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BELLSOUTH®

Spectrus® Multipoint Video Conferencing Service Operational & Performance Specifications

Technical Reference

SPECTRUS®
MULTIPOINT VIDEO CONFERENCING SERVICE
OPERATIONAL AND PERFORMANCE SPECIFICATIONS

NOTICE

This Technical Reference describes the operational and performance characteristics of Spectrus® Multipoint Video Conferencing Service (MVCS). Spectrus MVCS is a service which utilizes a Multipoint Control Unit (MCU) to provide dynamic control and enhanced management functionalities for multipoint conferencing of audiovisual terminals.

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If further information is required, please contact:

Director – Technical Standards
BellSouth Telecommunications
North W1E1
3535 Colonnade Parkway
Birmingham, AL 35243
(205) 977–7607

SPECTRUS®
MULTIPOINT VIDEO CONFERENCING SERVICE
OPERATIONAL AND PERFORMANCE SPECIFICATIONS

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SPECTRUS®
MULTIPOINT VIDEO CONFERENCING SERVICE
OPERATIONAL AND PERFORMANCE SPECIFICATIONS

1. General

This Technical Reference describes the operational and performance characteristics of Spectrus® Multipoint Video Conferencing Service (MVCS). Spectrus MVCS is a service which utilizes a Multipoint Control Unit (MCU) to provide dynamic control and enhanced management functionalities for multipoint conferencing of audiovisual terminals.

1.1 Reason for Reissue

This document is being revised to include public switched access as well as private line access to the MCU. In addition, improvements in the conference handling capabilities of the service are addressed.

2. Service Description

Spectrus Multipoint Video Conferencing Services (MVCS) is a BellSouth public network capability which provides for management and switching of connected digital coders/decoders (codecs) for audiovisual communication. Spectrus MVCS accommodates call setup and communication between any two or more audiovisual terminals with network access. It supports the establishment of simultaneous connections between three or more such terminals for multipoint audiovisual conferencing. The service is intended to satisfy needs of business and government for cost effective video conferencing. It is expected to be of particular value for distance learning applications and desktop video conferencing.

Spectrus MVCS supports audiovisual terminals which conform to ANSI T1.800.01−1995. The service will support the number of terminals, conferences and users per conference as depicted in Section 8 of this document. The service can also be expanded to support additional conferences and terminals by cascading MCU's. All terminals interconnected in a single conference must operate at the same line transfer rate. This service will operate with multiple audio coding algorithms per ITU−T Recommendations G.711, G.722, G.728.

Spectrus MVCS operates in accordance with The ANSI Standards as listed in Section 12. The particular capabilities which the service supports are described in this document. Spectrus MVCS audiovisual conferences may be held in either voice activated, chairman, or broadcast mode.

Spectrus MVCS can support audiovisual access through any digital transport service which accommodates the requisite minimum bandwidth and format specifications. MVCS will be offered through existing Tariffed transport services (e.g., AccuPulse® (Switched 56 kbit/s Service), ISDN BRI & PRI, MegaLink®, LightGate® and through High Capacity Digital Access). Customer−controlled routing and multiplexing with these services are supported through FlexServ®. Interested customers should consult their marketing representative for current availability.

Some of the capabilities described in this document may not be available initially. It is suggested that the customer consult a marketing representative for current status. The tariff should be referred to when ordering this service.

3. Service Architecture

Spectrus MVCS provides for the establishment of two point or multipoint connections between accessible customer−owned audio−visual terminals. The end−to−end service consists of one or more multipoint conferencing devices with switching capability; transport services connecting the conferencing devices to user locations; and management functions provided over a dial−up line or internet through which the customer schedules conferences. Control and management of the conference is accomplished with in−band control signals. An essential part of the network, the devices which encode and decode audio and video signals to and from the digital form required for transmission over the BellSouth Telecommunications Network, **must be provided by the customer as CPE**.

