AM-TR-NIS-000137

SERIAL COMPONENT VIDEO SERVICE INTERFACE SPECIFICATIONS

A technical description of the User/Network Interface for AT&T's Serial Component Video Service.

To: All AT&T and Vendor Community

Effective Date: September, 2007

Issue Date: Issue 4, August 31, 2007

Expires On:

Related Documents: Refer to Section 5N/A Product Management TPPE -DATS

Canceled Documents:

Points Of Contact: Wallace Murray, Area Manager Maintenance Engineering/Technical Support, 313-983-8421
Russ Lundsgaard, Sr Technical Manager, 312-845-3176
Ted Bickley, Associate Director Broadcast Services, 330-384-3238

Author(s):
Wallace Murray (2006 & 2007 update)

Table Of Contents

TECHNICAL REFERENCE NOTICE

This Technical Reference is published by AT&T to provide a technical description of the User/Network Interface for AT&T Advanced Video Service. It provides interface specifications and operating requirements as a guide for system users and vendors.

AT&T reserves the right to revise this document for any reason including, but not limited to, conformity with standards promulgated by various agencies, utilization of advances in the state of the technical arts, or the reflection of changes in the design of any equipment, techniques or procedures described or referred to herein.

AT&T MAKES NO REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO THE SUFFICIENCY, ACCURACY, OR UTILITY OF ANY INFORMATION OR OPINION CONTAINED HEREIN. AT&T EXPRESSLY ADVISES THAT ANY USE OF OR RELIANCE UPON THIS TECHNICAL REFERENCE IS AT THE RISK OF THE USER AND THAT AT&T SHALL NOT BE LIABLE FOR ANY DAMAGE OR INJURY INCURRED BY ANY PERSON ARISING OUT OF THE SUFFICIENCY, ACCURACY, OR UTILITY OF ANY INFORMATION OR OPINION CONTAINED HEREIN.

This document is not to be construed as a suggestion to any manufacturer to modify or change any of its products, nor does this document represent any commitment by AT&T or anyAT&T operating company to purchase any product, whether or not it provides the described characteristics.

AT&T does not recommend products, and nothing contained herein is intended as a recommendation of any product to anyone.

Nothing contained herein shall be construed as conferring by implication, estoppel, or otherwise any license or right under any patent, whether or not the use of any information herein necessarily employs an invention of any existing or later issued patent.

AT&T reserves the right not to offer any or all of these services and to withdraw any or all of them at any future time.

With respect to services offered pursuant to tariff, however, the terms and conditions of the service offering are determined by the tariff and applicable laws and regulations.

For further information, contact:

Information Manager, AT&T, 2000 W. AT&T Center Drive, 3A43E, Hoffman Estates, IL 60196-1025

Any questions regarding this document, please contact the APEx Help Desk at 847-248-4328.

General

This document describes the User/Network Interface Specifications for AT&T’s Serial Component Video Service (SCVS).

1. Change and Reissue

ISSUE #2 – This document is being re-issued to provide for additional network interfaces, for DS-3/compressed hand-off, and separate interfaces for analog or AES/EBU audio, machine control and time code.

ISSUE #3 – Re-issued to provide for additional interface descriptions for DVB-ASI & SDTI (SMPTE 305M), internally within the document and as an addendum at the end of the document.

ISSUE #4 – Add Audio embedding to the addendum.

2. Service Description

Serial Component Video Service is a broadband digital video transport (270 Mbps) of high quality video and audio materials. Differing formats are:

SDI 270

SDI is as defined in the Society of Motion Picture and Television Engineers (SMPTE) Standard 259M.

This interface describes a serial digital interface for system M (525/60) NTSC digital television equipment operating with 4:2:2 serial component signals. Serial Component video Service provides one-way transmission capability for transporting digital signals that conform to ANSI/SMPTE 259M-1993 serial digital video format. SCVS employs digital network facilities between customer designated premises through serving wire centers and has one or more channel termination designations. Hubbed service is also available between customer premises and an AT&T hub or switching location.

