

# **QWEST Corporation Technical Publication**

## **Unbundled Network Element Combinations Including Enhanced Extended Loop (EEL) and Loop Mux Combinations (LMC)**

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**77403  
Issue C  
June 2002**

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## **1. Introduction**

### **1.1 General**

This publication describes the QWEST service Unbundled Network Element Combinations including Enhanced Extended Loop (EEL) and Loop Mux Combinations (LMC). These are available to Competitive Local Exchange Carriers to be used in providing service to their customers. The publication includes technical information about EEL and LMC as well as the Network Channel and Network Channel Interface Codes used in specifying these services.

### **1.2 Reason for Reissue**

This is reissued to expand the Loop Mux Combination (LMC) descriptions and details. This revision also has minor adjustments, improving style and clarity.

### **1.3 Document Organization**

This document is organized as follows:

<b><u>Chapter</u></b>	<b><u>Contents</u></b>
-----------------------	------------------------

- |   |  |
|---|--|
| 1 | Introduction: General information about the document's contents.   |
| 2 | Service Overview: Description of UNE Combinations.   |
| 3 | Network Channel/Network Channel Interface Codes: General information about the codes and a summary of codes used in the publication.   |
| 4 | DS0/Voice UNE Services: Description of DS0 and Voice level UNE services.   |
| 5 | DS1 EEL/LMC Services: Description of DS1 level UNE services.   |
| 6 | DS3 EEL/LMC Services: Description of DS3 level UNE services.   |
| 7 | EEL with Concentration Ability.  |
| 8 | Definitions: Acronyms and Glossary.  |
| 9 | References: List of publications mentioned in this document with ordering instructions. Also contains a list of Trademark information. |

### **1.4 Document Scope**

This document provides an overview of the EEL and LMC services including a technical description of the service and its options. References are included to other QWEST Technical Publications that give additional technical parameters of the various types of EEL and LMC channels and interfaces. Lists of Network Channel and Network Channel Interface codes are included. These codes are to be used to order EEL and LMC.

Full ordering information and other administrative information is beyond the scope of this publication. Appropriate contracts should be consulted for availability and other non-technical information.

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## 2. Service Description

### 2.1 Enhanced Extended Loop (EEL) and Loop Mux Combination (LMC) General Description

The Enhanced Extended Loop (EEL) is a private line, interoffice transport service available to Competitive Local Exchange Carriers (CLECs). EELs are delivered to the CLEC in the QWEST wire center where the CLEC's equipment is collocated or to the CLEC's Point of Presence. In this document, the CLEC's Point of Presence is identified as the CLEC's Wire Center.

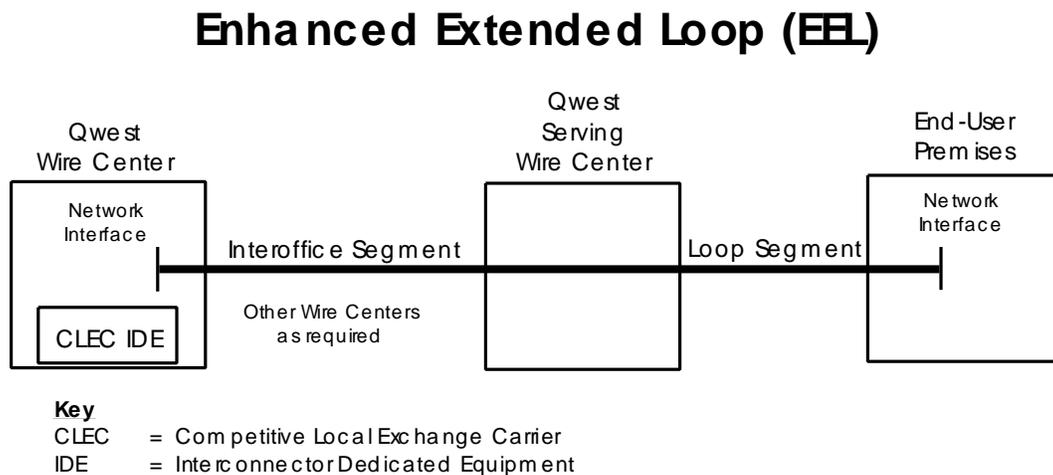
EELs and LMCs are available only where permitted by contract or regulatory order.

The EEL is available in two configurations: the Point-to-Point EEL and the Multiplexed EEL. Both are described as follows.

When no Interoffice transport segments are needed, the Loop Mux Combination (LMC) provides Co-providers with the ability to access end users and aggregate DS1 or DS0 loops to a higher bandwidth via a DS1 or DS3 multiplexer all in the same Wire Center. There is no loop or interoffice transport between the multiplexer and the collocation, Central Office NI with Loop Mux Combinations.

#### 2.1.1 Point-to-Point EEL Configuration

Figure 2-1 illustrates the basic concept of a Point-to-Point EEL of any level.



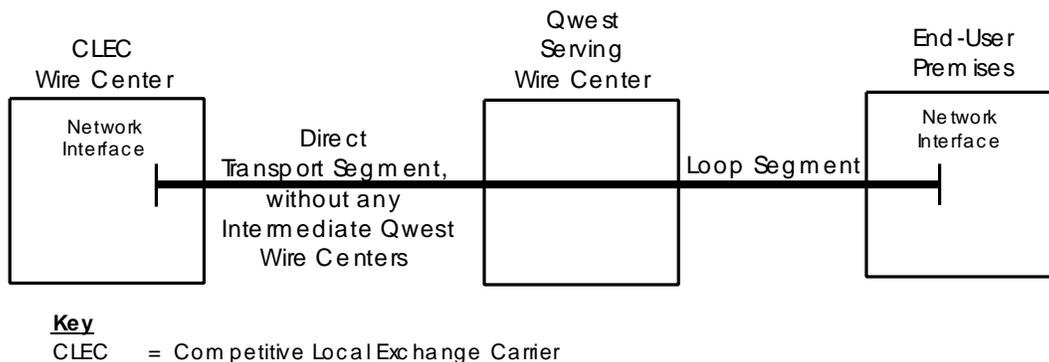
**Figure 2-1** Point-to-Point EEL Concept

The Point-to-Point EEL consists of a loop segment connected to an interoffice transport segment. The loop goes from a Network Interface (NI) at an End-User premises to the Serving Wire Center. There it is cross-connected to an interoffice transport channel going to another wire center. The latter wire center is the

location where a CLEC has collocated transmission equipment called Interconnector Dedicated Equipment (IDE). The EEL may go through one or more intermediate wire centers.

In those cases where the CLEC Wire Center is located within the geographical Serving Area of the QWEST Wire Center, an EEL may connect the CLEC to an End-User without a segment that goes through other QWEST Wire Centers. Figure 2-2 illustrates that situation.

### Enhanced Extended Loop (EEL)

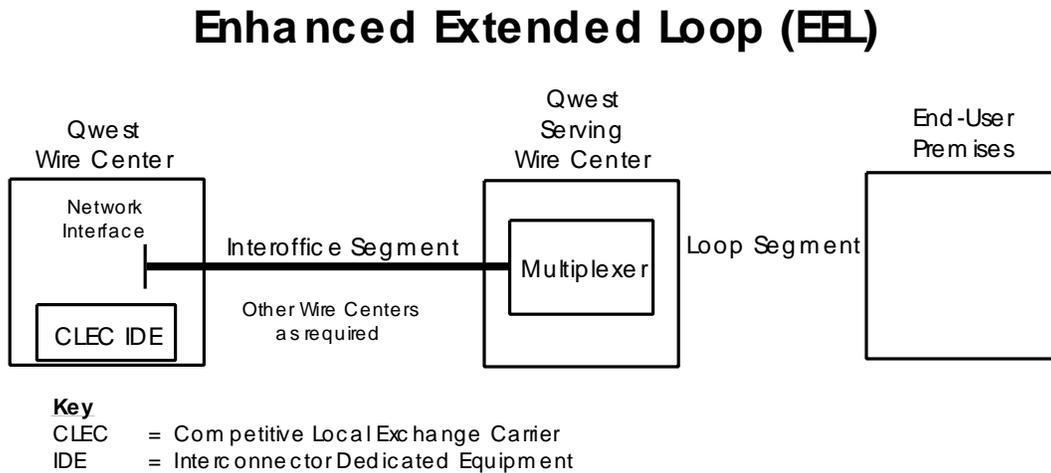


**Figure 2-2** Point-to-Point EEL Concept, without QWEST Interoffice Links

Network Interfaces are available at voiceband, DS1 or DS3 signal levels. SONET EEL channels are available through a special request process. Information regarding QWEST SONET services is in Technical Publication 77346, *Synchronous Service Transport*.

### 2.1.2 Multiplexed EEL and LMC Configurations

The Multiplexed EEL is generally an interoffice segment with an attached multiplexer in the QWEST Serving Wire Center. Figure 2-3 illustrates the concept. The Multiplexed EEL has no loop segment. As illustrated in Figure 2-2, it is possible to have a Multiplexed EEL without going through intermediate, QWEST Wire Centers.

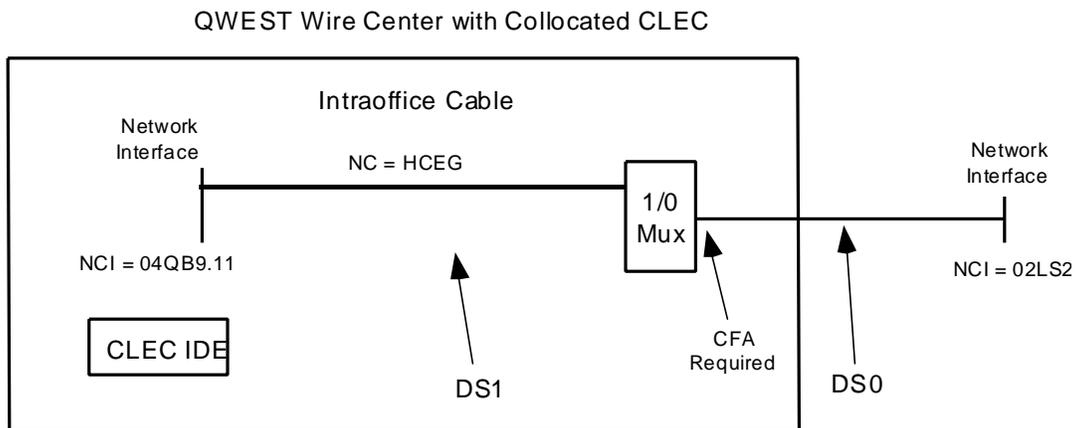


**Figure 2-3** Multiplexed EEL Concept

Lower level EEL loops may be ordered and transported on the higher level EEL between the multiplexer location and the wire center where the CLEC is collocated. The order must include Carrier Facility Arrangement (CFA) information to assign the lower level EEL loops to the proper channel on the higher level Multiplexed EEL.

When no Interoffice transport segments are needed, the Loop Mux Combination (LMC) provides Co-providers with the ability to access end users and aggregate DS1 or DS0 loops to a higher bandwidth via a DS1 or DS3 multiplexer all in the same Wire Center. There is no loop or interoffice transport between the multiplexer and the collocation, Central Office NI with Loop Mux Combinations.

## Loop Mux Combination



**Key**  
 CFA = Carrier Facility Assignment  
 CLEC = Competitive Local Exchange Carrier  
 LMC = Loop Mux Combination  
 Mux = Multiplexer  
 NC = Network Channel  
 NCI = Network Channel Interface

**Figure 2-4** Loop Mux Combination Concept

### 2.1.3 Additional Information

Further information about IDE, ICDFs and collocation may be found in PUB 77386, *Interconnection and Collocation for Transport and Switched Unbundled Network Elements and Finished Services*.

Additional information about EELs and LMC may be found in the contract between the CLEC and QWEST.

### 2.2 EEL Features and Functions

EELs are available at many levels or bandwidths: ~~DS3~~; DS3 (44.736 Mbit/s), DS1 (1.544 Mbit/s) and DS0/analog voice grade.

EELs and their features and functions are described in detail later in this publication. Chapter 4 describes DS0/analog voice grade EELs. Chapters 5 and 6 describe the DS1 and DS3 EELs respectively.

