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Technical Publication

QWEST Basic Video Dialtone Service

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NOTICE

This publication describes the common network interfaces that are required to interconnect facilities and equipment across the QWEST Basic Video Dialtone network in the Omaha Trial area. Included are descriptions of the interface between the interactive video service provider and the video dialtone network for transporting service information, as well as the interface for the distribution of these services from the video dialtone network to the end-user.

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CONTENTS

Chapter and Section **Page**

CONTENTS (Continued)

Chapter and Section **Page**

Figures

Tables

1. Introduction

1.1 Purpose

This document describes QWEST Basic Video Dialtone (BVDT) Service offered by QWEST Communications, Inc. for the Omaha Trial service area. It covers distinguishing service features, technical specifications and defines valid interfaces.

1.2 Reason For Reissue

This technical publication is being reissued for the following reasons:

a) Addition of a new digital interface for using 9-Quadrature Partial Response (QPR) modulation technique for special program material, shown in Network Disclosure No. 176, dated 8-1-94.

b) Changes in network interfaces shown in Network Disclosure No. 217, dated 4-19-95. The radio frequency bands have been expanded.

c) Various editorial changes in the document.

1.3 Scope

Throughout this document, the QWEST Basic Video Dialtone Service shall be referred to as BVDT.

This publication describes the common network interfaces that are required to deploy transport facilities across the BVDT network. Included are descriptions of the interface specifications between the video programmers, information providers and enhanced video providers **(hereafter referred to as "provider")** and the BVDT network for transporting service information, as well as the requirements for the distribution of these services from the BVDT network to the end-user. For this service, the term end-user refers to the subscriber of the BVDT Service.

Information is transported from the provider to a central reception and distribution point, commonly referred to as the QWEST Level 1 Gateway. The information is a combination of video, audio, private data, and network control data. BVDT Service is capable of supporting both traditional broadcast and cable television programming as well as enhanced pay-per-view, video-on-demand, and interactive services through the use of analog video technology and compressed digital technology.

2. Description of Service

2.1 Applicability of Technical Specifications

The technical specifications presented in this document are applicable to QWEST Basic Video Dialtone (BVDT) Service for the Omaha Trial service area. It does not attempt to describe the transmission equipment used to provide this service.

2.2 General

It should be noted that the communications described in this document are common to a passband architecture. This design takes advantage of modulated Radio Frequency (RF) carriers to combine several types of modulation schemes, contention techniques, and transport protocols over one shared medium. Critical to the understanding of this process is the concept of forward and reverse path signaling. The RF spectrum is split into two separate and distinct directional communication pathways. The reverse path is the spectrum reserved for communication from end-users on the shared network to the centralized control area commonly referred to as the QWEST Level 1 Gateway. Forward path signaling is the spectrum reserved for communication from the QWEST Level 1 Gateway to the multiple end-users of the shared medium. The two communication pathways are separated by a guard band where no communication is carried in order to eliminate interference.

This publication describes the common network interfaces that are required to deploy transport facilities across the BVDT network. Included are descriptions of the interface between the providers and the BVDT network for transporting service information, as well as the interface for the distribution of these services from the BVDT network to the end-user. A general network layout and the interfaces (numbered 1 - 6) are shown on the following Figure 2-1.

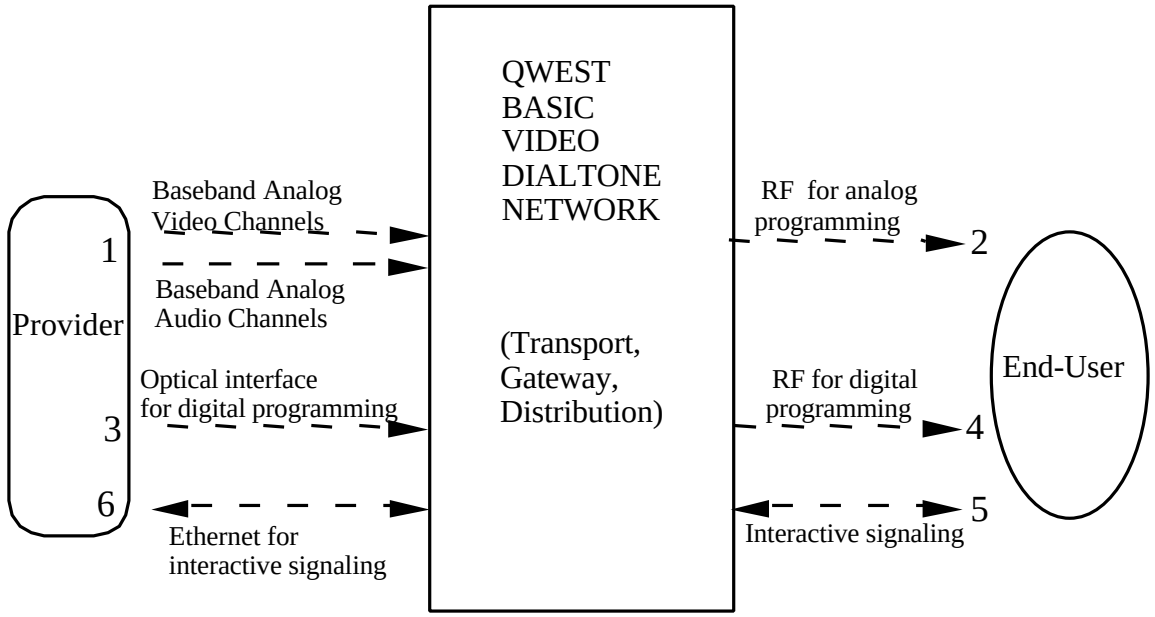


Figure 2-1 QWEST Basic Video Dialtone Service Network

BVDT provides RF spectrum to the end-user for provision of various program services. There are two sets of standard Federal Communications Commission (FCC) format signals included in the RF signal. One set of signals contains commonly used RF channels that are directly usable by an end-user's receiver. The other set of RF signals contain encoded digital programming signals. An interactive signaling channel is also provided for control by the end-user and for selection of programming.