Delivery or receipt at the network interface of a serial component video signal may include multiplexed (embedded) digital audio, machine control information and time code information as created and requested by the customer.

The serial digital interface conforms to ANSI/SMPTE 259M-1993. This transport is intended to transport System M 10-Bit 4:2:2 Component Serial Digital Television information for 270 Mbps signals. The 45 Mbps (DS-3) interface is in compliance with AT&T AM TR-TMO-000101, AT&T OPTINET Digital Service Transmission Parameters, Issue 2, 1992.

When one end of the service is a 45 Mbps (DS-3) interface, the other network interface must have separate digital video, audio, machine control, and time code Channel interfaces.

SDTI 270

SDTI is defined in SMPTE 305.2M-2000 and looks like the physical layer of a SMPTE 259M signal at 270 Mbps. The data stream uses the digital television active line for the payload. Ancillary data packets defined by SMPTE 291M in the horizontal blanking interval are used to identify the payload application. Payload data rates are up to 200 Mbps for 270 Mbps SDI systems.

The transport protocol is undefined, however the payload data may be organized in fixed length or variable length blocks. The key here is that the information must be organized so that it resembles a SMPTE 259M data stream with active picture and ancillary data space which is in compliance with SMPTE 291M-1998. While SDTI may be used to carry a compressed SMPTE 292M signal, this is not the only data that can be transported. Compression of HDTV signals is not a part of this reference or service.

DVB-ASI 270

DVB-ASI is a standard 270 Mbps transport of single or multiple MPEG-2 or MPEG-4 transport streams as defined in ISO 13818-1. The customer demarcation point shall operate in accordance with European Standard, (EN 50083-9). DVB-ASI uses 8b/10b coding of each word from a lookup table before serialization and is polarity sensitive (i.e., cannot be inverted). Unlike 270 Mbps SDI signals, DVB-ASI does not contain timing reference signals (TRS) to indicate start of active video (SAV) and end of active video (EAV).

Typical use of the DVB-ASI signals is for transporting compressed HDTV at 19.38Mb transport stream (ATSC/SMPTE 310M) and in the cable market for multiple 3-4Mb MPEG program transport streams for video on demand (VOD) or trunking. For the AT&T service the customer is responsible to combine multiple MPEG-2 or MPEG-4 signals to a transport stream and encapsulate this into a 270 Mbps ASI format. The transmission specifications to be used by the AT&T service are outlined in Chapter 4, Technical Requirements, of this document. Further details can be obtained from the standards document for the respective interface.

2.1. Channel Interfaces

This service offers several different channel interfaces. The Serial Component Video Service channel interfaces are:

SDI / SDTI 270 Mbps Interface

Channel interface will receive or deliver serial digital component video signals to or from the network interface. Embedded audio, machine control, and time code will be transported.

DVB-ASI 270 Mbps Interface

The DVB-ASI signal is comprised of multiple digital video streams compressed using MPEG-2 techniques. The quality of the signals depends on the compression factor. The customer will be responsible for compression and encoding of the multiple video streams while AT&T will provide transport without making any changes to the content of the signal.

MULTIPLEXED INTERFACE

Channel interface with separate digital video, analog or AES/EBU digital audio, machine control, and time code that will receive or deliver the above signals to or from the network.

COMPRESSED INTERFACE

Channel interface that will receive or deliver DS-3 signals to or from the network. The other end of this circuit must be ordered with the interface defined directly above.

Several of the Analog Audio input/output configurations allow for interoperability with AES/EBU digital audio. For a single termination/NI, all audio must be either analog or AES/EBU digital. If the protocol option code is 20A or 20D it is permissible to mix these thus permitting analog-to/from - analog, AES/EBU - to/from - AES/EBU, and analog - to/from - AES/EBU. If the protocol option code is 15A at one end, the other end must be DS-3. The 15A protocol option code defines an audio interface on a video codec that has limited availability and is being phased out.

The digital audio channel interface (for AES/EBU) input/out configurations) for inserting/extracting embedded audio complies with AES3-1992 (ANSI S4.40-1992) Revision of AES3-1985 (ANSI S4.40-1985), “AES Recommended Practice for Digital Audio Engineering.”