### 2.3 LMC Features and Functions

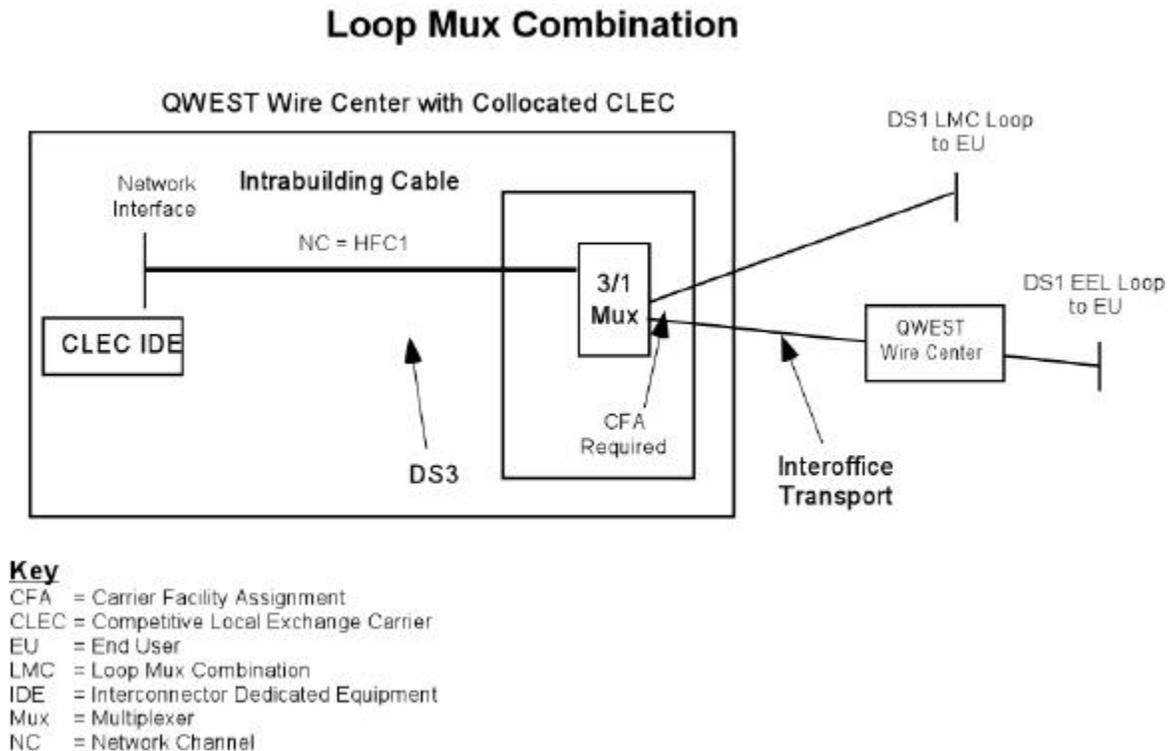
LMC is available to multiplex 24 DS0/analog voice band signals into a channelized DS1 that is delivered to the CLEC's collocation interface in the same Wire Center building. LMC is also available to multiplex 28 DS1 channels into a channelized DS3 that is delivered to the CLEC's collocation interface in the same Wire Center building.

### 2.4 Building a Network ~~Using UNE~~ Using UNE Combinations

The CLEC may order DS0/voice, DS1 or DS3 EELs as point-to-point circuits from each End-User location to the collocation wire center to meet their demand.

Alternatively, the CLEC may order DS3 or DS1 Multiplexed EELs to collect (multiplex) lower level channels for transport back to their IDE or physical location. Then the lower-level channels may be ordered. These lower-level channel orders must include instructions (i.e., the CFA) as to which channel of the higher level system should be used to transport the lower level channel. SONET multiplexing is available through the Special Request Process.

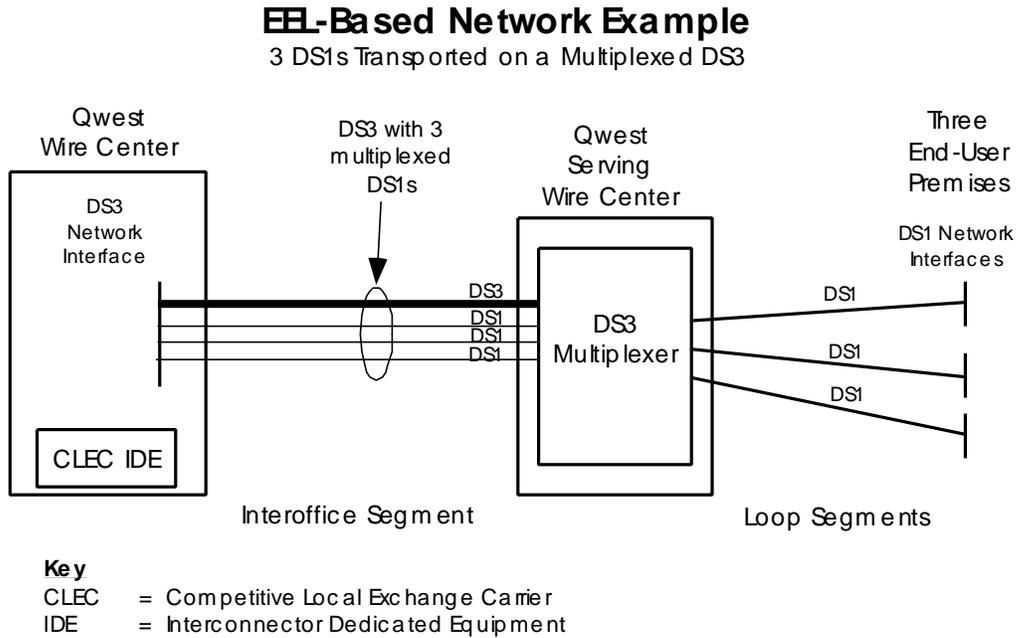
Loop Mux Combinations enable CLECs to multiplex unbundled loops at DS0/analog voice band into a DS1 channel to ride their network. Similarly, unbundled DS1 loops can be aggregated into the DS3 level to interface the CLEC network.



**Figure 2-5** ~~LMC5~~ LMC Network Example

While EELs may be used for many applications, the primary application will permit a CLEC to serve customers out of several wire centers without establishing collocation in all of the wire centers. The CLEC could, for example, establish collocation in one (or more) QWEST wire centers within a metropolitan area and then feed distant customers from this central location.

Figure 2-6 illustrates a situation where three DS1 EEL loops from three different End-User premises are multiplexed together in the Serving Wire Center onto a previously ordered, Multiplexed DS3 EEL. The DS3 then transports the three DS1s to the wire center with the CLEC presence.



**Figure 2-6** EEL Network Example

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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<sup>®</sup> code set. The NC code is used to identify a channel used with the service. Telcordia document, MC-CL-IN-008, *Common Language Network Channel and Channel Interface Codes (NC/NCI Codes)*, describes these coding schemes. 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 Network Channel (NC) codes for Enhanced Extended Loop (EEL) and Loop Mux Combinations (LMC) at the DS0/voice level. Table 3-2 lists the codes for DS1 and DS3 EELs and LMC.

**Table 3-1** Available DS0/Voice Network Channel Codes - Summary

NC Code Point-to-Point	Channel Description	Description In Chapter
LC --	Voice, Loop Start (VG 2)	4
LD --	Voice, Ground Start (VG 3)	4
LD --	Voice, Reverse Battery (VG 3)	4
LH --	Voice, Transmission Only (VG 7)	4

**Table 3-2** Available DS1, DS3 Network Channel Codes - Summary

Network Channel Code		Channel	Description
Point-to-Point	With Multiplexing	Description	
			Description in Section
		<b><u>DS1</u></b>	
HC--	HC-G	SF and AMI	5.2, 5.3
HCD-	HCDG	ANSI ESF and AMI	5.2, 5.3
HCE-	HCEG	ANSI ESF and B8ZS	5.2, 5.3
HCF-	HCFG	Non-ANSI ESF and AMI	5.2, 5.3
HCG-	HCGG	Non-ANSI ESF and B8ZS	5.2, 5.3
HCJ-	N.A.	Free Framing and B8ZS	5.2, 5.3
HCZ-	HCZG	SF and B8ZS	5.2, 5.3
		<b><u>DS3</u></b>	
HF--		M2/3 Multiplex Format	6.2
	HF-4	M2/3 Multiplex Format, Multiplexer can be optioned for four (4) DS1 Clear Channels at a time using B8ZS Line Code	6.3
	HF-7	M2/3 Multiplex Format, Multiplexer can be optioned for seven (7) DS1 Clear Channels at a time using B8ZS Line Code	6.3
	HFZM	M2/3 Multiplex Format, B8ZS is the line code for the individual DS1s riding within the DS3, Central Office Multiplexer	6.3
	HF-M	M2/3 Multiplex Format (DS1 Clear Channel Capability optioning capability not specified)	6.3
HFC-		M2/3 Multiplex Format, C-Bit Parity	6.2
	HFC1	M2/3 Multiplex Format, C-Bit Parity, Multiplexer can be optioned for one (1) DS1 Clear Channel at a time using B8ZS Line Code	6.3
	HFC4	M2/3 Multiplex Format, C-Bit Parity, Multiplexer can be optioned for four (4) DS1 Clear Channels at a time using B8ZS Line Code	6.3
	HFC7	M2/3 Multiplex Format, C-Bit Parity, Multiplexer can be optioned for seven (7) DS1 Clear Channels at a time using B8ZS Line Code	6.3
	HFCM	M2/3 Multiplex Format, C-Bit Parity (DS1 Clear Channel Capability optioning capability not specified)	6.3

Key: AMI = Alternate Mark Inversion  
ANSI = American National Standards Institute  
B8ZS = Bipolar 8 Zero Substitution  
ESF = Extended Superframe  
N.A. = Not Applicable  
SF = Superframe

### 3.2 Network Channel Interface (NCI) Codes

#### 3.2.1 General

Network Channel Interface (NCI) codes are a part of the COMMON LANGUAGE<sup>®</sup> code set. The NCI code is used to identify a network interface of a service in our mechanized systems.

#### 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.

**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. Values are listed in Table 3-4

**Table 3-3** NCI Impedance Values

Impedance in Ohms (Character Position 5)			
Data Value	Code	Data Value	Code
110	0	124	7
150	1	Variable	8
600	2	100	9
900	3 *	Fiber	F
1200	4	Radio	Z
135	5	50 Coaxial	C
75	6	Multiple	M

\* Except for interface code 04DD3, the impedance character 3, when used with a 4-wire voice-frequency path at the POT, denotes a historical customer (IC) provided transmission termination rather than a 900 ohm impedance. Such terminations were provided by customers in accordance with FCC Docket No. 20099 settlement Agreement and by Automatic Transmission Test and Control Circuit used in the previous provisioning process.

**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.

**Transmission Level Point(s)** (character positions 8 through 12) is assigned one or two-character alpha code corresponding to a value for Transmission Level Point(s) (TLPs) from either the Exchange Carrier/service provider or customer end. Values are listed in Table 3-4.

The convention for TLP Levels is as follows:

- Transmitting TLP Level signifies the TLP transmit signal level at the QWEST interface when transmitting to the customer.
- Receiving TLP Level signifies the TLP transmit signal level at the QWEST interface when receiving from the customer.

Table 3-4 NCI Transmission Levels

Transmission Level Point Code (Character Positions 11 and 12)	
Data Value	Code
-16.0	A
-15.0	B
-14.0	C
-13.0	D
-12.0	E
-11.0	F
-10.0	G
-9.0	H
Fractional TLPs	I
-8.0	J
-7.0	K
-6.0	L
-5.0	M
-4.0	N
None This Direction (One-way Service)	O
-3.0	P
-2.0	Q
-1.0	R
0.0	S
+1.0	T
+2.0	U
+3.0	V
+4.0	W
+5.0	X
+6.0	Y
+7.0	Z
QWEST Specified	-
Recommended	(Blank)

Further information about NCI Codes may be found in ANSI T1.223-1997.

### 3.2.3 Available Network Channel Interface Codes

Tables 3-5 through 3-7 list a summary of NCI codes (positions 3 and 4) and options (positions 7, 8 and 9) valid for EELs at different locations. The full NCI codes and further information are listed in the appropriate chapter later in this publication. See the listed QWEST Technical Publication listed in the last column for further information about the Network Interface (NI).

**Table 3-5** Summary of Available NCI Codes- CLEC End

Protocol		Definition	See QWEST PUB *
Code 3 4	Option 7 8 9		
DS		Digital Hierarchical Interface	
	15	1.544 Mbit/s (DS1) Superframe (SF) Format and Alternate Mark Inversion (AMI) per GR-342-CORE	77375
	15B	1.544 Mbit/s (DS1) SF Format and B8ZS Clear Channel Capability (CCC) per GR-342-CORE	77375
	15J	1.544 Mbit/s (DS1) Freeframing Format	77375
	15K	1.544 Mbit/s (DS1) Non-ANSI Extended Superframe (ESF) Format and AMI per GR-342-CORE	77375
	15S	1.544 Mbit/s (DS1) Non-ANSI Extended Superframe (ESF) Format and B8ZS CCC per GR-342-CORE	77375
	1K	1.544 Mbit/s (DS1) ANSI ESF and AMI per GR-342-CORE	77375
	1S	1.544 Mbit/s (DS1) ANSI ESF and B8ZS per GR-342-CORE	77375
GO		Ground Start Signaling Open-End (Switch) Function Presented by IC/CLEC at Interface to QWEST Access Service	77310
LO		Loop Start Signaling Open-End (Switch) Function Presented by the customer at Interface to QWEST Access Service	77310
QB		Manual Cross-Connect Termination with no Subrating Capability	
	11	DS1 to DS1. This code may or may not meet DS1 signal levels as specified by GR-342-CORE	77386
	33	DS3 to DS3. This code may or may not meet DS1 signal levels as specified by GR-342-CORE	77386
	LL	Fiber Cross-Connect on fiber distribution bay	77386

\* PUB titles may be found in Chapter 9.