Spectrus MVCS is a shared network service utilizing the capabilities depicted in Figure 1. The heart of Spectrus MVCS is the audio−visual switching and conferencing device known as the multipoint control unit (MCU). The MCU enables video−conferencing among multiple sites to simulate a single meeting. Figure 1, illustrates the role of the MCU in the architecture of an end user's videoconferencing network.

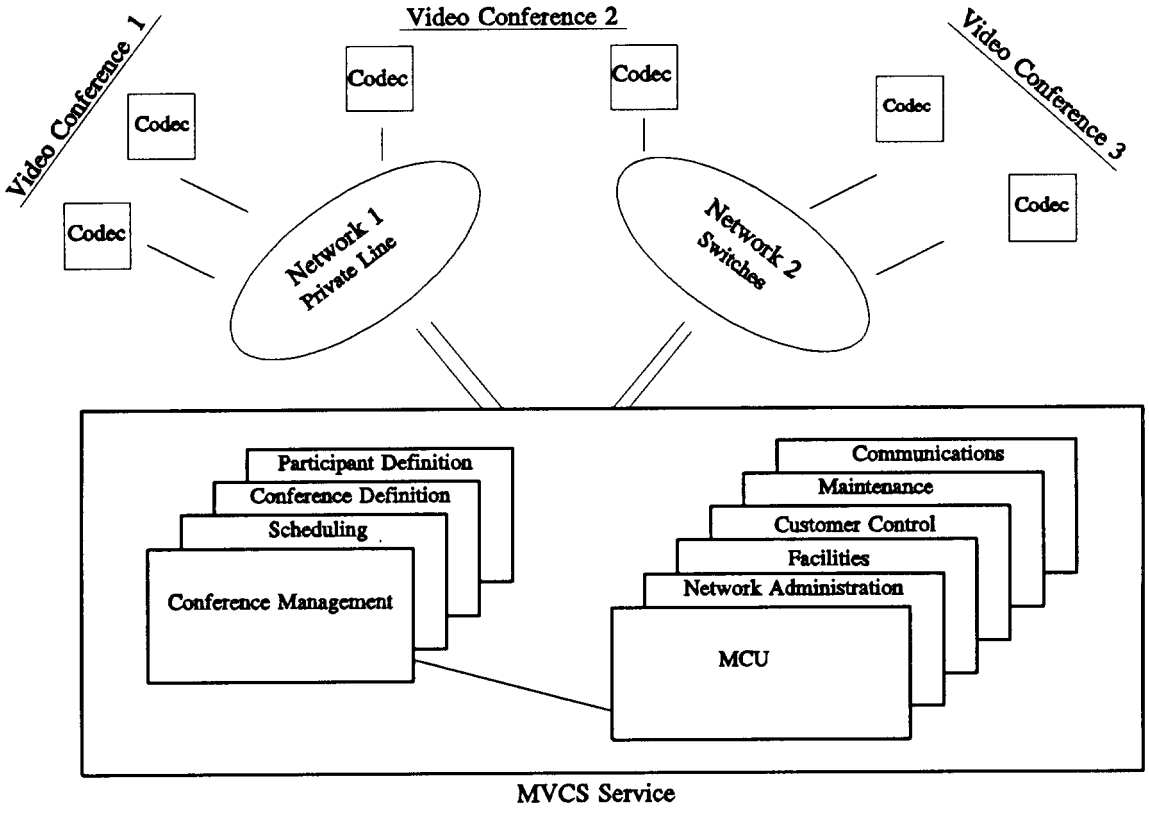

Figure 1 − Multipoint Video Conference Network Architecture

The MCU provides for termination of digital transport facilities; for extraction of encoded and multiplexed audio and video signals; for audio sampling and mixing; and for switching of video based either on user command or on the audio. The MCU operates in accordance with the ANSI Standards as listed in Section 12.1. The MCU is located in a centralized wire center to ensure minimization of transport costs and maximize efficiency of maintenance.