2.2. Transmission Quality

A digitized video signal is defined for the purposes of Serial Component Video Service as the use of digital methods for the transmission of digital video signals from one point to another to complete a transmission service.

A digital channel termination for Serial Component Video Service transmits or receives at 270 Mbps. Customers are cautioned to verify performance of their receive CPE as some manufacturers specify other performance limits. The AT&T receive performance is based on 30 dB of loss at 135 MHz due to coaxial cable.

Serial Component Video Service provides network capability that meets the digital interface and performance objectives specified in ANSI/SMPTE 259M-1993 for SDI, SDTI as specified in SMPTE 305.2M-2000 and EN50083-9 for DVB-ASI.

Analog and digital audio signals have terminating impedance of 600 Ohms and 110 Ohms (respectively), resistive and balanced to ground.

Digital transport performance is consistent with **AM TR-TMO-000101**. Currently no active error detection and handling (EDH) is incorporated in this transport.

2.3. Circuit Architecture - Serial Component Video

SDI 270 - Serial Component Video accepts serial component digital video signals with or without multiplexed (embedded) video, audio, machine control, and time code information in one serial bit stream. Options are available to provide separate physical interfaces for digital video, analog or digital AES/EBU audio, machine control, and time code.

SCVS service can also be provided using a DS-3 video codec. In this case, only separate physical interfaces for uncompressed digital video, analog or digital AES/EBU audio, machine control, and time code are available at one end delivered via a DS-3 codec; i.e., the single embedded interface cannot be used. The other end of this circuit is a DS-3. It is possible to order two such circuits and have them cross connected at the DS-3 interface in an AT&T central office, hub, or switch location (in effect creating a hubbed version of the “separate interfaces input” -to-“separate interfaces output” service offering described in the preceding paragraph). Only one end of each such hub circuit (or any single SCVS service in general) can have a DS-3 interface. Since no single standard exists for compression, it is up to the customer to identify a compatible codec; otherwise, compatible operation cannot be guaranteed.

DVB-ASI 270 - The customer shall provide an electrically presented 270Mbps bearer with encapsulated transport streams conforming to DVB-ASI specifications under the parameters stated in EN50083-9. The physical interface parameters are as follows;

Peak-to-peak signal amplitude = 800 mV +/# 10% or a range of 720 mV to 880 mV

Maximum Rise and fall times determined between the 20% and 80% amplitude points of the waveform = 1 and 2 ns respectively

Deterministic Jitter (DJ) and Random Jitter (RJ) = 10% and 8% respectively

It should be noted that AT&T will provide a 270 Mbps transport pipe for the DVB-ASI signal. The compression, encod-

ing, and error recovery of video signals will be the customer's responsibility. TR 101 290 transport stream analysis is available to do out of service testing and some in service testing.

3. Interface Requirements

The physical interface for the 270 Mbps video signal, at both the customer originating and terminating locations, will be a telephone company provided female "BNC" connector mounted on a rack mounted panel. The "BNC" connector will have a nominal 75 Ohm impedance. This also applies to the DS-3 45 Mbps interface.

The physical interface for the multiplexed (embedded) ancillary data signals, at both the customer originating and terminating locations, will be a telephone company connector block or other suitable connector. The audio input must be specified as either analog or digital. Audio output can be either analog or digital.

3.1. Network Channel (NC) Code

The Network Channel (NC) code, as described in Telcordia (formally Bellcore) documents SR STS-000307 and SR STS-000323, is a four-character representation of the channel parameters. It consists of two data elements: 1) a two-character position that specifies the type and quality of the channel; and 2) two positions that specify an available option code for the channel type. The NC code for SCVS is described below.

NC code: **TDG**This code supports all the following service arrangements which are detailed in the Network Interface Codes.

Flexible Transport of video services including SD-SDI (SMPTE 259M), SDTI (SMPTE 305M), and DVB-ASI (Standard EN 50083-9).