**Table 3-6** Summary of Available NCI Codes - End-User End

Protocol		Definition	See QWEST PUB *
Code 3 4	Option 7 8 9		
DU		<b>End-User Locations</b> Digital Access Interface (at End-User location)	
	1KN	DS1, ANSI ESF, AMI, without Line Power	77375
	1KX	DS1, ANSI ESF, AMI, without Line Power, DSX-1 Interface	77375
	1SN	DS1, ANSI ESF, B8ZS, without Line Power	77375
	1SX	DS1, ANSI ESF, B8ZS, without Line Power, DSX-1 Interface	77375
	AN	DS1, Freeframing Format per PUB 41451	77375
	AX	DS1, Freeframing Format per PUB 41451, DSX-1 Interface	77375
	BN	DS1, SF Format and AMI, without Line Power	77375
	BX	DS1, SF Format and AMI, without Line Power, DSX-1 Interface	77375
	CN	DS1, Non-ANSI ESF, AMI, without Line Power	77375
	CX	DS1, Non-ANSI ESF, AMI, without Line Power, DSX-1 Interface	77375
	DN	DS1, SF with B8ZS, without Line Power	77375
	DX	DS1, SF with B8ZS, without Line Power, DSX-1 Interface	77375
	SN	DS1, Non-ANSI ESF Format with B8ZS, without Line Power	77375
SX	DS1, Non-ANSI ESF Format with B8ZS, DSX-1 Interface	77375	
GS		Ground Start Signaling Closed-End (Station) Function Presented by IC/CLEC or End-User at Network Interface (NI) to QWEST Access Service	77310
LS		Loop Start Signaling Closed-End (Station) Function Presented by the Customer at NI to QWEST Access Service	77310
RV		Reverse Battery (Trunk Signaling) at NI	
	T	Loop Closure provided by QWEST to End-User; Battery Provided by End-User to QWEST	77310

\* PUB titles may be found in Chapter 9.

**Table 3-7** Summary of Available NCI Codes - Either End

Protocol		Definition	See QWEST PUB *
Code 3 4	Option 7 8 9		
DS		Central Office or End-User Locations Digital Hierarchical Interface	
	44	44.736 Mbit/s (DS3), M2/3 Format, 28 DS1 Channels	77324
	44A	44.736 Mbit/s (DS3), unchannelized application and C-Bit Parity. Supports a user payload of 44.210 Mbit/s per ANSI T1.107-1995	77324
	44I	44.736 Mbit/s (DS3), M2/3 Format and C-Bit Parity, 28 DS1 Channels	77324
	44R	44.736 Mbit/s (DS3), unchannelized application. Supports a user payload of 44.210 Mbit/s per ANSI T1.107-1995	77324
NO		Connects Customer to an channel for Voice Band Transmission with No Signaling Provided by QWEST	77310

\* PUB titles may be found in Chapter 9.

### 3.3 Valid Network Channel/Network Channel Interface Combinations

Valid combinations of NC and NCI codes are included in the appropriate chapter.

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## 4. DS0/Voice EEL/LMC Services

### 4.1 General

The Enhanced Extended Loop (EEL) and Loop Mux Combination (LMC) services are available at the DS0-analog voice grade level. This chapter includes descriptive information about these loops, including valid Network Channel (NC) ~~and Network Channel Interface (NCI) Codes~~, Network Channel Interface (NCI) Codes, and their valid combinations. References to other publications are included to further describe these services.

Henceforth, in this document DS0-analog voice grade EEL/LMC loops will be referred to as voice grade EEL/LMC loops. The voice grade EEL- is available in a point-to-point configuration. Both EEL and LMC voice grade loops may be connected to a DS1 multiplexer.

### 4.2 DS0-Analog Voice Grade EEL/LMC

The voice grade EEL/LMC loops are voiceband analog channels similar to the voice grade services described in PUB 77310, *Private Line Voice Grade Analog Channels for Access Service*. Only options listed in this document are available with EEL and LMC.

CLECs desiring other options listed in PUB 77310 should order the appropriate Voice Grade Access Service from the appropriate tariff.

Usable frequencies are nominally 300 to 3000 Hz. Four signaling options are available. They include Loop Start, Ground Start, Reverse Battery, and No Signaling.

#### 4.2.1 Loop Start Signaling

EEL/LMC with Loop Start Signaling are based on the Voice Grade 2 (VG2) in PUB 77310. This EEL/LMC is suitable for the access segment of voice line-type switched special service circuits such as Plain Old Telephone Service (POTS) circuits. The service is suitable for the station or closed-end at the End-User.

The valid NC code is LC-. The valid NCI code at the End-User Network Interface (NI) is 02LS2. Several NCI codes are valid at the CLEC NI including DS0/voice, DS1 and DS3 level interfaces. These codes, and their valid combinations, are summarized the Tables 4-1 through 4-3.

#### 4.2.2 Ground Start Signaling

EEL/LMC with Ground Start Signaling are based on the Voice Grade 3 (VG3) in PUB 77310. This EEL/LMC is suitable for the access segment of voice, Private Branch Exchange (PBX) trunk-type circuits. The service is suitable for the closed-end at the End-User.

The valid NC code is LD-. The valid NCI code at the End-User Network Interface (NI) is 02GS2. Several NCI codes are valid at the CLEC NI including DS0/voice, DS1 and DS3 level interfaces. These codes, and their valid combinations, are summarized the Tables 4-1 through 4-3.

### 4.2.3 Reverse Battery Signaling

EEL/LMC with Reverse Battery Signaling are based on the Voice Grade 3 (VG3) in PUB 77310. This EEL/LMC is suitable for the access segment of voice trunk-type circuits.

The valid NC code is LD--. The valid NCI code at the End-User Network Interface (NI) is 02RV2.T. Several NCI codes are valid at the CLEC NI including DS1 and DS3 level interfaces. These codes, and their valid combinations, are summarized the Tables 4-1 through 4-3.

### 4.2.4 No Signaling

EEL/LMC with no signaling are based on the Voice Grade 7 (VG7) in PUB 77310. This EEL/LMC is suitable for the access segment of many types of voiceband and voiceband data private line services.

The valid NC code is LH--. The valid NCI code at the End-User Network Interface (NI) are 02NO2 and 04NO2. Several NCI codes are valid at the CLEC NI including DS0/voice, DS1 and DS3 level interfaces. These codes, and their valid combinations, are summarized the Tables 4-1 through 4-3.

## 4.3 Technical Parameters and Options

The technical parameters of EEL and LMC loops are the same as those of the identified Voice Grade services (i.e., VG2, VG3 or VG7). The options available are those identified by the NC and NCI code combinations of Table 4-3.

Detailed Technical Parameters are in TR-NWT-000335, *Voice Grade Special Access Service - Transmission Parameter Limits and Interface Combinations*.

## 4.4 Available NC and NCI Codes

Tables 4-1 and 4-2 identify the available NC and NCI Codes respectively. The access customer in the tables is the CLEC. The access provider is QWEST.

**Table 4-1** Voice Grade EEL/LMC Loops - NC Codes

NC Code	Description
LC--	Channel Code of LC (VG-2) is suitable for the EEL/LMC portion of voice 2-point private line and switched special service circuits. Usable frequencies are nominally 300 to 3000 Hz. This service extends from a CLEC's NI to an End-User's location. The dashes denote that there are no further options.
LD--	Channel Code of LD (VG-3) is suitable for the EEL/LMC portion of voice trunk type circuit. Usable frequencies are nominally 300 to 3000 Hz. This service extends from a CLEC's NI to an End User's location. The dashes denote that there are no further options.
LH--	Channel Code of LH (VG-7) is suitable for the EEL/LMC portion of voiceband services. Usable frequencies are nominally 300 to 3000 Hz. This service extends from a CLEC's NI to an End User's location. The dashes denote that there are no further options.

**Table 4-2** Voice Grade EEL/LMC Loops - NCI Codes

NCI Code*	Description
02GO2 ** 04GO2	Ground start Signaling Open-End (switch) function presented by CLEC at interface to QWEST facilities
02GS2	Ground start Signaling Closed-End (station) function presented by End-User at interface to QWEST facilities
02LO2 ** 04LO2	Loop-Start Signaling-Open-End (switch) function presented by the customer at the interface to QWEST facilities
02LS2	Loop-Start Signaling-Closed-End (station) function presented by the customer at the interface to QWEST facilities
02NO2 ** 04NO2	Connects customer to an access service suitable for voice transmission with no signaling provided by QWEST
02RV2.T	Reverse Battery (trunk signaling) at interface. Loop closure provided by QWEST to the customer; battery provided by the customer to QWEST.

\* Transmission Level Points (TLPs) will default to QWEST specified values.

\*\* Two-wire Interfaces at the CLEC end should be avoided. The additional 4-to-2 and 2-to-4 wire conversions may degrade the signal.

#### 4.5 Valid NC/NCI Code Combinations

Table 4-3 lists valid NC and NCI code combinations. Combinations of NC and NCI codes in the same rows are compatible. For example, for the NC code LC--, the NCI code 02LS2 at the End-User NI is compatible with 04LO2, any DS1 code, or any compatible digital signal. The DS1 and DS3 codes are identified in Chapters 5 and 6, respectively.

**Table 4-3** Voice Grade EEL/LMC Loops- Valid NC/NCI Combinations

NC Code	CLEC Network Interface		End-User NCI Code
	Level	NCI Code	
LC--	DS0/voice	04LO2 02LO2 *	02LS2
	DS1	Any DS1	
LD--	DS0/voice	04GO2 02GO2 *	02GS2
	DS1	Any DS1	
	DS1	Any DS1	02RV2.T
LH--	DS0/voice	04NO2	02NO2
	DS1	Any DS1	04NO2

\* Two-wire Interfaces at the CLEC end should be avoided if the CLEC intends to transport the DS0 EEL on a derived channel. The additional 4-to-2 and 2-to-4 wire conversions may degrade the signal.

#### 4.6 Configurations Used for Multiplexed EEL/LMC Delivery

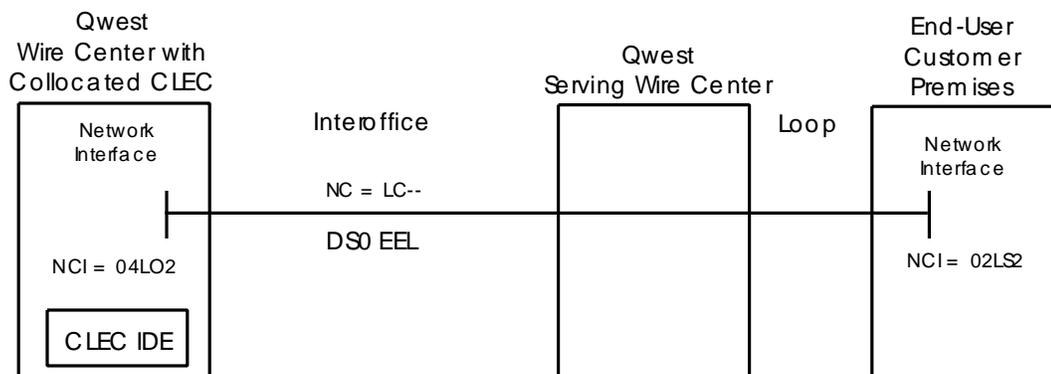
Voice grade EEL and LMC loops can be delivered to the CLEC at the DS1 level with multiplexing. The level is identified by the NCI code at the CLEC end of the EEL or LMC.

NCI codes at the DS1 level associated with voice grade EEL and LMC loops mean that the CLEC has ordered a DS1 EEL or LMC with multiplexing to transport the voice grade EEL or LMC loops. For example, if voice grade EEL/LMC loops are ordered with DS1 NCI codes, the CLEC must have already ordered a DS1 EEL or LMC with multiplexing as described in Chapter 5. The CLEC must provide a Carrier Facility Assignment (CFA) when ordering voice grade EEL or LMC loops to tell QWEST which channel on the multiplexed DS1 to place the voice grade loop.

Figure 4-1 illustrates the arrangement meeting at the DS0/voice level. The NC and NCI codes are the ones that would be used to order an analog voice grade EEL with Loop Start signaling (Section 4.2.1).