Multiplexed audio signals conforming to a number of different rates and formats per ITU−T Recommendations G.711, G.722 and G.728 are accommodated. The embedded audio, video and data signals must comply with ANSI T1.800.03−1995 for frame structure. To insure satisfactory operation, terminal equipment provided by the customer must comply with ANSI T1.800.01−1995, "Narrow−band Visual Telephone Systems and Terminal Equipment".

All physical terminations to the MCU for audio and video signals are made at the DS1 level of the digital hierarchy. User access to the MCU may be at DS1 or lower rates. The MCU will process audiovisual and data signals transferred at four basic rates, i.e., 1544/1536 kbit/s, 128/112, 384/336, and 768 kbit/s. Video transmission at any other line transfer rate is not supported by MVCS Service. Individual conference line rates for MVCS will be determined by the customer at subscription.

BellSouth's transport services that support Spectrus MVCS include ISDN BRI/PRI, Accupulse, MegaLink, LightGate Service (DS1/DS3), and High Capacity Digital Access (HCDS) at DS1 or higher rates. Transport between user locations and the MCU may be via point−to−point or configurable DS1 facilities or through the ISDN or AccuPulse Network. Where private line facilities are utilized, each DS1 channel as shown in Figure 2 will accommodate one to twelve logical video channels, depending on the audiovisual encoding used by the customer. Multiplexing of multiple logical channels onto a single physical channel is the responsibility of the customer under this architecture. A single MCU will accommodate physical/logical terminations as depicted in Section 8.

Increased flexibility and the ability to interconnect more user locations than the port capacity of the MCU allows can be realized through networks equipped with BellSouth's FlexServ service (see Figure 2). FlexServ provides for the multiplexing and switching of individual DS1 time slots, under customer control, through capabilities provided by the digital crossconnect system (DCS). The interpositioning of one or more DCS's accommodates multiplexing of audiovisual signals from multiple customer locations onto a single DS1 facility terminated in the MCU.