2.2.1 Analog Channels

At the provider location QWEST will receive baseband analog video channels (Number 1) which convey a 525-line, System M-National Television Systems Committee (NTSC) color or monochrome video signals. In addition QWEST will receive two 15 KHz baseband audio signals associated with each video channel.

The baseband video and audio signals as described in the standards document EIA/TIA-250-C-1989, *Electrical Performance Standard for Television Transmission Systems*, except as described in this technical publication. The baseband video interface shall be a 1 volt peak-to-peak signal with a 75 ohm unbalanced termination. The baseband audio interface shall be a 600 ohm balanced termination for left and right channels.

The BVDT output to an end-user is a RF electrical signal (Number 2) as described in the standards document National Cable Television Association (NCTA), *Recommended Practices for Measurements on Cable Television Systems*, Second Edition, Part 1. International Standard Book Number 0-940272-17-2. The frequency range of the RF electrical signal shall be between 54 MHz and 552 MHz. The RF interface will be a 75 ohm unbalanced termination. Each RF channel occupies a 6 MHz envelope according to the FCC Standard.

Complete network interface information may be found by referring to the QWEST Network Disclosure No. 121, dated 8-1-93.

2.2.2 Digital Channels

At the provider location QWEST will receive optical signals (Number 3) conveying digitized representations of 525-line, System M-National Television Systems Committee (NTSC) color or monochrome video signals, associated audio signals and associated synchronization signals. Digital programming (Number 4) will be provided to the end-user as a result of interactive signaling (Number 5) between the end-user, QWEST BVDT network and provider. Four common interfaces will be utilized which are described as follows (and by referring to the Figure 2-1 shown previously). Complete network interface information may be found by referring to QWEST Network Disclosure No. 217, dated 4-19-95.

- Number 3: Describes the input to the QWEST Level 1 Gateway. This is a 155.520 Mbit/s Optical Signal interface transporting MPEG-2 Systems Transport Streams. The physical interface for the BVDT optical signal shall meet the specifications described for OC-3 optical interface, intermediate reach, as defined in Bellcore document TR-NWT-000253, Issue 2, December 1991, Section 4, Table 4.11, Column IR-1, *SONET Common Generic Criteria* (see References). The physical optical connector shall be a FC/PC mechanical connector. The BVDT interface layers shall be defined in Bellcore document TR-NWT-000253, Issue 2, December 1991, Section 3.3.1. The BVDT interface signal shall be synchronized from a derived Stratum 3 timing source. The performance of the Stratum 3 timing is defined in Bellcore document TA-NWT-000436, *Digital Network Synchronization Plan*. The jitter specification for the BVDT signal shall meet the requirements described in Bellcore document TR-NWT-000253, Section 5.6.1.
- Number 4: Describes the interface at the system output to the end-user. This is a 64 Level Quadrature Amplitude Modulated (QAM) electrical signal in the RF spectrum, transporting MPEG-2 Systems Transport Streams. The frequency range of the QAM electrical signal shall be 552 MHz to 686 MHz with a FCC standard 6 MHz spacing between individual QAM signals for the subsplit cable known as "Cable A." The frequency range of the QAM electrical signal shall be 152 MHz to 752 MHz with a FCC standard 6 MHz spacing between individual QAM signals for the midsplit cable known as "Cable B." The physical interface will be a 75-ohm, female F connector.

QAM is used as a means of encoding digital information over radio, wireline or fiber transmission links. The method is a combination of amplitude and phase modulation techniques. QAM is an extension of multiphase phase shift keying which is a type of phase modulation. The primary difference between the two is the lack of a constant envelope in QAM versus the presence of a constant envelope in Phase Shift Keying (PSK) techniques. The technique is used as a result of its performance with respect to spectral efficiency.

Each 6 MHz envelope of the interactive spectrum will transport the digital information to the end-user set-top terminal. 64-QAM is used for the transport of digital signals over an analog carrier. Several simultaneous video programs can reside in a single 6 MHz envelope using digital encoding of the compressed video signal. The information rate of a 64-QAM, 6 MHz envelope is 30 Mbit/s. Of the total, approximately 3 Mbit/s is used for forward error correction. The net program information rate is approximately 27 Mbit/s.

An additional digital interface will be deployed using 9-Quadrature Partial Response (QPR) modulation technique for special program material. This process is used to increase the bandwidth of QAM signaling by modulating the in-phase and quadrature channels with partial response coders.). Complete network interface information may be found by referring to Network Disclosure No. 176, dated 8-1-94.

- Number 5: Describes the signaling interface to and from the QWEST Level 1 Gateway and the end-user. This is forward and reverse path signaling utilizing differentially encoded Offset Quaternary Phase-Shift Keying (O-QPSK) modulation. The frequency range for the reverse path electrical signal will occupy 1.544 MHz in the spectrum between 5 MHz and 30 MHz in the subsplit cable known as "Cable A." The frequency range for the forward path electrical signal will be between 108 MHz and 120 MHz.
- Number 6: Describes the signaling interface to and from the QWEST Level 1 Gateway and the Provider. This is a forward and reverse path signaling utilizing Ethernet as described in Institute of Electrical and Electronic Engineers (IEEE) 802.3, *Local and Metropolitan Area Networks - Part 3: Carrier Sense Multiple Access with Collision Detection (CSM/CD) Access Method and Physical Layer Specifications.* The media access interface is as described in, *The Ethernet - A Local Area Network - Data Link Layer and Physical Layer Specifications, Version 2.0, 1982* (shown in References).

