BER of  $10^{-2}$  or worse continuously for three or more consecutive seconds, which can last up to 120 seconds. A SIE clears when 10 consecutive seconds with BER better than 10 occur.

Note - The “ $10^{-2}$  BER continuously” over each second implies that all sub-intervals, where the second is divided into at least 10 equal sub-intervals, have a BER of  $10^{-2}$  or worse.

### **Short Interruption Event Count (SIEC)**

A count of the Short Interruption Events in a given time frame (e.g., one month).

### **Special Access Service**

A service that provides a transmission path within a LATA and directly connects a POT to an End-User's premises or to another POT.

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## **8. References**

### **8.1 Qwest Documents**

Technical Publication 77332 *Qwest Self-Healing Network Service*, Issue N, January 2005

Technical Publication 77340 *Self-Healing Alternate Route Protection (SHARP)*, Issue F, September 2001

Technical Publication 77375 *1.544 Mbit/s Channel Interfaces*, December 2001, Issue F

### **8.2 Telcordia Documents**

TR-INS-000342 *High Capacity Digital Special Access Service*, Issue 1, February 1991

TR-NWT-000499 *Transport Systems Generic Requirements*, Issue 4, Revision 1, April 1992

### **8.3 American National Standards Institute (ANSI) Documents**

ANSI T1.102-1987 *Digital Hierarchy - Electrical Interfaces*

ANSI T1.107-1988 *Digital Hierarchy - Formats Specifications*

ANSI T1.107a-1990 *Digital Hierarchy - Supplement to Formats Specifications*

ANSI T1.404-1989 *Customer Installation to Network, DS3 Metallic Interface Specifications*

ANSI T1.503-1989 *Telecommunications - Network Performance Parameters for Dedicated Digital Service*

### **8.4 Document 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 order;  
American National Standards Institute (ANSI) documents from:

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