3.2. Network Channel Interface (NCI) Code

The NCI code is an encoded representation used to identify five (5) interface elements located at a POT or customer location. The interface elements are: (1) Total Conductors, (2) Protocol, (3) Impedance, (4) Protocol Options, and (5) Transmission Level Point which is ignored in TV services; however, these positions are used to indicate direction of service.

THE NUMBER OF CONDUCTORS IS AS FOLLOWS:

02 for combined (embedded) video/audio/machine control/time code.

>02 for separate video/analog or digital AES/EBU audio and machine control/time code signals.*

NOTE:
Number of conductors is based on two-wire connectivity. The video is two-conductor (coax), all audio is two wires per channel, and the machine control/time code is handled as a combined service connection of four wires.

Examples:

video + four audio = 10 conductors.

Video + two audio + machine/time = 10 conductors

(Protocol Option below separates these two cases with the same number of conductors.)

THE PROTOCOL CODE IS AS FOLLOWS:

TG Flexible Video Interface, Auto-Sensing port accommodates a number of video interface types as designated in the protocol options, (The customer may change video type without notifying the provider).

DS Digital Heirarchy Interface

THE IMPEDANCE CODE IS:

6 (75 ohms)

THE PROTOCOL OPTION CODE IS AS FOLLOWS:

See Apex document number ATT-TR-NIS-000-000-003 by going to http://apex.web.att.com

THE DIRECTION OF SERVICE CAN BE ONE OF TWO OPTIONS:

O-for transmit end

-O for the receive end

Example of NCI with directionality for TGA- service follows:

Transmit End: **02TG6.A.O-**

Receive End: **02TG6.A.-O**

4. Technical Performance Objectives

General

The following specification is presented to describe the special access and local channel services that are offered by AT&T to Intra LATA customers and Inter Exchange Carriers. These services are high speed digital in nature and are suitable for the one-way transmission of 4:2:2 component 270 Mbps ANSI/SMPTE 259M signals between a customer premises or DS-3(45 Mbps) interface via appropriate codec.

4.1. Performance Objectives

Video with multiplexed (embedded) audio, machine control and time code. Component Signal Transmission 4:2:2 component serial transmission as described in ANSI/SMPTE 125M Appendix G and ANSI/SMPTE 259M

Output Impedance: 75 Ohms Unbalanced to ground (Resistive Load connected directly to output with a return loss greater than 15 dB over a frequency range of 5 MHz to 270 MHz)

Input Impedance: 75 Ohms Unbalanced to ground with a return loss greater than 15 dB over a frequency range of 5 MHz to 270 MHz

Signal Amplitude: 800 mV +/- 10% (Measured across 75 Ohm Res.)

DC Offset: 0.0V+/-0.5V (Measured at mid amplitude point of signal)

Rise and Fall Times: .75 ns to 1.50 ns +/-0.5 ns (measured between the 20% and 80% amplitude points and measured across a 75 Ohm resistive load)

Rising Edge Timing: Within +/-0.25 ns of the average timing of rising edges as determined over a period of one line

Transmission Order: Least Significant Bit (LSB) first

Coding: NRZI scrambled

Scrambling Polynomial: (NRZ) G1(X) = X E9+X E4+1

NRZI Sequence: (polarity free) G1(X) = X+1 (See ANSI/SMPTE 259M - 1993 Annex A)

Data Word Length: 10 bits

Bit Rate: 270 Mbps nominal

Ancillary Data: If present, shall be passed transparently if the conductor code ordered is 02. (see ANSI/SMPTE 272M-1994)

Embedded Audio: If present, shall be passed transparently if the conductor code ordered is 02. (see ANSI/SMPTE 272M- 1994)

The following apply if the conductor code is greater than 02:

Protocol Option 15A

Analog Audio: 15 KHz. See Telcordia (formally Bellcore) TR-TSV-000338

Issue 2, August 1993, Page 4-3, table 4-2.

WHERE MULTIPLE VALUES ARE PROVIDED, SHORT HAUL VALUES APPLY.