3. Network Channel (NC) and Network Channel Interface (NCI) Codes

Network Channel (NC) and Network Channel Interface (NCI) codes convey service and technical parameters. This chapter provides information about the NC shown in Section 3.2 , and the NCI shown in Section 3.1, used with QWEST Basic Video Dialtone (BVDT) Service in the Omaha Trial area. This chapter explains the codes in a general manner and then provides specific code combinations to aid in ordering transport for BVDT service, using example configurations of the analog and digital transport schemes.

The NC code defines the channel while the NCI code defines the interface at the ends of the channel. A brief explanation of the format of these codes is provided in the following sections. For a more detailed view of coding parameters, refer to the American National Standards Institute (ANSI) document T1.223-1991, *Telecommunications - Information Interchange - Structure and Representation of Network Channel (NC) and Network Channel Interface (NCI) Codes for the North American Telecommunications System.*

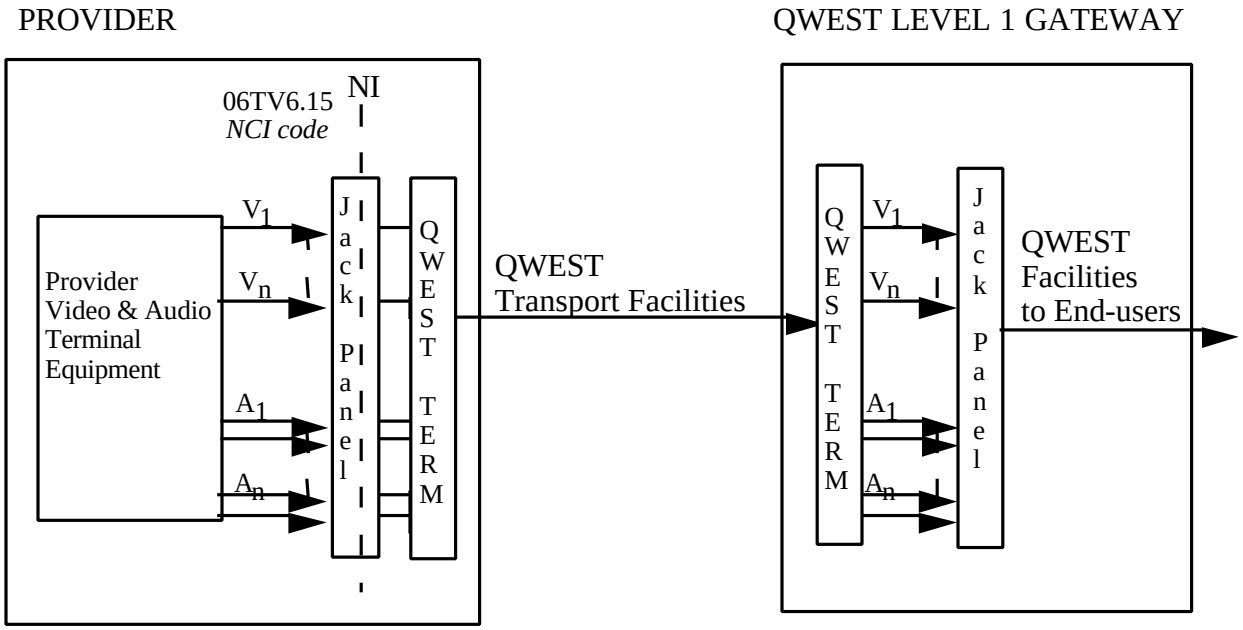
3.1 NCI Code Function

The electrical interface with the QWEST network is described by an NCI code for the provider end of the service. Signal specifications information at an interface are encoded into **NCI codes**. The interface codes for the service must be specified by the provider when ordering the BVDT transport.

The NCI code identifies four interface elements located at the Network Interface (NI). The interface elements are: (1) The number of conductors, (2) protocol, (3) impedance, and (4) protocol option. Note that by definition, there is a 5th interface element, Transmission Level Point (TLP), which is not used for this application.

3.1.1 BVDT Analog NCI Code Options

NCI coding for BVDT Analog transport identifies one interface required to provision the video and audio baseband spectrum from the provider to the QWEST Level 1 Gateway. Figure 3-1 shows the general network configuration for this interface, which is then described, in terms of coding.



V_1 - Video Channel #1
(subscript indicates channel number)
A_1 - Audio Channel for Video Channel #1
(there are 2 audio channels)
n - number of channels delivered by provider
NI - Network Interface
TERM - Terminal Equipment required for specific transport (FDM analog, digital, or baseband)
FDM - Frequency Division Multiplex

QWEST TERM equipment depends on type of transport facilities between Provider and Level 1 Gateway

Figure 3-1 QWEST Basic Video Dialtone Analog Configuration

- Baseband Video and Audio Signals, transported to the QWEST Level 1 Gateway, Figure 3-2. The provider will deliver programming required for the BVDT Network. These signals are processed for delivery over the QWEST distribution network to the end-users. These individual video signals are combined for transmission through the network.