### Sample NC/NCI Code Usage for Typical EELs

#### DS0 with Loop Start Signaling Two-Point EEL



**Key**

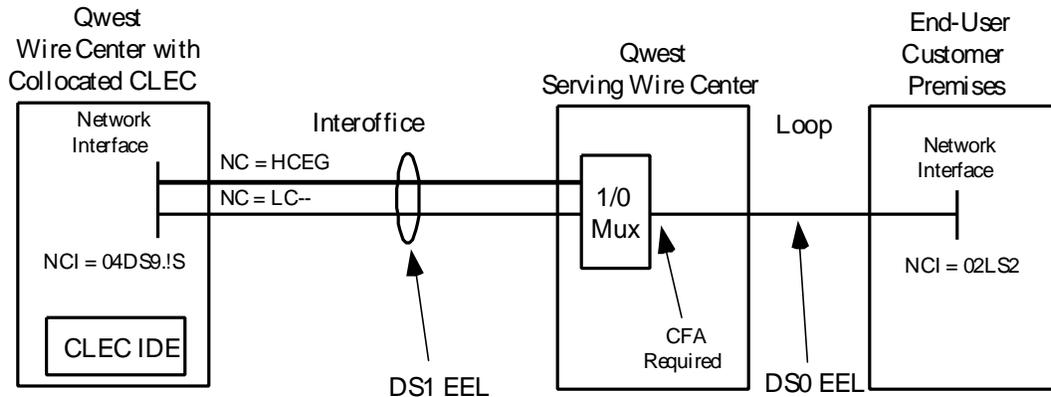
- CLEC = Competitive Local Exchange Carrier
- EEL = Enhanced Extended Loop
- IDE = Interconnector Dedicated Equipment
- NC = Network Channel
- NCI = Network Channel Interface

**Figure 4-1** Illustration of NC and NCI Code Usage - Point to Point Voice Grade EEL

Figure 4-2 illustrates DS1 arrangements (with proper NC/NCI codes) used to order ~~ana~~ voice grade EEL with Loop Start signaling (Section 4.2.1). The drawing shows a DS1 EEL with Central Office Multiplexing carrying the VG2 EEL loop. The higher level multiplexed EEL must be ordered prior to ordering the lower level EELs.

## Sample NC/NCI Code Usage for Typical EELs

### DS1 EEL with Multiplexing and DS0 with Loop Start Signaling Two-Point EEL



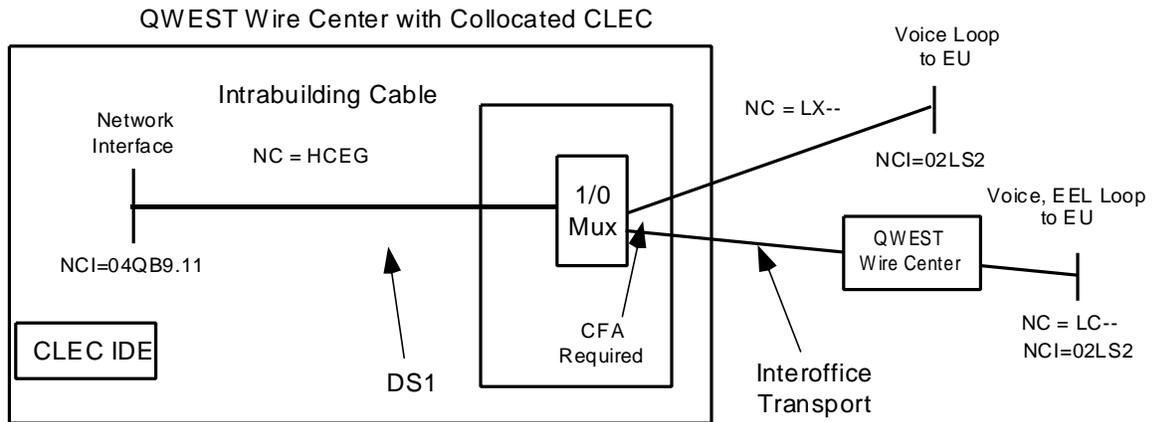
#### **Key**

- CFA = Carrier Facility Assignment
- CLEC = Competitive Local Exchange Carrier
- EEL = Enhanced Extended Loop
- IDE = Interconnector Dedicated Equipment
- Mux = Multiplexer
- NC = Network Channel
- NCI = Network Channel Interface

**Figure 4-2** Illustration of NC and NCI Code Usage - Multiplexed DS0 EEL

Multiplexed LMC with LMC loops can be used when no interoffice transport segments are needed. The LMC provides Co-providers with the ability to access end users and aggregate DS0 loops to a higher bandwidth via a DS1 multiplexer all in the same Wire Center. There is no loop or interoffice transport between the multiplexer and the collocation, Central Office NI with Loop Mux Combinations. The loops can be within the serving area of that Wire Center or distant. Figure 4-3 illustrates several applications.

### Loop Mux Combination



**Key**

- CFA = Carrier Facility Assignment
- CLEC = Competitive Local Exchange Carrier
- EU = End User
- LMC = Loop Mux Combination
- IDE = Interconnector Dedicated Equipment
- Mux = Multiplexer
- NC = Network Channel
- NCI = Network Channel Interface Code

**Figure 4-3** Illustration of NC and NCI Code Usage – LMC

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## **5. DS1 UNE Services**

### **5.1 General**

The Enhanced Extended Loop (EEL) and Loop Mux Combination (LMC) services at the DS1 (1.544 Mbit/s) level include:

- Point-to-point (loop plus interoffice) -- EEL
- Multiplexed (interoffice with multiplexing) -- EEL
- A DS1 from a Co-provider's collocation equipment to a multiplexer in the same QWEST Wire Center – LMC
- A DS1 LMC/EEL loop connected to a DS3 multiplexed LMC/EEL facility.

Configurations are discussed in Chapter 2. The DS1 Unbundled Network Element (UNE) Combinations of EELs and LMCs may be ordered by a Competitive Local Exchange Carrier (CLEC).

Technical parameters for these DS1 UNEs are described in PUB 77200, *QWEST DS1 Service and Rate Synchronization Service*, and PUB 77375, *1.544 Mbit/s Channel Interfaces*.

DS1 EELs and LMCs are available with various line codes and frame formats. The NC and NCI code lists in the remainder of this chapter identify available options. The above two publications should be consulted for further information about these codes and formats.

### **5.2 Point-To-Point DS1 EELs**

Figure 2-1 illustrates the basic concept of the point-to-point EEL. This section lists the options available with the EEL.

#### **5.2.1 Network Channel (NC) Codes**

Table 5-1 lists the valid NC codes for the point-to-point DS1 EEL

**Table 5-1** DS1 Point-to-Point EEL - Valid NC Codes

Network Channel  Code	Channel Description *	
	Frame Format	Line Code
HC--	SF	AMI
HCD-	ANSI ESF	AMI
HCE-	ANSI ESF	B8ZS
HCF-	Non-ANSI ESF	AMI
HCG-	Non-ANSI ESF	B8ZS
HCJ-	Free Framing	B8ZS
HCZ-	SF	B8ZS

\* HC is described as a High Capacity DS1 (1.544 Mbit/s) Channel

Key: AMI = Alternate Mark Inversion  
 ANSI =American National Standards Institute  
 B8ZS = Bipolar 8 Zero Substitution  
 ESF = Extended Superframe  
 SF = Superframe

### 5.2.2 Network Channel Interface (NCI) Codes

Table 5-2 lists the valid NCI codes for the point-to-point DS1 EEL

The “DS” NCI codes in the table provides a standard “Templated” ANSI signal (or as defined in GR-342-CORE). The “QB” NCI code may not provide the same signal. The level is determined by the arrangement in specified wire centers. See PUB 77386, Chapter 16 for further information.

**Table 5-2 DS1 Point-to-Point EEL - Valid NCI Codes**

Description		NCI Code	
Frame Format	Line Code	CLEC End *	End-User End**
SF	AMI	04DS9.15 04QB9.11	04DU9.BN 04DU9.BX
ANSI ESF	AMI	04DS9.1K 04QB9.11	04DU9.1KN 04DU9.1KX
ANSI ESF	B8ZS	04DS9.1S 04QB9.11	04DU9.1SN 04DU9.1SX
Non-ANSI ESF	AMI	04DS9.15K 04QB9.11	04DU9.CN 04DU9.CX
Non-ANSI ESF	B8ZS	04DS9.15S 04QB9.11	04DU9.SN 04DU9.SX
Free Framing	B8ZS	04DS9.15J 04QB9.11	04DU9.AN 04DU9.AX
SF	B8ZS	04DS9.15B 04QB9.11	04DU9.DN 04DU9.DX

\* DS is defined as a Digital Hierarchical Interface. Per GR-54-CORE.  
04QB9.11 is defined as Manual Cross-Connect Termination with no Subrating Capability, DS1 to DS1.

\*\* DU is defined as a Digital Access Interface. The N denotes without line Power. Per GR-54-CORE

### 5.2.3 Valid NC and NCI Code Combinations

Table 5-3 lists the valid NC and NCI code Combinations for the point-to-point DS1 EEL

**Table 5-3** Valid DS1 Point-to-Point EEL NC/NCI Combinations

NC Codes	Frame Format & Line Code	CLEC Network Interface		End-User NCI Code
		Level	NCI Code **	
HC--	SF & AMI	DS1	04DS9.15 04QB9.11	04DU9.BN 04DU9.BX
		DS3	Any DS3	
HCD-	ANSI ESF & AMI	DS1	04DS9.1K 04QB9.11	04DU9.1KN 04DU8.1KX
		DS3	Any DS3	
HCE-	ANSI ESF & B8ZS	DS1	04DS9.1S 04QB9.11	04DU9.1SN 04DU9.1SX
		DS3	Any DS3 with CCC*	
HCF-	Non-ANSI ESF & AMI	DS1	04DS9.15K 04QB9.11	04DU9.CN 04DU9.CX
		DS3	Any DS3	
HCG-	Non-ANSI ESF & B8ZS	DS1	04DS9.15S 04QB9.11	04DU9.SN 04DU9.SX
		DS3	Any DS3 with CCC*	
HCJ-	Free Framing	DS1	04DS9.15J 04QB9.11	04DU9.AN 04DU9.AX
		DS3	Any DS3 with CCC*	
HCZ-	SF & B8ZS	DS1	04DS9.15B 04QB9.11	04DU9.DN 04DU9.DX
		DS3	Any DS3 with CCC*	

\* CCC means DS1 Clear Channel Capability (i.e., with B8ZS).

\*\* See Chapter 6 for DS3 NCI code definitions.

Key: AMI = Alternate Mark Inversion  
ANSI = American National Standards Institute  
B8ZS = Bipolar 8 Zero Substitution  
ESF = Extended Superframe  
SF = Superframe

### 5.3 Multiplexed DS1 EEL and LMC

Multiplexed DS1 EEL or LMC is available with the same line code and frame format options as the point-to-point EEL with the exception of the Free Framing frame format. Free Framing is not available with multiplexing.

The multiplexer located in the QWEST wire center will be a 24 channel D4-type of channel bank commonly used in the industry. The multiplexer will be externally synchronized to a source traceable to a Stratum I clock as discussed in PUB 77386.

### 5.3.1 NC Codes

Table 5-4 lists the valid NC codes for the DS1 multiplexed EEL or LMC.

**Table 5-4** DS1 Multiplexed EEL/LMC - Valid NC Codes

Network Channel  Code	Channel Description *	
	Frame Format	Line Code
HC-G	SF	AMI
HCDG	ANSI ESF	AMI
HCEG	ANSI ESF	B8ZS
HCFG	Non-ANSI ESF	AMI
HCGG	Non-ANSI ESF	B8ZS
HCZG	SF	B8ZS

\* HC is described as a High Capacity DS1 (1.544 Mbit/s) Channel. The G in the fourth position denotes a multiplexer for voice or data.

Key: AMI = Alternate Mark Inversion  
 ANSI = American National Standards Institute  
 B8ZS = Bipolar 8 Zero Substitution  
 ESF = Extended Superframe  
 SF = Superframe

### 5.3.2 NCI Codes

Table 5-5 lists the valid NCI codes for the DS1 multiplexed EEL and LMC.

**Table 5-5** DS1 Multiplexed EEL/LMC - Valid UNE Codes

Description		NCI Code CLEC End *
Frame Format	Line Code	
SF	AMI	04DS9.15 04QB9.11
ANSI ESF	AMI	04DS9.1K 04QB9.11
ANSI ESF	B8ZS	04DS9.1S 04QB9.11
Non-ANSI ESF	AMI	04DS9.15K 04QB9.11
Non-ANSI ESF	B8ZS	04DS9.15S 04QB9.11
SF	B8ZS	04DS9.15B 04QB9.11

\* DS is defined as a Digital Hierarchical Interface. Per GR-54-CORE  
QB is defined as Manual Cross-Connect Termination with no Subrating Capability.