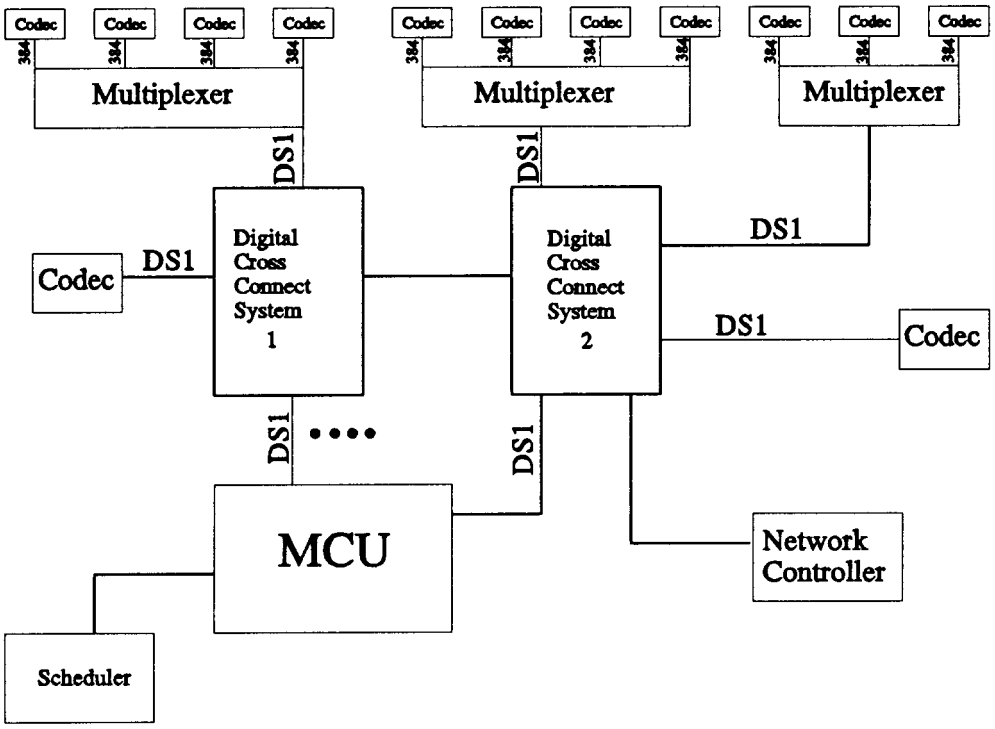

Figure 2 − FlexServ Configuration

It is anticipated that in the future Spectrus MVCS will support larger conferences and geographically remote sites via cascading. Customers should consult their marketing representative for availability.

4. Conference Management

This feature of Spectrus MVCS Service provides the user with the capability to access a BellSouth reservation system called a master scheduler (MS) to schedule conferences. Direct customer control will require access either by private line or internet to the MS Center. Conferences may also be scheduled through a BellSouth reservation agent.

Users may access the MS to modify their conference definition and to change or delete site information at any time before the conference start time.

4.1 Conference Definition

This function allows users to define the conference and capabilities and provide the information to the MS for storing. The MS uses this information for establishing and supporting a multipoint conference per ANSI T1.800.07−1995 and includes the following:

- Sites
- Start time
- Length of conference

- Parameters of conference conduct (e.g., chairman, voice activation)
- Password for each terminal that must supply one (chairman control)
- Conference features (e.g., graphics, etc.)
- Number of sites on the conference

4.2 Site Definition

This function allows users to define the participants of a conference. It includes the following:

- Sites and their capabilities
- Site and the sites they normally conference with
- Authorizations for users
- Lists of participants who are often in the same conference
- Operating calendars for sites

4.3 Conference Schedule

This function allows the user to record, track and define the schedule of conferences which includes the following:

- Keep track of existing scheduled conferences
- Allow scheduling preferences for date and time ranges
- Check preferred date and time against availability
- Schedule conferences at earliest time within a date and time range or at a specific date and time

5. Conference Setup Commands and Structure

This feature is the heart of the multipoint videoconferencing service capability. The responsibility of this feature is to insure proper conference initialization and operation which includes call set−up; network interfaces to external terminals; audio, video, and data distribution; and termination.

5.1 Control Structure

Spectrus Multipoint Videoconferencing Services are provided by transmission systems in which relevant signals are multiplexed onto one of BellSouth's tariffed digital services. In addition to the audio, video and user data information, these signals include information for the proper functioning of the system.

5.1.1 Frame Structure

ANSI T1.800.03−1995 provides for dynamically subdividing a transmission channel of 64 to 1536 kbit/s into lower rates suitable for audio, video and data. The overall transmission channel is derived by synchronizing and ordering transmissions over from 2 to 6 B−connections (64 kbit/s), from 1 to 5 H_0−connections (384 kbit/s), or an H_{11} connection (1536 kbit/s). The first connection established is the initial connection and carries the initial channel in each direction. The additional connections carry additional channels.

Each 64 kbit/s channel is structured into octets transmitted at 8 kHz. Each bit position of the octets may be regarded as a sub−channel of 8 kbit/s (see Table 1). The eighth sub−channel is called the Service Channel (SC). An 80 − octet frame length produces an 80 − bit word in the Service Channel. These 80 bits are numbered 1 − 80 (see Table 1). Bits 1 − 8 of the Service Channel constitute the frame alignment signal (FAS). Bits 9 − 16 constitute the bit−rate allocation signal (BAS). The remaining capacity of the bits constitutes a variety of signals specified in ANSI T1.800.03−1995.

An H_0 or an H_{11} channel may be regarded as consisting of a number of 64 kbit/s time−slots (TS). The lowest numbered time−slot is structured exactly as described for a single 64 kbit/s channel, while the other TS have no such structure. In case of multiple B or H_0 channels, all channels have a frame structure; that is the initial channel controls most functions across the overall transmission, while the frame structure in the additional channels is used for synchronization, channel numbering and related controls.