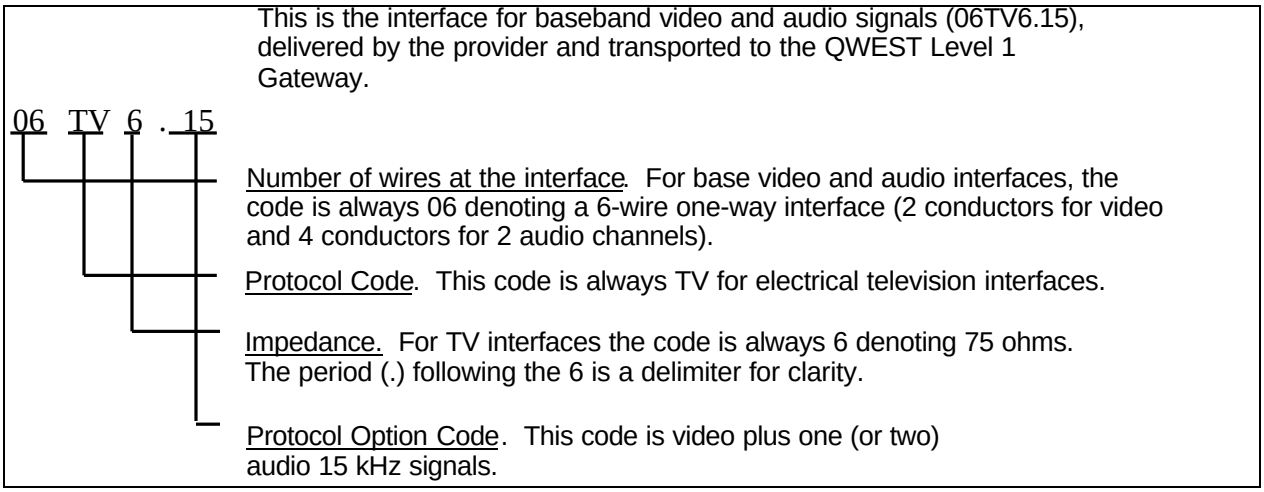
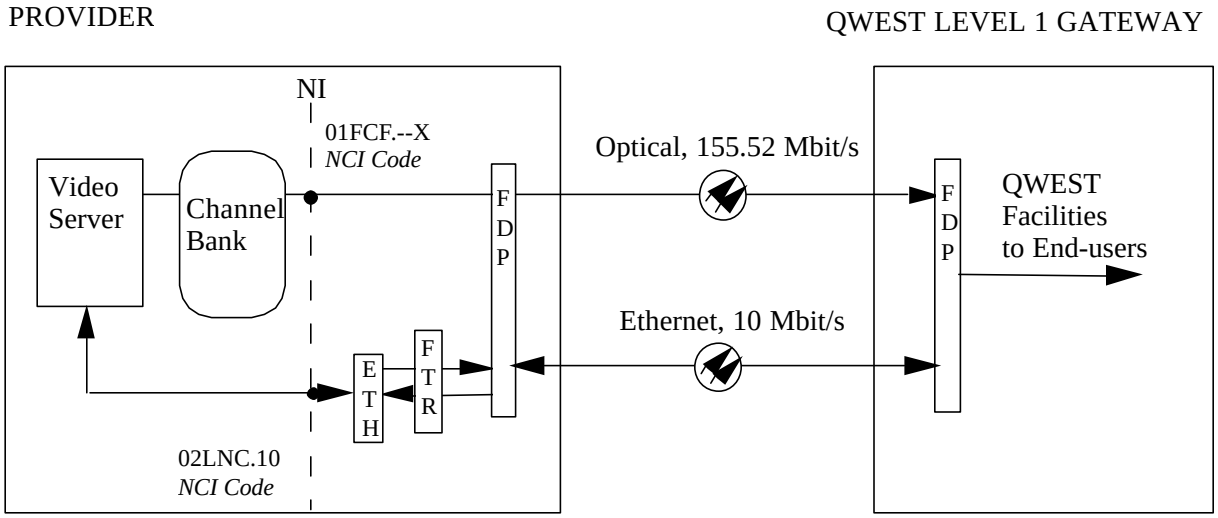


Figure 3-2 Baseband Video and Audio Signal NCI Code

3.1.2 BVDT Digital NCI Code Options

Four interfaces are utilized to provision the digital video signals from the provider to the end-user, and two actually require NCI coding for the transport facilities, shown in Figure 3-3. This provides for two-way functionality including customer selection of service, system signaling, system control and signal delivery to the end-user. Each interface is then described in terms of coding.



FDP - Fiber Distribution Panel
FTR - Fiber Transceiver Equipment
ETH - Ethernet Equipment
NCI - Network Channel Interface
NI - Network Interface

Figure 3-3 QWEST Basic Video Dialtone Digital Configuration

- A 155.520 Mbit/s Optical Signal, appearing at the provider and transported via fiber optic cable to the QWEST Level 1 Gateway, Figure 3-4. The provider will deliver programming as video, audio and data formatted in MPEG-2 Transport Streams required for the BVDT Network. These signals are processed for delivery over the QWEST distribution network to the end-users. This signal is demultiplexed into five 64 Level QAM signals.