Key: AMI = Alternate Mark Inversion  
ANSI = American National Standards Institute  
B8ZS = Bipolar 8 Zero Substitution  
ESF = Extended Superframe  
SF = Superframe

### 5.3.3 Valid NC and NCI Code Combinations

Table 5-6 lists the valid NC and NCI code Combinations for the Multiplexed, point-to-point DS1 EEL

**Table 5-6** Valid DS1 Multiplexed UNE NC/NCI Combinations

NC Codes	Frame Format & Line Code	CLEC Network Interface		End-User NCI Code
		Level	NCI Code **	
HC-G	SF & AMI	DS1	04DS9.15 04QB9.11	Not Used
		DS3	Any DS3	
HCDG	ANSI ESF & AMI	DS1	04DS9.1K 04QB9.11	Not Used
		DS3	Any DS3	
HCEG	ANSI ESF & B8ZS	DS1	04DS9.1S 04QB9.11	Not Used
		DS3	Any DS3 with CCC*	
HCFG	Non-ANSI ESF & AMI	DS1	04DS9.15K 04QB9.11	Not Used
		DS3	Any DS3	
HCGG	Non-ANSI ESF & B8ZS	DS1	04DS9.15S 04QB9.11	Not Used
		DS3	Any DS3 with CCC*	
HCZG	SF & B8ZS	DS1	04DS9.15B 04QB9.11	Not Used
		DS3	Any DS3 with CCC*	

\* CCC means DS1 Clear Channel Capability (i.e., with B8ZS).

\*\* See Chapter 6 for DS3 NCI code definitions.

Key: AMI = Alternate Mark Inversion  
ANSI = American National Standards Institute  
B8ZS = Bipolar 8 Zero Substitution  
ESF = Extended Superframe  
SF = Superframe

## 5.4 EEL and LMC Loops

### 5.4.1 NC Codes

Table 5-7 lists the valid NCI codes for the DS1 multiplexed EEL and LMC.

**Table 5-7** DS1 EEL and LMC Loops - Valid NC Codes

Network Channel  Code	Channel Description *	
	Frame Format	Line Code
HC--	SF	AMI
HCD-	ANSI ESF	AMI
HCE-	ANSI ESF	B8ZS
HCF-	Non-ANSI ESF	AMI
HCG-	Non-ANSI ESF	B8ZS
HCJ-	Free Framing	B8ZS
HCZ-	SF	B8ZS

\* HC is described as a High Capacity DS1 (1.544 Mbit/s) Channel

Key: AMI = Alternate Mark Inversion  
ANSI = American National Standards Institute  
B8ZS = Bipolar 8 Zero Substitution  
ESF = Extended Superframe  
SF = Superframe

#### 5.4.2 NCI Codes

**Table 5-8** DS1 EEL and LMC Loops - Valid NCI Codes

Description		NCI Code	
Frame Format	Line Code	CLEC End	End-User End**
SF	AMI	Any DS3	04DU9.BN 04DU9.BX
ANSI ESF	AMI	Any DS3	04DU9.1KN 04DU9.1KX
ANSI ESF	B8ZS	Any DS3 with CCC*	04DU9.1SN 04DU9.1SX
Non-ANSI ESF	AMI	Any DS3	04DU9.CN 04DU9.CX
Non-ANSI ESF	B8ZS	Any DS3 with CCC*	04DU9.SN 04DU9.SX
Free Framing	B8ZS	Any DS3 with CCC*	04DU9.AN 04DU9.AX
SF	B8ZS	Any DS3 with CCC*	04DU9.DN 04DU9.DX

\* CCC means DS1 Clear Channel Capability (i.e., with B8ZS).

\*\* See Chapter 6 for DS3 NCI code definitions.

\*\*\* DU is defined as a Digital Access Interface. The N denotes without line Power. Per GR-54-CORE

### 5.4.3 NC and NCI Code Combinations

**Table 5-9** Valid DS1 EEL and LMC Loops NC/NCI Combinations

NC Codes	Frame Format & Line Code	CLEC Network Interface		End-User NCI Code
		Level	NCI Code **	
HC--	SF & AMI	DS3	Any DS3	04DU9.BN 04DU9.BX
HCD-	ANSI ESF & AMI	DS3	Any DS3	04DU9.1KN 04DU8.1KX
HCE-	ANSI ESF & B8ZS	DS3	Any DS3 with CCC*	04DU9.1SN 04DU9.1SX
HCF-	Non-ANSI ESF & AMI	DS3	Any DS3	04DU9.CN 04DU9.CX
HCG-	Non-ANSI ESF & B8ZS	DS3	Any DS3 with CCC*	04DU9.SN 04DU9.SX
HCJ-	Free Framing	DS3	Any DS3 with CCC*	04DU9.AN 04DU9.AX
HCZ-	SF & B8ZS	DS3	Any DS3 with CCC*	04DU9.DN 04DU9.DX

\* CCC means DS1 Clear Channel Capability (i.e., with B8ZS).

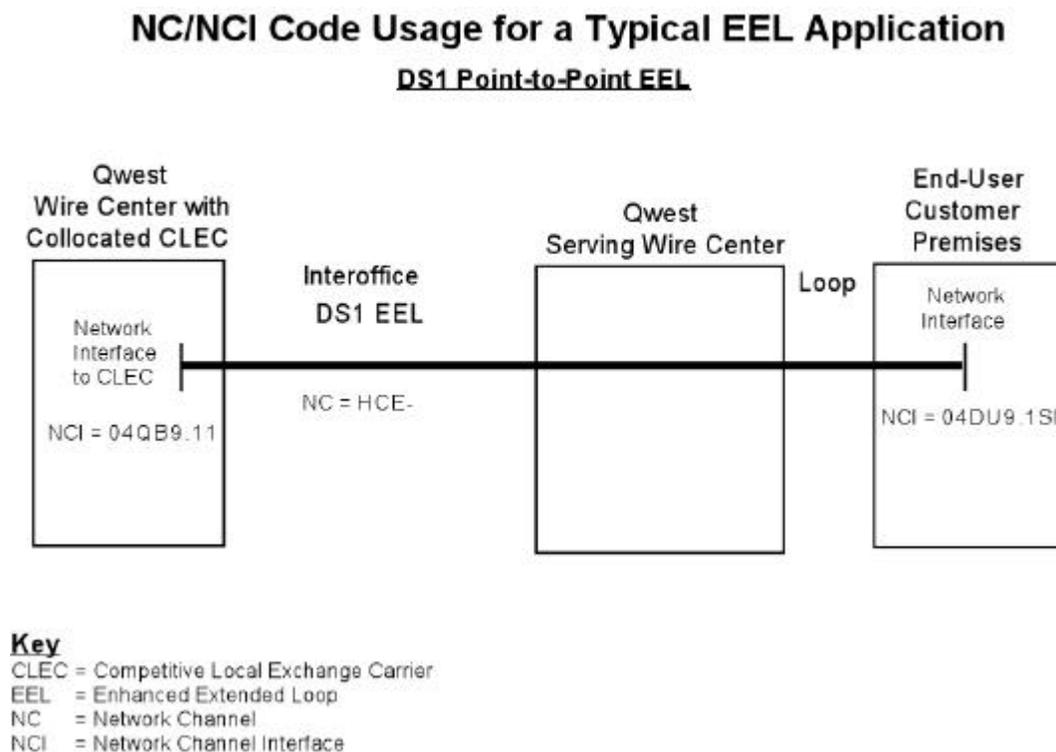
\*\* See Chapter 6 for DS3 NCI code definitions.

Key: AMI = Alternate Mark Inversion  
ANSI = American National Standards Institute  
B8ZS = Bipolar 8 Zero Substitution  
ESF = Extended Superframe  
SF = Superframe

### 5.5 Typical Configurations Used for EEL and LMC Applications

DS1 EELs can have many configurations to meet CLEC needs. They can be delivered to the CLEC at the DS1 or DS3 level. A basic DS1 EEL is a Point-to-Point DS1 using interoffice and loop facilities.

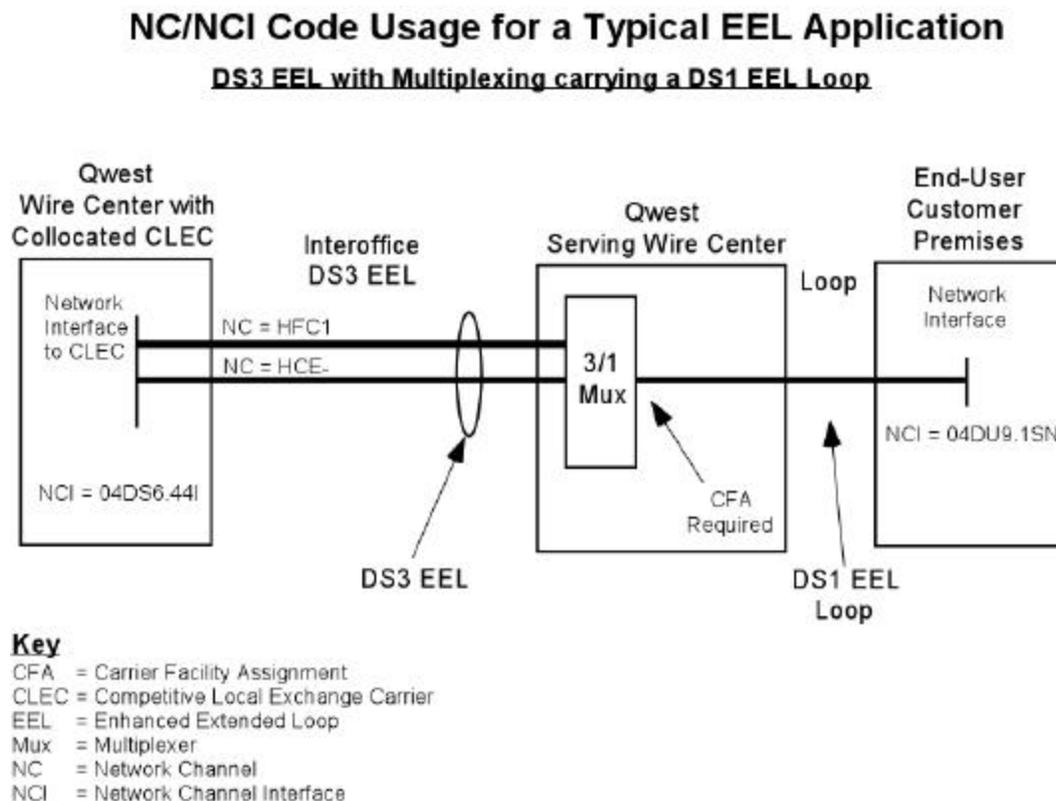
Figure 5-1 illustrates a Point-to-Point DS1 EEL with ESF and B8ZS.



**Figure 5-1** Illustration of NC and NCI Code Usage – Point-to-Point DS1 EEL

NCI codes above the DS1 level encountered with DS1 EEL-/LMC loops communicate that the CLEC has ordered a DS3 EEL or LMC with multiplexing to carry the DS1 EEL/LMC loop. For example, if DS1 EEL-or LMC loops are ordered with DS3 NCI codes, the CLEC must have already ordered a DS3 EEL or LMC with multiplexing as described in Chapter 6. The CLEC must provide a Carrier Facility Assignment (CFA) when ordering the DS1 EEL/LMC loop to tell QWEST which channel on the multiplexed DS3 to place the DS1.

Figure 5-2 illustrates a typical DS3 arrangement (with proper NC/NCI codes) used to order a DS1 EEL with ESF and B8ZS. The DS3 EEL has C-Bit parity.

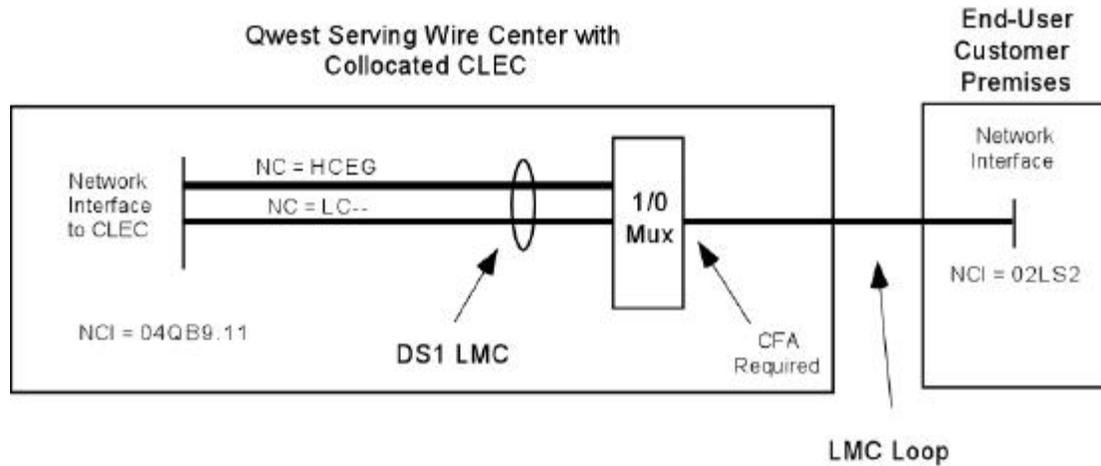


**Figure 5-2** Illustration of NC and NCI Code Usage - DS1 on Multiplexed DS3 EEL

A Multiplexed DS1 LMC consists of a DS1 from a CLEC's collocation equipment in the same Serving Wire Center as the DS1 to Voice multiplexer. Figure 3 illustrates this situation.