Bit Number								Octet
1	2	3	4	5	6	7	8	Number
								1
S	S	S	S	S	S	S	FAS	.
u	u	u	u	u	u	u		8
b	b	b	b	b	b	b		9
–	–	–	–	–	–	–	BAS	.
C	C	C	C	C	C	C		16
h	h	h	h	h	h	h		17
a	a	a	a	a	a	a	(ECS)	.
n	n	n	n	n	n	n		24
n	n	n	n	n	n	n		25
e	e	e	e	e	e	e		.
l	l	l	l	l	l	l		.
#	#	#	#	#	#	#	#	.
1	2	3	4	5	6	7	8	80

Table 1: Frame Structure of a Single 64 kbit/s Channel

5.1.2 Frame Alignment Signal

The Frame Alignment Signal (FAS) structures each 64 kbit/s channel into frames of 80 octets each and multiframes (MF) of 16 frames each. Each multiframe is divided into eight 2−frame sub−multiframes (SMF). In addition to framing and multiframing information, control and alarm information is inserted in the FAS, as well as error check information to control end−to−end error performance and to check frame alignment validity. Other time−slots are aligned to the first. Additional information pertaining to the FAS signal is contained ANSI Standard T1.800.03−1995.

5.1.3 Bit−Rate Allocation Signal (BAS) and Control and Indication (C&I) Signals

The BAS allows the transmission of codewords to describe the capability of a terminal to structure the capacity of the channel or synchronize multiple channels in various ways, and to command a receiver to demultiplex and make use of the constituent signals in such structures according to ANSI T1.800.03−1995. The C&I signals which are carried by the BAS reflect the fact that while some bits are genuinely for "control", causing a state change somewhere else in the system, others provide for indications to the users as to the functioning of the system. The MCU, when installed in BellSouth's network should support the BAS signal as specified in ANSI T1.800.03−1995 and the standard control and indication signals as specified in ANSI T1.800.05−1995 and ANSI T1.800.07−1995.

5.2 Selected Communication Mode (SCM)

For each conference call a "selected communication mode (SCM)" is identified in the MCU according to ANSI T1.800.04−1995. The SCM capability set consists of codes as defined in ANSI T1.800.03−1995 which summarize communications capabilities including the transfer rate, video, audio, and data capabilities of the participating terminals. The transmission order is immaterial with the exception that video picture format values must be followed by minimum picture interval values. The SCM capability set that the MCU will establish in the conference is based on information passed to the MCU by the master scheduler over a data link. The MCU sends the SCM capability set to all terminals.

The ability of a terminal to receive and decode signals is made known to the MCU by transmission of its capability set, consisting of the BAS−capability marker followed by all of the current capabilities. The MCU treats any terminal that cannot support the SCM capability set as a "secondary terminal" and connects it to the conference in audio−only mode. The MCU notifies the terminal that it is a "secondary terminal" by sending the command "**MIS**" which is one of the control and indication signals for multipoint videoconferencing as specified in ANSI T1.800.05−1995.

5.3 Numbering of Terminals

All terminals are given a unique number <M><T> in the range <1 to 224><1 to 224>, where <M> is an 8 bit number allocated to the local MCU and <T> is an 8 bit number allocated by the local MCU to the terminal. Both 8 bit numbers are encoded using one of the set of single byte extension (**SBE**) symbols (e.g., '**NUM**' as shown in Table 2 below indicates terminal number). Terminal numbers are always preceeded by a "C & I" symbol

The value of <M=0> is not assigned, on the basis that it should correspond to the no−MCU (point−to−point) case. With a single MCU only involved in the call the value is set to <1>.