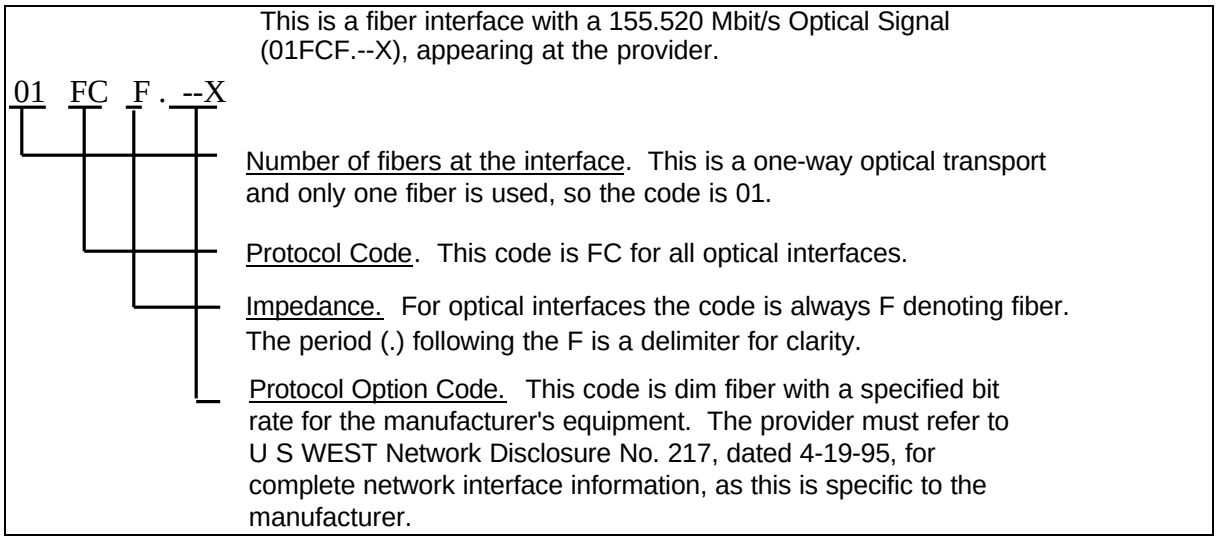


Figure 3-4 Fiber Interface with 155.520 Mbit/s Optical Signal NCI Code

- Forward and reverse path electrical signaling, two-way processing from the end-user with the QWEST BVDT Network. The end-user initiates a program request upstream to the QWEST Level 1 Gateway using QPSK signaling in the 5 MHz to 30 MHz Radio Frequency (RF) spectrum. The process is validated by a control computer and the request is forwarded via an Ethernet link to the provider for delivery of the requested program.

- Forward and reverse path Ethernet signaling, two-way processing from the QWEST Level 1 Gateway with the provider. This interface is shown in Figure 3-5.

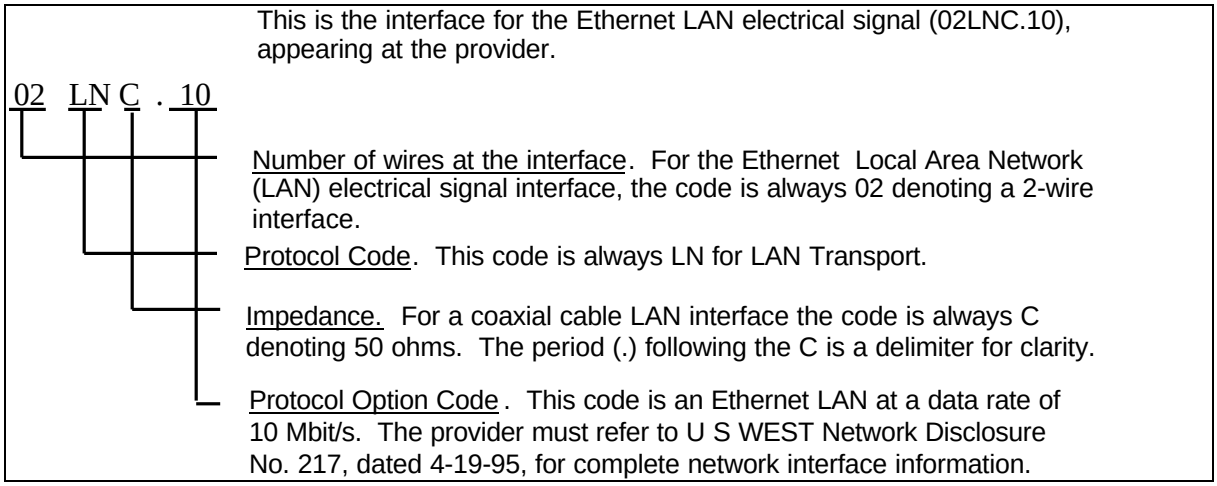


Figure 3-5 Ethernet LAN Electrical Signal NCI Code

3.2 Network Channel (NC) Codes

The BVDT Service utilizes a set of NC codes for the "provider to QWEST Level 1 Gateway" transport facilities as defined in this section. The NC code consists of four character positions as shown Table 3-1. The first two characters (positions 1 and 2) of the NC code specify the type and quality of the channel. Character positions 3 and 4 represent the option codes available for a particular NC code.

Table 3-1 QWEST Basic Video Dialtone NC Codes

NC Code			
Position			Description
1 & 2	3	4	
TZ			Private Line video service with optional audio channels
	B		Provides a full-motion, high-quality video performance channel, visually comparable to broadcast-quality transport service and up to 2 audio channels. Performance parameters are specified by QWEST.
		-	Point-to-Point Service
HO			SONET Transport Synchronous Digital High Capacity (using a manufacturer specific format)
	-		Point-to-Point Service
		M	Central Office Multiplexing (for this application, this is the QWEST Level 1 Gateway)
HM			Transparent Local Area Network (LAN) Transport, Ethernet
	-	-	Point-to-Point Service

3.3 Network Interfaces, Physical Connectors and Signals

Table 3-2 summarizes the network interfaces, physical connectors and signals required for the BVDT interfaces with the providers and end-users.