## NC/NCI Code Usage for a Typical EEL Application

### DS1 EEL with Loop Mux Combination

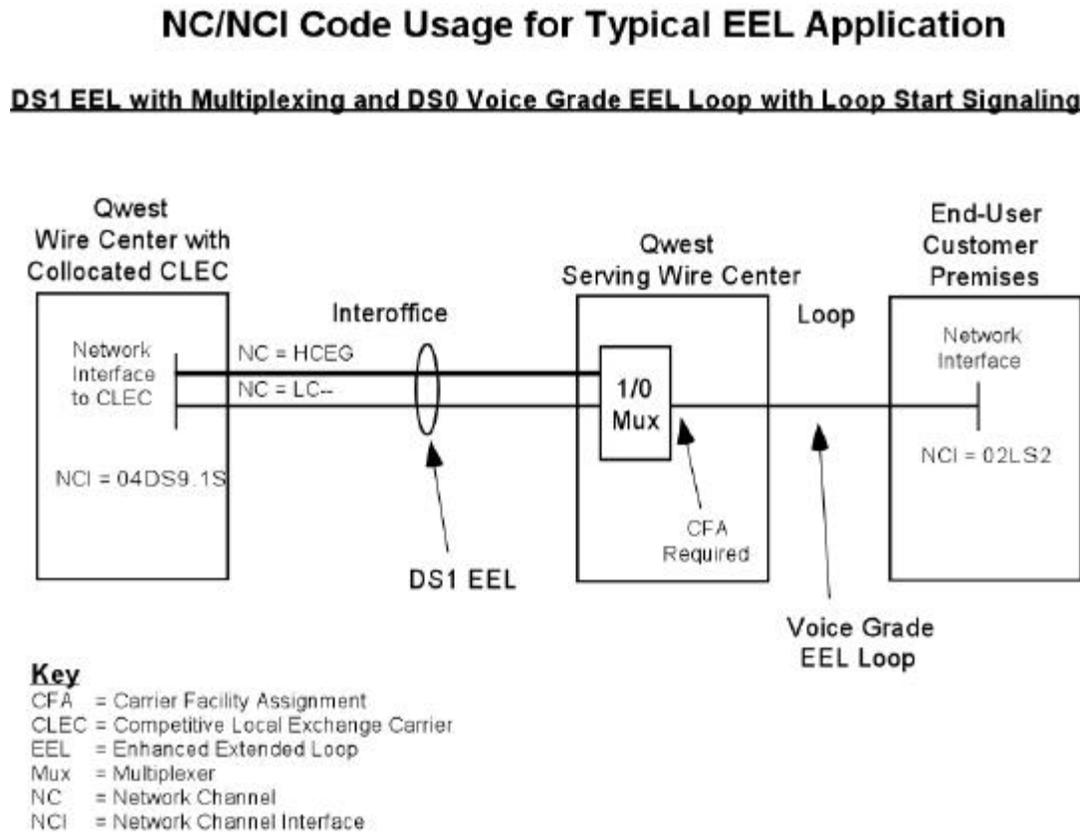


**Key**

- CFA = Carrier Facility Assignment
- CLEC = Competitive Local Exchange Carrier
- EEL = Enhanced Extended Loop
- LMC = Loop Mux Combination
- Mux = Multiplexer
- NC = Network Channel
- NCI = Network Channel Interface

**Figure 5-3** Illustration of NC and NCI Code Usage - DS1 Loop Mux Combination.

A DS1 EEL with interoffice segments and multiplexing to DS0/Voice is another available configuration. It is shown in Figure 5-4.



**Figure 5-4** Illustration of NC and NCI Code Usage – DS0/Voice on Multiplexed DS1 EEL

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## 6. DS3 UNE Combination Services

### 6.1 General

The Enhanced Extended Loop (EEL) and Loop Mux Combination (LMC) services at the DS3 (44.736 Mbit/s) level include:

- Point-to-point (loop plus interoffice) -- EEL
- Multiplexed (interoffice with multiplexing) -- EEL
- A DS3 from a Co-provider's collocation equipment to a multiplexer in the same QWEST Wire Center -- LMC

Configurations are discussed in Chapter 2. The DS3 Unbundled Network Element (UNE) Combinations of EELs and LMCs may be ordered by a Competitive Local Exchange Carrier (CLEC).

Technical parameters for these DS3 UNE Combinations are described in PUB 77324, *QWEST DS3 Service*.

DS3 UNE Combinations are available with various frame format applications. The NC and NCI code lists in the remainder of this chapter identify available options. The above publication should be consulted for further information about these codes and formats.

### 6.2 Point-to-Point DS3 EELs

Figure 2-1 illustrates the basic concept of the point-to-point EEL. This section lists the options available with the EEL.

#### 6.2.1 Network Channel (NC) Codes

Table 6-1 lists the valid NC codes for the point-to-point DS3 UNE

**Table 6-1** DS3 Point-to-Point EEL - Valid NC Codes

Network Channel Code	Channel Description *
HF--	DS3 M-Frame structured signal. It may or may not be channelized with the M2/3 Multiplex format.
HFC-	DS3 M-Frame structured signal and C-Bit Parity. It may or may not be channelized with the M2/3 Multiplex format.

\* HF is described as a High Capacity DS3 (44.736 Mbit/s) Channel

#### 6.2.2 Network Channel Interface (NCI) Codes

Table 6-2 lists the valid NCI codes for the point-to-point DS3 EEL. The "DS" NCI codes in the table provide a standard "Templated" ANSI signal as defined in ANSI T1.404-1994. The "QB" NCI code may not provide the same signal. The level is determined by the arrangement in specified wire centers. See PUB 77386, Chapter 16 for further information.

**Table 6-2 DS3 Point-to-Point EEL - Valid NCI Codes**

NCI Code	Definition *
04DS6.44	44.736 Mbit/s (DS3), M2/3 Format.
04DS6.44A	44.736 Mbit/s (DS3), Unchannelized Application and C-Bit Parity. Supports a user payload of 44.210 Mbit/s per ANSI T1.107-1995.
04DS6.44I	44.736 Mbit/s (DS3) and C-Bit Parity, M2/3 Format - 28 DS1 Channels.
04DS6.44R	44.736 Mbit/s (DS3), Unchannelized Application. Supports a user payload of 44.210 Mbit/s per ANSI T1.107-1995.
04QB6.33	Manual Cross-Connect Termination with no Subrating Capability, DS3 to DS3. This code may or may not meet DS3 signal levels as specified by ANSI T1.102. (See PUB 77386, Chapter 16, for further information.)

\* Note: This Table reflects recently approved NCI code changes and will not match other documents until those documents are updated.

### 6.2.3 Valid NC/NCI Combinations

Table 6-3 lists the valid NC/NCI code combinations for DS3 point-to-point EELs.

**Table 6-3 DS3 Point-to-Point EEL - Valid NC/NCI Combinations**

Network Channel Code	Network Channel Interface Code	
	CLEC End	End-User End
HF--	04DS6.44 04DS6.44R 04QB6.33 *	04DS6.44 04DS6.44R
HFC-	04DS6.44I 04DS6.44A 04QB6.33 *	04DS6.44I 04DS6.44A

\* See PUB 77386, Chapter 16 for further information.

### 6.3 Multiplexed DS3 EEL

The Multiplexed DS3 EEL will connect to DS1 EEL Loops. The DS1 ports on DS3 EEL Multiplexer are EEL available with the same line code and frame format options as DS1 point-to-point EELs. See Table 6-4 for DS1 line code options. However, not all options are available in all locations.

The multiplexer located in the QWEST wire center will be a 28 channel multiplexer or equivalent device as commonly used in the industry. The multiplexer will be externally synchronized to a source traceable to a Stratum I clock as discussed in PUB 77386.

### 6.3.1 NC Codes

Table 6-4 lists the valid NC codes for the DS3 multiplexed ELL.

**Table 6-4** DS3 Multiplexed EEL Valid NC Codes

Network Channel Code	Channel Description
HF - 4	M2/3 Multiplex Format, Multiplexer can be optioned for four (4) DS1 Clear Channels at a time using B8ZS Line Code
HF - 7	M2/3 Multiplex Format, Multiplexer can be optioned for seven (7) DS1 Clear Channels at a time using B8ZS Line Code
HF - M	M2/3 Multiplex Format (DS1 Clear Channel Capability optioning capability not specified)
HFZM	M2/3 Multiplex Format, B8ZS is the line code for the individual DS1s riding within the DS3, Central Office Multiplexer
HFC 1	M2/3 Multiplex Format, C-Bit Parity, Multiplexer can be optioned for one (1) DS1 Clear Channel at a time using B8ZS Line Code
HFC 4	M2/3 Multiplex Format, C-Bit Parity, Multiplexer can be optioned for four (4) DS1 Clear Channels at a time using B8ZS Line Code
HFC 7	M2/3 Multiplex Format, C-Bit Parity, Multiplexer can be optioned for seven (7) DS1 Clear Channels at a time using B8ZS Line Code
HFCM	M2/3 Multiplex Format, C-Bit Parity (DS1 Clear Channel Capability optioning capability not specified)

### 6.3.2 NCI Codes

Table 6-5 lists the valid NCI codes for the DS3 multiplexed EEL.

**Table 6-5** DS3 Multiplexed EEL - Valid NCI Codes

NCI Code	Definition *
04DS6.44	44.736 Mbit/s (DS3), M2/3 Format.
04DS6.44A	44.736 Mbit/s (DS3), Unchannelized Application and C-Bit Parity. Supports a user payload of 44.210 Mbit/s per ANSI T1.107-1995.
04DS6.44I	44.736 Mbit/s (DS3) and C-Bit Parity, M2/3 Format - 28 DS1 Channels.
04DS6.44R	44.736 Mbit/s (DS3), Unchannelized Application. Supports a user payload of 44.210 Mbit/s per ANSI T1.107-1995.
04QB6.33	Manual Cross-Connect Termination with no Subrating Capability, DS3 to DS3. This code may or may not meet DS3 signal levels as specified by ANSI T1.102. (See PUB 77386, Chapter 16, for further information.)

\* Note: This Table reflects recently approved NCI code changes and will not match other documents until those documents are updated.

### 6.3.3 Valid NC/NCI Combinations

Table 6-6 lists the valid NC and NCI combinations for the DS3 Multiplexed EEL. The channel will be channelized with M2/3 Multiplex Format.

**Table 6-6** DS3 Multiplexed EEL Valid NC/NCI Combinations

Network Channel Code	Network Channel Interface Code	
	CLEC End	Multiplexed End
HF - M HF - 4 HF - 7 HFZM	04DS6.44 04DS6.44R 04QB6.33 *	Not used
HFCM HFC4 HFC7	04DS6.44A 04DS6.44I 04QB6.33 *	Not used

\* See PUB 77386, Chapter 16 for further information.

## 6.4 Loop Mux Combination DS3

The Multiplexed DS3 Loop Mux Combination will connect to DS1 LMC or EEL Loops. The DS1 ports on DS3 LMC Multiplexer are EEL available with the same line code and frame format options as DS1 point-to-point EELs. See Table 6-7 for DS1 line code options. However, not all options are available in all locations.

The multiplexer located in the QWEST wire center will be a 28 channel multiplexer or equivalent device as commonly used in the industry. The multiplexer will be externally synchronized to a source traceable to a Stratum I clock as discussed in PUB 77386.

### 6.4.1 NC Codes

Table 6-7 lists the valid NC codes for the DS3 LMC.