The MCU notifies the terminal of its number by sending it the "C & I" command Terminal Indicate Assignment (**TIA**) followed by the number <M><T>, where <M> is the MCU number and <T> the number assigned by the MCU.

The following table shows the terminal information messages specified in ANSI T1.800.07−1995 which the MCU supports for providing information to all parties within a conference concerning the addition or dropping of terminals on the conference.

Signal	Information
TIN,num	Highest terminal number assigned by the MCU
TIA,num	The assigned numbers of terminals that have been connected
TID,num	The numbers of any terminals that have been dropped from the conference
VIN,num	The terminal number associated with incoming video
TIF,num	Requests from the floor

Table 2: Terminal Information Messages

(a) **Identity Information**

Provision is made for the transfer of personal or terminal identity numbers, names or other information from a terminal at the request of the MCU. The MCU transmits the commands Terminal Command Identity (**TCI**) or Terminal Command String (**TCS−n**) where n has one of several values as listed in ANSI T1.800.05−1995. On receiving TCI the terminal responds with a sequence of double symbols (**TII, A−N**), where TII represents the command for Terminal Indicate Identity and A−N represents one of a set of values defined for alphanumeric in ANSI T1.800.05−1995. The sequence should be transmitted using consecutive BAS positions and must be terminated by the end marker command Terminal Indicate Identity−Stop (**TIS**).

Provision is made for the transmission of personal or terminal identity numbers, names, or other information between a terminal and its local MCU. Initially this capability will be used to pass conference passwords from the terminal to the MCU if both devices are suitably equipped. Until the correct password has been received by the MCU if used, the terminal will be held in loopback mode.

6. Conference Initialization

The initialization procedure for MVCS is very similar to that between two terminals, as specified in ANSI T1.800.04−1995. All terminals must synchronize their outgoing transmissions to the bit rate incoming from the local MCU when they receive the Multipoint Command Conference (MCC) command from the MCU. This procedure is accomplished by connection of the MCU to terminals whose capabilities have been preset in the MCU through the master scheduler. Initialization of a conference with terminals connected to a restricted network are detailed in ANSI T1.800.04−1995.

When a connection has been established, each terminal transmits a signal according to ANSI T1.800.03−1995; it sends capabilities and waits to receive frame structure and capabilities, as described in ANSI T1.800.04−1995. In order to avoid unintelligible audio at the remote terminal(s), terminals should mute their loudspeakers. For multiple B−connections, FAS and BAS are transmitted in each B−channel. For multiple H_0 connections, the FAS and BAS are transmitted in the first time slot of each H_0. Additional requirements for B−, H_0− and restricted connections are described in ANSI T1.800.03−1995 and ANSI T1.800.04−1995. There are additional procedures, such as identy checking, to be carried out before the terminal is added to the conference.

6.1 Security

The MCU in BellSouth's network will require security authorization such as an identifier and/or a password before allowing access of potential users. This information is matched against the information preprogrammed in the master scheduler's database and is used to determine the user's privileges before any terminal can be added to a conference.

6.2 Terminal Connection

The MCU will send the appropriate set of capabilities (**cap−set**), according to the type of communication intended. ANSI T1.800.06−1995 provides the capabilities which the MCU will be able to declare if the terminals connected have appropriate capabilities, and the modes it will be able to transmit.

As described in Section 5.2, for each conference call a "selected communication mode (SCM)" is identified in the MCU. During the call, the MCU strives to maintain this SCM as that transmitted bidirectionally between itself and all terminals, and between itself and other MCUs. At the start of a call, the cap−set transmitted by the MCU will be that which corresponds to the selected communication mode (**SCM**). This is referred to as the "**SCM−cap**". Any terminal which is found, from its declared cap−set, not be capable of transmitting the SCM will be connected in the conference at the audio mixer only.

Terminal connection is based on the frame structure and capabilities as described in ANSI T1.800.04−1995. Procedures for operation of terminals in restricted networks are also described in the previous ANSI Standard. The following procedures describe non−restricted terminal connections of primary terminals only. Secondary non−restricted terminal connections are audio connections only.