Table 3-2 Summary of Network Interfaces, Physical Connectors and Signals

Network Interface Location		Physical Connector	Signal
Provider	Jack Panel	BNC	Baseband Video
	Jack Panel	Type 310 Audio	Baseband Audio
	FDP/Splice	FC/PC	Optical 155.52 Mbit/s
	Jack Panel	BNC ThinNet	Ethernet10 Mbit/s
End-user*	Home Receiver	Female F	AM-VSB RF
	Set-top Terminal	Female F	64 Level QAM RF 9-QPR RF
	Set-top Terminal	Female F	O-QPSK RF

*Two Coaxial Cables Used

4. Performance Specifications

4.1 Baseband Video and Analog Signals

The performance specifications for a baseband video and audio signal are shown in Table 4-1 and 4-2, respectively. These specifications are required at the QWEST Level 1 Gateway. The specifications at the provider location must be determined by QWEST according to the type of transport facilities utilized for the provider.

Table 4-1 QWEST Level 1 Gateway Video Signal Transmission Channel Performance Specifications

Parameters		Standard
Amplitude response versus frequency (50-IRE-unit sine wave)		
0.5	MHz	+2.5 to -2.4 IRE units
1.0	MHz	+3.5 to -3.2 IRE units
2.0	MHz	+4.7 to -4.3 IRE units
3.0	MHz	+6.1 to -5.4 IRE units
3.58	MHz	+3.6 to -3.3 IRE units
4.2	MHz	+7.4 to -6.4 IRE units
Chrominance-to-luminance gain inequality		+7 to -7 IRE units
Chrominance-to-luminance delay inequality		+60 to -60 ns
Field-time waveform distortion		3 IRE units max. from flat
Line-time waveform distortion		2 IRE units
Short-time waveform distortion		3 %
Damped Low-Frequency Distortion (Bounce)		
Without Terminal Clamping With Terminal Clamping		35 IRE Overshoot with 5 sec settling 8 IRE Overshoot with 3-sec settling
Line-by-Line DC Offset (Piano Keying)		2 IRE units
Insertion gain and variation		
Gain		0 IRE
Variation		+5 to -5 IRE units
Luminance nonlinearity		10%
Differential gain		10%
Differential phase		3°
Chrominance-to-luminance intermodulation		4 IRE units
Chrominance nonlinear gain		5 IRE units
Chrominance nonlinear phase		5°
Dynamic gain of picture signal		6 IRE units
Dynamic gain of the synchronizing signal		2.8 IRE units
Transient synchronizing signal nonlinearity		5 IRE units
Signal-to-weighted-random-noise ratio, time base corrected (10 KHz-4.2 MHz)		47 dB
Signal-to-low-frequency-noise ratio (0-10 KHz)		43 dB
Signal-to-periodic-noise ratio (300 Hz-4.2 MHz)		57 dB

Table 4-2 QWEST Level 1 Gateway Audio Signal Transmission Channel Performance Specifications

Parameter	Standard
Amplitude response versus frequency Frequency Range	Response Limits
50 to 100 Hz	+0.5 dB to -1.0 dB
101 to 7500 Hz	+0.5 dB to -0.5 dB
7501 to 15000 Hz	+0.5 dB to -1.5 dB
Total harmonic distortion plus noise (4 sec/404 Hz/+18 dBm)	0.5%
Signal-to-noise ratio	56 dB
Insertion gain @ 400 Hz (nominal)	0 dB
Gain difference between channels	
50 to100 Hz	1.0 dB
101 to 7500 Hz	0.5 dB
7500 Hz to 15 KHz	1.0 dB
Phase difference between channels	
50 to100 Hz	=10°
101 to7500 Hz	= 3°
7501 Hz to 15 KHz	=10°
Crosstalk Coupling Loss Between Channels	
50 Hz to l5 KHz	56 dB
Audio-to-video time differential range	25 ms lead 40 ms lag

4.2 RF Electrical Signal

The system output (to the end-user) is a Radio Frequency (RF) electrical signal with the following specifications shown in Table 4-3.

Table 4-3 RF Electrical Signal Performance to End-user

Parameter	Standard
Carrier-to-Noise (C/N 4 MHz Bandwidth)	49 dB
Composite Triple Beat (CTB-Carrier to average CTB, measured on unmodulated carrier on any carrier)	-53 dB
Composite Second Order (CSO-Beat to unmodulated carrier)	-56 dB
Cross Mod (XMOD-per NCTA practice)	-53 dB

4.3 155.52 Mbit/s Optical Signal

The 155.52 Mbit/s optical signal being transported from the provider shall adhere to these specifications. The physical interface shall meet the specifications described for OC-3 optical interface, intermediate reach, as defined in Bellcore document TR-NWT-000253, Issue 2, December 1991, Section 4, Table 4.11, Column IR-1, *SONET Common Generic Criteria* (see References). The physical optical connector shall be a FC/PC mechanical connector. The interface layers shall be defined in Bellcore document TR-NWT-000253, Issue 2, December 1991, Section 3.3.1. The interface signal shall be synchronized from a derived Stratum 3 timing source. The performance of the Stratum 3 timing is defined in Bellcore document TA-NWT-000436, *Digital Network Synchronization Plan*. The jitter specification shall meet the requirements described in Bellcore document TR-NWT-000253, Section 5.6.1.

4.4 64 Level QAM Electrical Signal

The 64 Level QAM electrical signal appears at the end-user set-top terminal in an RF format with the following specifications shown in Table 4-4.

Table 4-4 64 Level QAM Electrical Signal Performance to End-user

Parameter	Standard
Carrier-to-Noise (C/N 4 MHz Bandwidth)	43 dB
Composite Triple Beat (CTB-Carrier to average CTB, measured on unmodulated carrier on any carrier)	-47 dB
Composite Second Order (CSO-Beat to unmodulated carrier)	-50 dB
Cross Mod (XMOD-per NCTA practice)	-47 dB

These minimum end-of-line requirements assume a carrier level 6 dB below the analog signals if there is analog and digital traffic on the medium.