**Table 6-7** DS3 LMC Valid NC Codes

Network Channel Code	Channel Description
HF-4	M2/3 Multiplex Format, Multiplexer can be optioned for four (4) DS1 Clear Channels at a time using B8ZS Line Code
HF-7	M2/3 Multiplex Format, Multiplexer can be optioned for seven (7) DS1 Clear Channels at a time using B8ZS Line Code
HF-M	M2/3 Multiplex Format (DS1 Clear Channel Capability optioning capability not specified)
HFZM	M2/3 Multiplex Format, B8ZS is the line code for the individual DS1s riding within the DS3, Central Office Multiplexer
HFC1	M2/3 Multiplex Format, C-Bit Parity, Multiplexer can be optioned for one (1) DS1 Clear Channel at a time using B8ZS Line Code
HFC4	M2/3 Multiplex Format, C-Bit Parity, Multiplexer can be optioned for four (4) DS1 Clear Channels at a time using B8ZS Line Code
HFC7	M2/3 Multiplex Format, C-Bit Parity, Multiplexer can be optioned for seven (7) DS1 Clear Channels at a time using B8ZS Line Code
HFCM	M2/3 Multiplex Format, C-Bit Parity (DS1 Clear Channel Capability optioning capability not specified)

### 6.4.2 NCI Codes

Table 6-8 lists the valid NCI codes for the DS3 LMC.

**Table 6-8 DS3 LMC EEL - Valid NCI Codes**

NCI Code	Definition *
04DS6.44	44.736 Mbit/s (DS3), M2/3 Format.
04DS6.44A	44.736 Mbit/s (DS3), Unchannelized Application and C-Bit Parity. Supports a user payload of 44.210 Mbit/s per ANSI T1.107-1995.
04DS6.44I	44.736 Mbit/s (DS3) and C-Bit Parity, M2/3 Format - 28 DS1 Channels.
04DS6.44R	44.736 Mbit/s (DS3), Unchannelized Application. Supports a user payload of 44.210 Mbit/s per ANSI T1.107-1995.
04QB6.33	Manual Cross-Connect Termination with no Subrating Capability, DS3 to DS3. This code may or may not meet DS3 signal levels as specified by ANSI T1.102. (See PUB 77386, Chapter 16, for further information.)

\* Note: This Table reflects recently approved NCI code changes and will not match other documents until those documents are updated.

### 6.4.3 Valid NC/NCI Combinations

Table 6-9 lists the valid NC and NCI combinations for the DS3 LMC. The channel will be channelized with M2/3 Multiplex Format.

**Table 6-9 DS3 LMC Valid NC/NCI Combinations**

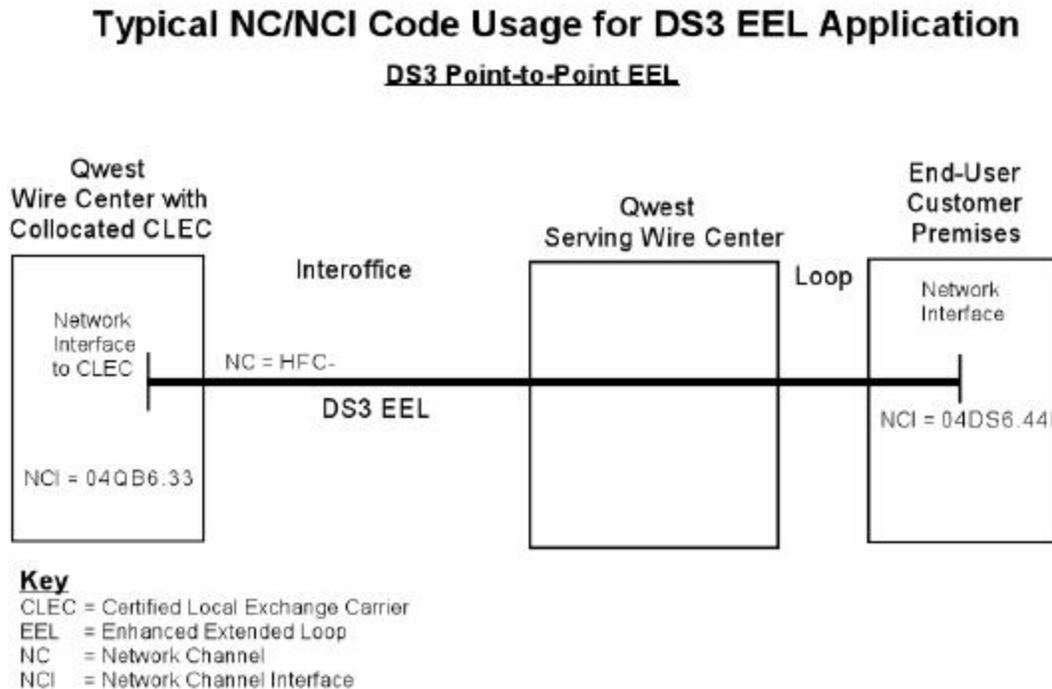
Network Channel Code	Network Channel Interface Code	
	CLEC End	Multiplexed End
HF - M HF - 4 HF - 7 HFZM	04DS6.44 04DS6.44R 04QB6.33 *	Not used
HFCM HFC4 HFC7	04DS6.44A 04DS6.44I 04QB6.33 *	Not used

\* See PUB 77386, Chapter 16 for further information.

### 6.5 Illustrative Configurations Used for EEL Delivery

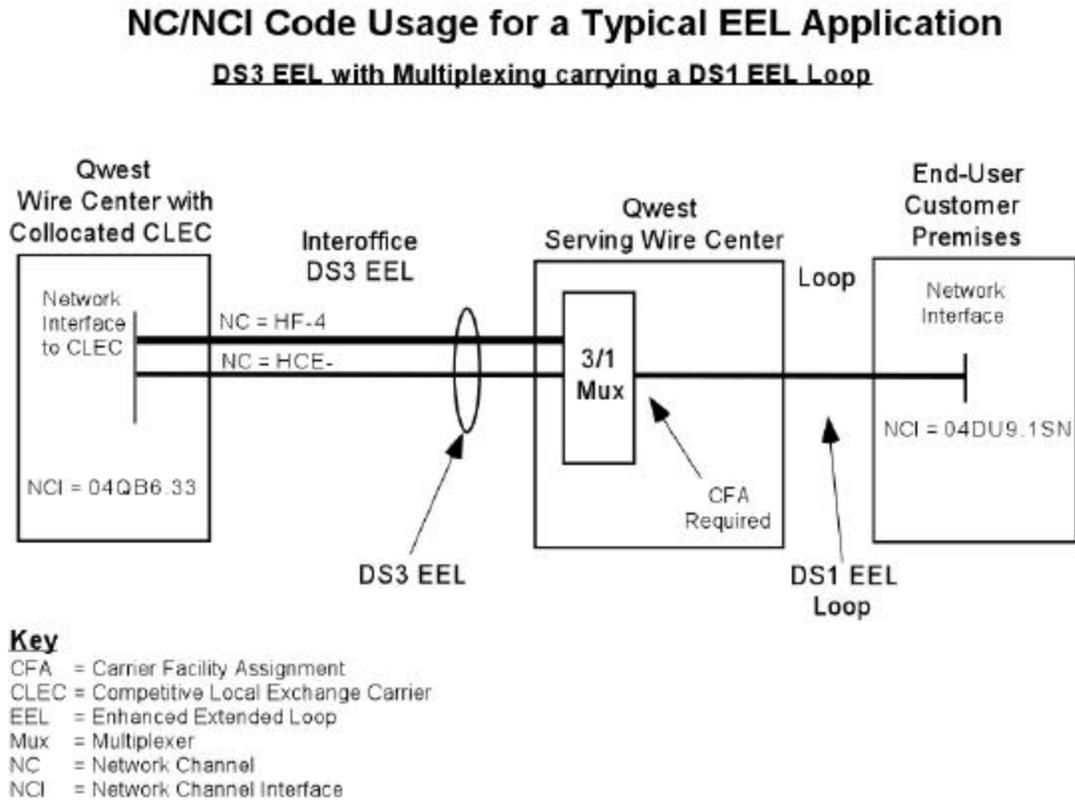
These DS3 EELs are delivered to the CLEC at the DS3 level.

Figure 6-1 illustrates a typical DS3 Point-to-Point arrangement (with proper NC/NCI codes) used to order a DS3 with C-Bit parity.



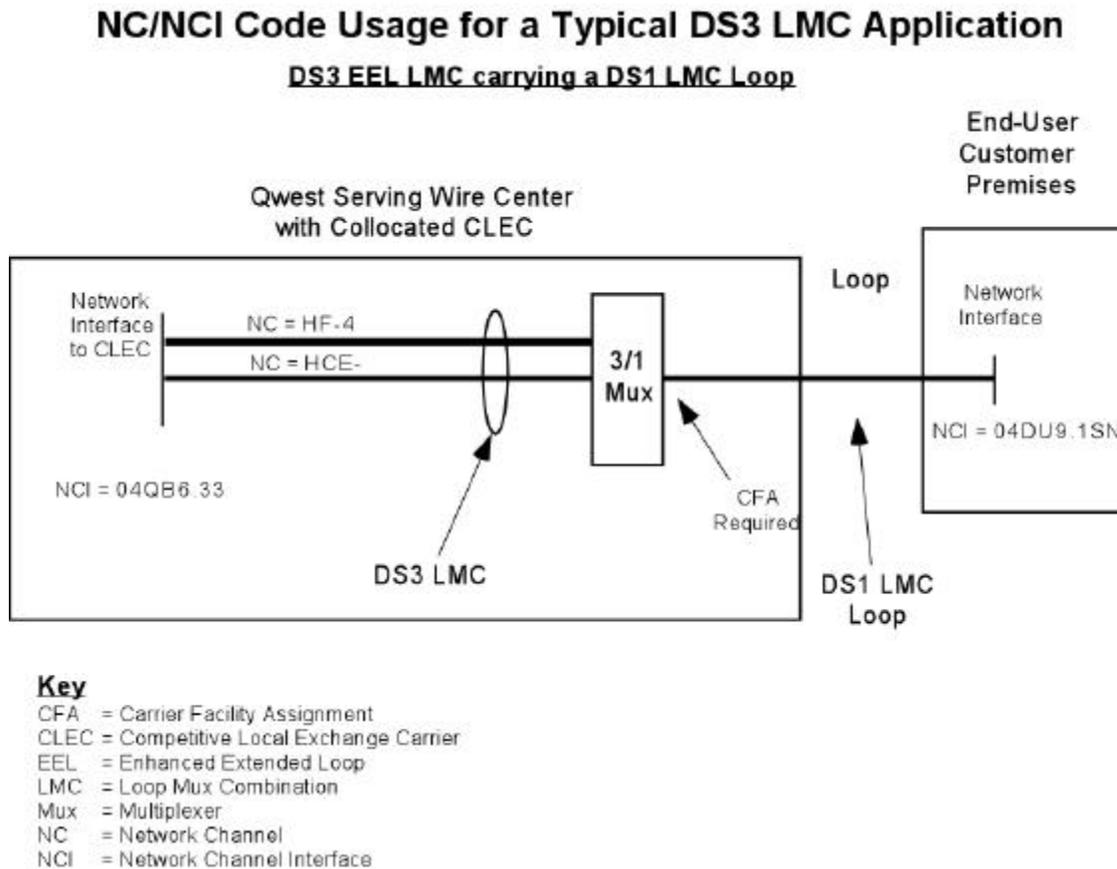
**Figure 6-1** Illustration of DS3 EEL NC and NCI Code Usage

Figure 6-2 illustrates a typical Multiplexed DS3 arrangement (with proper NC/NCI codes) used to order an M-Framed, DS3.



**Figure 6-2** Illustration of NC/NCI usage for DS3 Multiplexed EEL

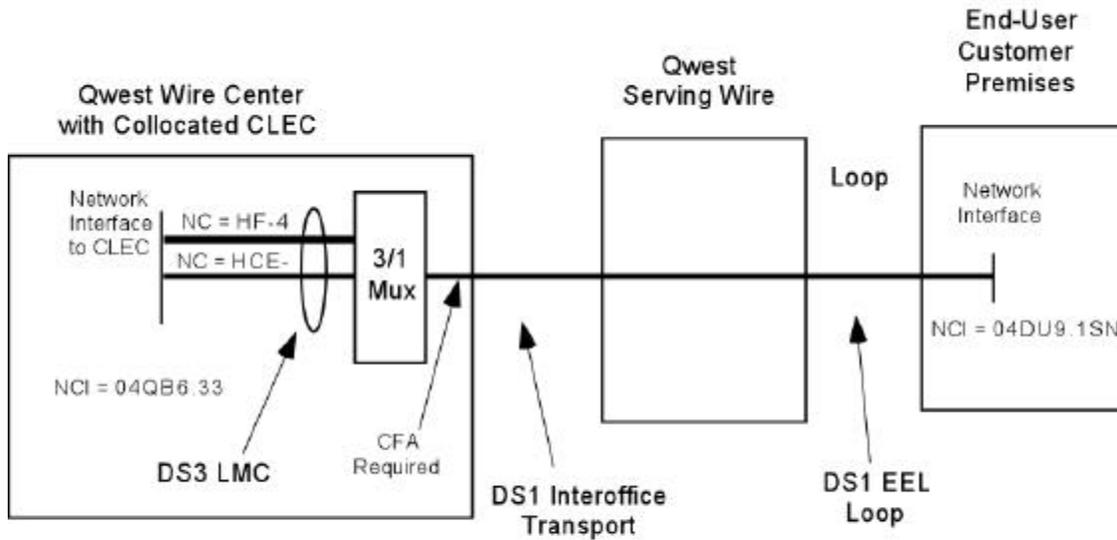
Figure 6-3 illustrates a typical LMC DS3 arrangement (with proper NC/NCI codes) used to order an M-Framed, DS3.