Protocol Options 20A/21A
Analog Audio: Up to 4 channels
Impedance: 600 Ohms balanced input and output
Freq resp: +/- 0.2 dB, 20 Hz to 20 KHz
Max steady state tone: 0 dBm
Max audio level: +18 dBm
Idle channel noise: -64 dBm0 20 Hz to 20 KHz
Signal to Noise: 82 dB
THD + Noise: 0.05%
Pre/De-emphasis: Flat
Protocol Option 20D/21D
AES/EBU Audio: Two AES/EBU streams per group (4 channels)
Mode: Stereophonic
Impedance: 110 Ohms balanced input and output
Input sampling rates: Synchronous 48 KHz (SMPTE 272M – A)
Output sampling rates: Synchronous 48 KHz (SMPTE-272M – A)

Machine control: Complies with EIA RS-422
Data rate: 38.4 Kbps
Line code: NRZ
Impedance: Per RS-422
Voltage levels: Per RS-422

NOTE: Only one direction of transmission is supported. Two circuits transmitting in opposite directions would need to be ordered for a complete control system.

SMPTE Time Code: Complies with SMPTE 12M – 1995
Embedded time codes supported
Output impedance: 50 Ohms balanced
Input impedance: 1000 Ohms balanced
Bit rate: Asynchronous less than 5000 bits per second
Frequency tolerance: +/- 100 ppm
Rise/Fall times: 40 us +/- 10 us
Amplitude distortion : 5%

DS-3 Interface: 75 Ohm Female BNC Connector
Impedance: 75 Ohm unbalanced
Framing: M23 framed
Bit rate: 44.736 MB/s

5. References

Normative References

Telcordia (formally Bellcore) SR STS-000307, NC/NCI Code Dictionary, Issue 4, February 1993

Telcordia (formally Bellcore) SR-STS-000323, NC/NCI Compatibility Guide, Issue 3, February 1993

Telcordia (formally Bellcore) GR-338-CORE, Television Special Access and Local Channel Services Transmission Parameter Limits and Interface Combinations, Issue 1, December 1995

ANSI/SMPTE 259M - 1993, Television - 10 - Bit 4:2:2 Component and 4 fsc NTSC Composite Digital Signals - Serial Digital Interface

ANSI/SMPTE 12M - 1995 for Television, Audio, and Film Time and Control Code

ANSI/SMPTE 272M - 1994 for Television - Formatting AES/EBU Audio and Auxiliary Data into Digital Video Ancillary Data Space

ANSI/SMPTE 272M - 1994 for Television - Formatting AES/EBU Audio and Auxiliary Data into Digital Video Ancillary Data Space

AES11 - 1991 (ANSI S4.44 - 1991) AES Recommended Practice for Digital Audio Engineering - Synchronization of Digital Audio Equipment in Studio Operations

AES3 - 1992 (ANSI S4.40 - 1992) AES Recommended Practice for Digital Audio Engineering - Serial Transmission Format For Two-Channel Linearly Represented Digital Audio Data

Informative References

Telcordia (formally Bellcore) GR-337-CORE, Program Audio Special Access and Local Channel Services, Issue 1 December 1995

ANSI/SMPTE 125M - 1992, Television - Component video signal 4:2:2 - Bit - Parallel Digital Interface

ANSI/SMPTE 170M - 1994, Television - Composite Analog Video Signal - NTSC for Studio Applications

ANSI/SMPTE 244M - 1993, Television - System M/NTSC Composite Video Signals - Bit - Parallel Digital Interface

ANSI/SMPTE 276M - 1995 for Television - Transmission of AES/EBU Digital Audio Signals Over Coaxial Cable

ANSI/SMPTE 291M - 1996 for Television Ancillary Data Packet and Space Formatting

SMPTE Recommended Practice RP 188 - 1996 Transmission of Time Code and Control Code in the Ancillary Data Space of a Digital Television Data Stream

TO ORDER TELCORDIA (FORMALLY BELLCORE DOCUMENTS, CONTACT:

Document Order Center, (847) 248-4324.

TO ORDER SMPTE REFERENCE DOCUMENTS, CONTACT:

Society of Motion Picture & Television Engineers

595 W. Hartsdale Avenue

White Plains, NY 10607

1-914-761-1100