4.5 9-QPR RF Electrical Signal

The RF level required for the 9-QPR electrical signal interface will be assigned to each provider. The end of line technical performance requirements must be met according to values shown in Table 4-5.

Table 4-5 9-QPR RF Electrical Signal Performance to End-user

Parameter	Standard
Signal-to-Interference (± 1.5 MHz center to center)	30 dB minimum
Carrier-to-Noise (C/N 3 MHz bandwidth)	22 dB
Tilt Response (3 MHz bandwidth)	± 4 dB

4.6 O-QPSK Modulated RF Electrical Signal

The Offset Quaternary Phase-Shift Keying (O-QPSK) modulated RF electrical signal appears at the end-user location for processing of end-user requests. Information regarding the performance parameters and operating levels may be found in the QWEST Network Disclosure No. 217, dated 4-19-95.

4.7 Ethernet LAN Electrical Signal

This signal appears at the provider for processing of the end-user program request. It meets the requirements outlined Institute of Electrical and Electronic Engineers (IEEE) 802.3, *Local and Metropolitan Area Networks - Part 3: Carrier Sense Multiple Access with Collision Detection (CSM/CD) Access Method and Physical Layer Specifications.* (shown in References).

5. Maintenance

5.1 Customer Responsibilities (Provider and End-User)

The customer is responsible for all equipment and cable on the customer side of the network interface at their location.

The customer or their agent must sectionalize the trouble and verify that 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 Central Office or other demarcation point may sometimes be necessary to isolate the trouble. The methods of measurement and test signals shall be derived from QWEST methods and procedures.

5.2 QWEST Responsibilities

QWEST is responsible for all equipment and cable on the QWEST side of the network interface at the customer location.

QWEST is responsible for maintaining the transmission facility between customer locations which may include an interoffice facility.

During the Omaha Trial of BVDT, it will be determined what the appropriate customer reporting procedures should be and applicable time frames for service restoral in order to maintain customer satisfaction and to minimize repair costs of QWEST.

6. Definitions

6.1 Acronyms

AM-VSB	Amplitude Modulated Vestigial Sideband
ANSI	American National Standard Institute
BER	Bit Error Rate
BVDT	Basic Video Dialtone
CO	Central Office
CSMA/CD	Carrier Sense Multiple Access with Collision Detection
CPE	Customer Provided Equipment
EFS	Error Free Second
FOT	Fiber Optic Terminal
FCC	Federal Communications Commission
FSK	Frequency Shift Keying
LAN	Local Area Network
LATA	Local Access and Transport Area
MPEG	Moving Picture Experts Group
NC	Network Channel
NCI	Network Channel Interface
NCTA	National Cable Television Association
NI	Network Interface
NTSC	National Television Systems Committee (Signal)
O-QPSK	Offset Quaternary Phase-Shift Keying
PCM	Pulse Code Modulation
POT	Point of Termination
PSK	Phase Shift Keying
QAM	Quadrature Amplitude Modulated (Signal)
QPR	Quadrature Partial Response (Signal)
RF	Radio Frequency
SONET	Synchronous Optical Network
STT	Set Top Terminal
TLP	Transmission Level Point
TLS	Transparent Local Area Network Service

6.2 Glossary

American National Standard Institute (ANSI)

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

Amplitude Modulated Vestigial Sideband (AM-VSB)

A double sideband amplitude modulated carrier signal is enhanced by bandwidth limiting and retention of the lower sideband.

Amplitude Response Versus Frequency

The amplitude response of a channel over the bandwidth provided. It is often called frequency response, and commonly is referred to as a single frequency within the passband.

Asynchronous Transmission

Not synchronous: Data transmission in which the time of occurrence of specified significant instant of a data bit (usually the leading edge) is arbitrary, and occurs without necessarily having a fixed time relationship to preceding comparable instants.

Attenuation Distortion

The change in attenuation with frequency relative to the attenuation at a reference frequency; the reference frequency is 1004 Hz unless otherwise specified.

Audio Transmission

Denotes the transmission of speech or music within the audible spectrum.

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.

Basic Video Dialtone Service, Omaha Trial

The transport of forward analog signals and/or forward or reverse path digital signals from the providers' premises to end-users in the BVDT Omaha Trial service area.

Bit (Binary Digit)

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

Bits/second (bit/s)

Bits per second, e.g., 1200 bit/s. In data transmission, it is the number of binary zero and one bits transmitted in 1 second. Modern terminology uses "bit/s" e.g., 1200 bit/s.

Bit Error Rate (BER)

The ratio of the number of bit errors to the total number of bits transmitted in a given time interval.

Carrier Sense Multiple Access with Collision Detection (CSMA/CD)

Carrier Sense Multiple Access with Collision Detection is a method of controlling access to a shared transmission path, particularly in local area networks.

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.

Channel Transmission Parameter

Denotes an objective, which expresses the performance of a one-way or two-way path.

Customers

Denotes end-users or providers in the BVDT Omaha Trial service area. Refer to these terms for complete definitions.

Customer Interface

The interface with a customer at a point of termination.

dBm

A decibel in which the reference power is one milliwatt. Decibel reference to one milliwatt.

End-User

The party subscribing to services offered by the provider or subscribing directly to QWEST for access to the network. End-users, as it relates to "passings," denotes those parties who have the opportunity to subscribe to BVDT Trial Service.

Ethernet

A packet-switched local network design (by Xerox Corp.) employing CSMA/CD as access control mechanism.

Exchange

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

Facilities

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

Fiber Optic Terminal (FOT)

The terminating or originating portion of a fiber optic system that performs both an electrical to optical conversion and a multiplexing function.