(a) **First Terminal Connection** to the MCU is accomplished when the MCU sends its SCM capabilities (**SCM−cap**) and the Control and Indication (**C&I**) symbols Multipoint Command Conference (**MCC**) and Multipoint Indication Zero−communication (**MIZ**) immediately after the last set of BAS−capability markers (**final CAP−Mark**) transmitted, indicating that a conference call is being set up and that no other terminals are yet connected and the user should wait.

The MCU finds incoming frame alignment sent by the first terminal and registers these capabilities. If the terminal is not capable of transmitting the SCM determined by the user, the MCU transmits to this terminal a reduced capset consisting of cap−mark and at least one audio capability code to hold it in audio−only mode.

(b) **Second terminal connection** to the MCU is accomplished when the MCU sends its SCM capabilities immediately followed after the final CAP−Mark by the Control and Indication signal MCC. The MCU finds incoming frame alignment and registers the capabilities of this second terminal. The MCU also sends cancel−MIZ to the first terminal. Once the MCU has multiframe alignment with both terminals, it sets up audio and video.

The MCU sends the appropriate Audio command to each terminal and begins sending the mixed audio (see "Audio Mixing" Par. 6.2) to each terminal at the next submultiframe.

The MCU sends the appropriate Video command to each terminal. When the MCU receives video from either or both terminals they are forwarded via the video switch using the proper mode switching procedure as specified in ANSI T1.800.04−1995. The command for fast update request (**VCU**) is sent towards the transmitter(s) of those signals. If the command for video indicate ready−to−activate (**VIR**) is received from either or both terminals, this is forwarded.

(c) **Additional terminals are connected** to the MCU when the MCU sends its SCM capabilities immediately followed by the Control and Indication signal MCC. The MCU finds incoming frame alignment and registers the capabilities of the terminal. Once the MCU has multiframe alignment, it sends the appropriate audio command to the new terminal and begins sending the mixed audio to that terminal at the next submultiframe. The audio mix for all previously attached terminals is updated to include the new terminal's audio. The MCU sends the new terminal the current broadcast video using the mode switching procedure described in ANSI T1.800.04−1995 and sends the command for fast update request (**VCU**) to the source of that video.

6.3 ISDN and AccuPulse Connection

All terminals operating in BellSouth's ISDN are expected to incorporate standard signaling arrangements for originating and terminating calls. Procedures for originating and terminating ISDN calls are in accordance with ITU−T Recommendations Q.931 and Q.932.

Terminals connecting through BellSouth's AccuPulse network (switched 56 kbps) must comply with the interface and transport specifications of BellSouth's Accupulse Service. Specifications for BellSouth's 4−wire Accupulse Service are contained in the AT&T Publication 41458 February 1990. Specifications for BellSouth's 2−wire Accupulse Service are contained in the Bellcore Technical Reference TR−EOP−000277 September 1985.

For multipoint audiovisual services on the BellSouth ISDN or AccuPulse networks, the initial connection shall be first established and according to the outcome of the in−band capability exchange the additional connections shall be established. This means that additional channels are added only by completion of the capability exchange sequence indicating mutual additional−channel capability or at some time later prompted by user action.

Consequently, for 2B (or 2 x 56 kbps) communications in the BellSouth network, the initial connection contains the initial channels of both directions, and the additional connection contains the additional channels of both directions as well. Another implication of this sequencing of in−channel negotiation and additional call establishment is that the capability set shall include "2B (or $2H_0$) or higher transfer rate" at the first capability exchange, otherwise the additional call setup is not activated at the start of communication.

When two or more connections are to be established, one unit must make all of the call requests − it is not permitted that a terminal, having answered an incoming call, make a request for a connection back to the same unit. If more than two connections are used, all the additional connections may be called simultaneously. Each additional channel number is allocated in the order of call establishment at the transmitter, a connection may convey two channels with different channel numbers in each direction.