**Figure 6-3** Illustration of NC/NCI usage for DS3 LMC with DS1 LMC Loop

## NC/NCI Code Usage for a Typical DS3 LMC Application

### DS3 EEL LMC carrying a DS1 LMC Loop with Interoffice Transport



#### Key

- CFA = Carrier Facility Assignment
- CLEC = Competitive Local Exchange Carrier
- EEL = Enhanced Extended Loop
- LMC = Loop Mux Combination
- Mux = Multiplexer
- NC = Network Channel
- NCI = Network Channel Interface

**Figure 6-4** Illustration of NC/NCI usage for DS3 LMC and a DS1 EEL Loop

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## 7. EEL with Concentration Ability

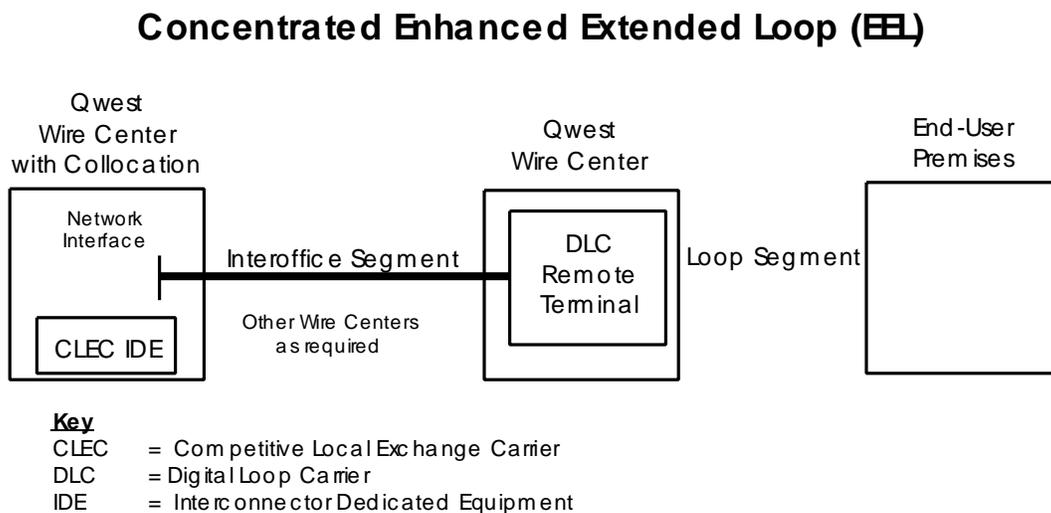
### 7.1 General

There may be situations when a Competitive Local Exchange Carrier (CLEC) is in an Enhanced Extended Loop (EEL) situation, and desires to use a Digital Loop Carrier (DLC) Remote Terminal (RT) instead of the DS1 Multiplexed (D4 compatible) EEL described in Chapter 5. For this application, QWEST offers the product *EEL with Concentration Ability*. This EEL consists of an Interoffice segment and a CLEC specified RT located in a QWEST Central Office building, also called Wire Center. Loop segments would be ordered separately, perhaps as Unbundled Loops from Technical Publication 77384.

The term *Concentration* comes from the ability of some DLC systems to concentrate channels for transport to their DLC, Central Office Terminal (COT) or Integrated DLC (IDLC) attached to their switch.

This chapter describes the EEL with Concentration Ability (EEL/C) application.

Figure 7-1 illustrates the basic arrangement.



**Figure 7-1** EEL with Concentration Ability-Concept

## **7.2 Technical Description**

Technical standards for this arrangement are primarily under CLEC control and influence. QWEST is open to work with any Standard level of transport and any customer requested equipment that is suitable for installation in a Central Office.

These standards along with appropriate Network Channel and Network Channel Interface codes will be provided in future issues of this publication as requests and installation experience provide data. Specific CLEC requests may require new Common Language codes. Any requests requiring new Codes will need additional time, beyond engineering time, to secure the new Codes.

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## 8. Definitions

### 8.1 Acronyms

AMI	Alternate Mark Inversion
ANSI	America National Standards Institute
APOT	Actual Point Of Termination
B8ZS	Bipolar with 8 Zero Substitution
CFA	Connecting Facility Assignment Carrier Facility Assignment
CLEC	Competitive Local Exchange Carrier
CLFI™	Common Language® Facility Identification
CO	Central Office
dB	Decibel
DS	Digital Signal
DS1	Digital Signal Level 1 (1.544 Mbit/s)
DS3	Digital Signal Level 3 (44.736 Mbit/s)
DS0	Digital Signal Level 0 (64 kbit/s) (1 voice channel)
DSX-1	Digital Signal Level 1 Cross-connect
DSX-3	Digital Signal Level 3 Cross-connect
EICT	Expanded Interconnection Channel Termination
ESF	Extended Super Frame
FDP	Fiber Distribution Panel
E-UDIT	Extended-Unbundled Dedicated Interoffice Transport
FOC	Firm Order Confirmation
Gbit/s	Gigabit per Second
Hz	1 Hertz (formerly 1 cycle per second)
ICDF	InterConnection Distribution Frame
IDF	Intermediate Distribution Frame
ISDN	Integrated Services Digital Network
kbit/s	kilobits per second (1,000 bit/s)
LASER	Light Amplification by Stimulated Emission of Radiation

LEC	Local Exchange Carrier
Mbit/s	Megabit per Second
NC	Network Channel
NCI	Network Channel Interface
NI	Network Interface
OC	Optical Carrier
OC-3	Optical Carrier level 1
OC-12	Optical Carrier level 12
OC-48	Optical Carrier level 48
OC-192	Optical Carrier level 192
SF	Superframe Format
SONET	Synchronous Optical Network
STS-1	Synchronous Transport Signal level 1
SWC	Serving Wire Center
TLP	Transmission Level Point
UCCRE	Unbundled Customer Controlled Rearrangement Element
UDIT	Unbundled Dedicated Interoffice Transport
UNE	Unbundled Network Element
$\mu$ f	Micro Farad

## 8.2 Glossary

### **Alternate Mark Inversion (AMI)**

A one (mark) pulse which is the opposite polarity as its predecessor.

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

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

### **Bandwidth**

The range of frequencies that contain most of the energy or power of a signal; also, the range of frequencies over which a circuit of system is designed to operate.

### **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.

### **C-Bit Parity**

An M-framed application in which the C bits are used for network management and maintenance functions instead of denoting the presence or absence of stuff bits.

### **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. It is also commonly used to refer to the building that houses the equipment. See Wire Center.

### **Competitive Local Exchange Carrier (CLEC)**

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

### **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.

**Closed-end**

The end of a switched service which transmits address signals.

**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 same customer's premises.

**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 Hierarchy Level**

The level in the digital hierarchy. The levels and the respective bit rates are:

<u>Level</u>	<u>Bit Rate</u>	<u>Level</u>	<u>Bit Rate</u>
DS0	64.0 kbit/s	DS3	44.736 Mbit/s
DS1	1.544 Mbit/s	DS4NA	139.264 Mbit/s
DS1C	3.152 Mbit/s	DS4	274.176 Mbit/s
DS2	6.312 Mbit/s		

**DS1 Clear Channel**

Denotes that 1.536 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.)

### **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.

### **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.

### **Gigabit per Second (Gbit/s)**

One billion (1,000,000,000) bits per second.

### **Impedance**

The total opposition offered by an electric circuit to the flow of an alternating current of a single frequency. It is a combination of resistance and reactance and is measured in ohms.

### **InterConnection Distribution Frame (ICDF)**

The generic name for a cross-connect frame(s) designated as the Network Interface between QWEST and a collocated Certified Local Exchange Carrier. ICDFs are generally level-specific (e.g., DS0/voice, DS1, DS3 or optical). These frames typically serve other purposes and normally will have a more specific name depending on usage in a specific location.

### **Kilobit/Second (kbit/s)**

One thousand (1000) bits/second

### **Local Exchange Carrier (LEC)**

Any company or corporation engaged for hire in providing Access and intraLATA communications services.

### **Loop**

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

### **Loop Signaling**

Loop signaling uses a DC path, or loop, to convey address and supervisory signaling information.

### **Meet Point**

A meet point is a point of interconnection between two networks, designated by two telecommunications carriers, at which one carrier's responsibility for service begins and the other carrier's responsibility ends.

### **Meet Point Interconnection Arrangement**

A meet point interconnection arrangement is an arrangement by which each local exchange carrier builds and maintains its network to a meet point.

### **Megabit per Second (Mbit/s)**

One million (1,000,000) bits per second

### **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.

### **Ohm**

The unit of electric resistance.

### **Open-end**

The end of a switched service from which dial tone is drawn.

### **Optical Carrier (OC)**

Optical carrier; the nomenclature for the line rate of the optical transmission signal described in this document.

### **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 of the Network Channel Interface [NCI] Code) is a two-character alpha code that defines requirements for the interface regarding signaling and transmission.

### **Signaling**

The transmission of information to establish, monitor, or release connections and/or provide Network Control.

## **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 (OC-1) level. Other rates, defined as OC-n where n=3, 12, 24, 48, or 192.

### **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.

### **Transmission Level Point (TLP)**

A point in a transmission system at which the ratio, usually expressed in decibels, of the power of a test signal at that point to the power of the test signal at a reference point, is specified. For example, a zero transmission level point (0 TLP) is an arbitrarily established point in a communication circuit to which all relative levels at other points in the circuit are referred.

### **Wire Center**

A building in which one or more central offices, used for the provision of local exchange services, are located. Also, see Central Office.

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## 9. References

### 9.1 American National Standards Institute Documents

- ANSI Technical Report 60                    *Unbundled Voicegrade Analog Loops*), July 1999 -
- ANSI T1.102-1993 (R 1999)                    *Telecommunications - Digital Hierarchy - Electrical Interfaces*
- 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.*
- ANSI T1.401-1993                    *Telecommunications - Interface between Carriers and Customer Installations - Analog Voicegrade Switched Access Lines Using Loop-Start and Ground-Start Signaling.*
- ANSI T1.403-1995                    *Telecommunications - Carrier to Customer Installation, DS1 Metallic Interface*
- ANSI T1.404-1994                    *Telecommunications - Carrier-to-Customer Installation-DS3 Metallic Interface Specifications*
- ANSI T1.417-2001                    *Telecommunications – Spectrum Management for Loop Transmission Systems*
- ANSI T1.510-1999                    *Telecommunications - Network Performance Parameters for Dedicated Digital Services -- Specifications*
- ANSI T1.514-2001                    *Telecommunications - Network Performance Parameters for Dedicated Digital Services -- SONET Bit Rates*
- ANSI T1.601-1992                    *Telecommunications - Integrated Services Digital Network (ISDN) Basic Interface for Use on metallic Loops for Application on the Network Side of the NT (Layer 2 Specification).*
- ANSI/IEEE 820-1984 (Reaffirmed 1993)                    *IEEE Standard Telephone Loop Performance Characteristics.*

### 9.2 Telcordia Documents

- MC-CL-IN-008                    Telcordia, *Common Language Network Channel and Channel Interface Codes (NC/NCI Codes)*, Issue 1, April 2001.
- GR-1089-CORE                    Telcordia, *Electromagnetic compatibility and Electrical Safety Generic Criteria for Network Telecommunications Equipment.*

- TR-NWT-000393     *Generic Requirements ~~For~~for Isdn Basic Access Digital Subscriber Lines.*  
January 1991.
- TR-NWT-000397     *Basic Access Transport System Requirements.* Issue 3, December 1993.

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- PUB 77200      *Qwest DSI Service and Qwest DSI Rate Synchronization Service.*  
Issue E, December 1998.
- PUB 77310      *Private Line Voice Grade Access Service.* Issue B, October 1998.
- PUB 77324      *Qwest DS3 Service.* Issue C, April 1993.
- PUB 77346      *Qwest Synchronous Service Transport.* Issue G, January 2001.
- PUB 77375      *1.544 Mbit/s Channel Interfaces.* Issue D, October 1995.
- PUB 77384      *Qwest Local Interconnection Service - Unbundled Loop.*  
Issue I, June 2001.
- PUB 77386      *Interconnection and Collocation for Transport and Switched Unbundled  
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