Frequency-Shift Keying (FSK)

A form of frequency modulation in which the modulating wave (often a binary signal) shifts the output frequency between predetermined values and the output wave has no phase discontinuity.

Gain/Frequency Characteristic

The change, plus or minus, in insertion loss or gain of a channel at specified frequencies.

Headroom

The difference, in dB, between the operating level and the overload level.

Insertion Loss

Insertion loss is the ratio (expressed in dB) of the power delivered to a specified load at the receiving interface by a specified source at the transmitting interface to the power delivered by the same source directly to an identical load.

Intermodulation Distortion

A measure of the nonlinearity of a channel.

Jitter

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

Line

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

Level 1 Gateway

The origination point for all signals carried on the Basic Video Dialtone network. Video program channels are received from the providers and distributed throughout the service network for use by end-users.

Local Access and Transport Area (LATA)

A geographic area for the provision and administration of communications service. It encompasses designated exchanges that are grouped to serve common social, economic and other purposes.

Local Area Network (LAN)

Network permitting the interconnection and intercommunication of a group of computers, primarily for the sharing or resources such as data storage devices and printers.

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.

NTSC (National Television Systems Committee) Signal

The standard North American television transmission signal format intended for the transmission of 525 line/60 field color or monochrome video and associated audio signals.

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 Control Signaling

The transmission of signals in the telecommunications system that perform functions such as supervision (control, status, and charge signals), address signaling (e.g. dialing), calling and called number identifications, rate of flow, service selection, error control, and audible tone signals (call-progress signals indicating reorder or busy conditions, alerting, coin denominations, coin-collect and coin-return tones) to control the operation of the telecommunications system.

Network Interface (NI)

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

Offset Quaternary Phase-Shift Keying (O-QPSK)

This is a four-phase shift keying digital modulation technique wherein the signal intervals overlap each other by 50%, which allows for a lower signal to noise ratio.

Ohm

The unit of electric resistance.

Phase Difference, Stereo

The phase difference at a given frequency between one channel of a stereo pair, used as a reference, and the other.

Phase Jitter

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

Point of Termination (POT)

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

Protocol

The rules for communication system operation which must be followed

Protocol Code

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

Provider

The party, including, but not limited to, information providers, video programmers, and enhanced video gateway providers, who orders BVDT Omaha Trial Service to transport analog or digital signals to their subscribers. The provider must be lawfully permitted to provider service in the BVDT Omaha Trial service area.

Pulse Code Modulation (PCM)

A type of modulation wherein the waveform of each channel is sampled many times per second in sequence. The amplitude of each sample is then encoded into a binary code and transmitted to the distant end where the pulse train is decoded and distributed to each channel in the exact time sequence to reproduce the original waveform of the channel.

Quadrature Amplitude Modulated (QAM)

Two carriers are modulated and then added together; one carrier is a sine wave and the other a cosine wave that are 90° apart. In order to get the appropriate signal point in this form of modulation, the X-axis is modulated by the cosine wave while the Y-axis is modulated by the sine wave. The two signals are then combined and transmitted on the carrier line.

Quadrature Partial Response (QPR)

The quadrature addition of the two partial response signals is expressed as:

$$s(t) = y_I \sin\omega_c t + y_Q \cos\omega_c t$$

The effect of the partial response coder is to produce three levels from a binary input. The resulting QPR signal llshaw1@qwest.com constellation is a 3 x 3 rectangle with nine states. QPR implementation is similar to QAM with the main differences being in the filtering and detection. After final filtering in the QPR demodulation, the *I* and *Q* baseband signals are independently detected using the partial response detection technique. 9 QPR achieves a 2-bit/s/Hz efficiency.

Return Loss

Denotes a measure of the similarity between the two impedances at the junction of two transmission paths. The higher the return loss, the higher the similarity.

Signal-To-Noise Ratio (S/N Ratio)

The ratio of the signal power to the noise power at a given point in a given system (usually expressed in decibels).

SONET

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

Synchronous Transmission

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

Transmission Path

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

Transmission Service Channel

A one-way transmission path between two designated points.

Transparent LAN Service (TLS)

A basic transport element designed to extend islands of Local Area Networks (LANs) across a limited geographic area (within a LATA and single Wire Center).

7. References

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ANSI/EIA/TIA-250-C-1989 *Electrical Performance Standard for Television Transmission Systems*, January 4, 1990.

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ANSI T1.223-1991, Telecommunications - *Information Interchange - Structure and Representation of Network Channel (NC) and Network Channel Interface (NCI) Codes for the North American Telecommunications System.*

7.2 Telcordia Technical Advisory

TA-NWT-000436 *Digital Network Synchronization Plan*, Issue 2, June 1993.

7.3 Telcordia Technical References

TR-NWT-000253 *Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria*, Issue 2, December 1991.

7.4 National Cable Television Association (NCTA) References

International Standard Book Number 0-940272-17-2 *NCTA Recommended Practices for Measurements on Cable Television Systems,* Second Edition, Part 1, October 1993.

7.5 QWEST Communications Network Disclosure Document

Network Disclosure News No. 121 *Video Dial Tone (VDT) Analog System - Broadband Network Interfaces,* August 1, 1993.

Network Disclosure News No. 176 *Video Dial Tone (VDT) Digital System - Quadrature Partial Response (QPR),* August 1, 1994.

Network Disclosure News No. 217 *Video Dial Tone (VDT) Digital System - Broadband Network Interfaces,* April 19, 1995.

7.6 Xerox Systems Institute References

The Ethernet - A Local Area Network - Data Link Layer and Physical Layer Specifications, Version 2.0, 1982 Part Number: XNS-018211

7.7 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.

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