During call establishment, an originating terminal shall reserve additional channels by not answering incoming calls on those channels until it is determined whether the additional channels will be used in the connection. This prevents multiple call collisions and contention for the available channels.

7. Conference Control

Established audiovisual conferences may be controlled by a participant designated as the conference chair. Alternately, control may be automatic through presentation of the video image from the immediately dominant audio source.

The MCU adheres to the mode change requirements specified in ANSI T1.800.03−1995. On receipt of a BAS command code in one (even) frame and its error−correcting code in the next (odd), the MCU can accept the stated mode change beginning in the subsequent (even) frame. Latency in responding to other commands will vary based on the specific command and what else the MCU is doing when the command arrives.

Note: **Control and Indication signals do not require immediate action by the MCU and, in some cases (e.g., Multipoint Command Token−claim "MCT": sent by a terminal to the MCU. The MCU accedes to this claim if the token is unassigned or has been released.), the MCU may ignore a command entirely**.

7.1 Video Switching

7.1.1 Video Switching Procedure

When the MCU decides that terminal A, currently receiving the video signal from terminal B, should instead receive the video signal from terminal C, it uses the following procedure:

(a) The MCU sends the Video Command "Freeze−Picture Request" (**VCF**) to terminal A, causing terminal A to freeze its currently displayed picture and ignore subsequent video; terminal A continues to track the error−correction framing and monitor Picture Headers for the Picture Freeze Release command.

(b) The MCU switches video such that the picture from terminal C is being sent to terminal A; terminal A loses error−correction frame alignment and takes a certain amount of time to regain it, dependent upon the video bit rate and other factors.

(c) After a short delay of time, intended to allow for terminal A to recover error correction frame alignment, the MCU sends terminal C the video command "Fast Update Request" (**VCU**), to cause a fast−update, and the command Multipoint Indication Visualization (**MIV**), to indicate that its video is being sent to other terminals.

(d) When it receives VCU, terminal C sends its next video frame in fast−update mode, together with the Picture Freeze Release command.

(e) When it receives the Picture Freeze Release command, terminal A reverts to displaying the incoming picture.

Note: **Users at other terminals that have been receiving the picture from terminal C continuously during the above procedures will be aware of the switching action because of the use of the fast−update mode: this is the transmission of a single new picture over a period inversely proportional to video bit rate − at 320 kbit/s this period is likely to be about 0.5 seconds**.

7.1.2 Automatic Switching

The MCU's default mode of video switching in a conference is to broadcast the video input from the dominant speaker (i.e., the "loudest" audio input) to all terminals except the dominant speaker's; the terminal that is the source of the video being broadcast continues to receive the video from the previous video source. When choosing a new video source, the MCU imposes separate time delays so as to: (1) avoid changing the image too frequently; and (2) avoid changing the video due to spurious sounds.

7.1.3 Visualization−Forcing

A terminal can request that the MCU broadcast its video signal to all other terminals, overriding the automatic mechanism, by sending Multipoint Command Visualization−Forcing (**MCV**). If the MCU is in automatic switching mode, it begins broadcasting the requesting terminal's video switching using the procedure outlined above. The MCU continues to broadcast that terminal's video until: (1) that terminal sends a cancel−MCV; (2) another terminal sends MCV; or (3) a Chair takes control of the source of video.

If a Chair has control of the source of video at the time a terminal sends MCV, the terminal's request is ignored. A Chair taking control of the source of video cancels all MCV requests. These requests are not stored or "remembered" by the MCU when the Chair returns the MCU to automatic mode.

7.2 Audio Mixing

The MCU accepts audio inputs from all terminals and selects up to 4 of those that have voice activity to be included in the output mix. The output mix is a digital sum of all selected inputs. The MCU sends this mixed audio output to all terminals (removing each terminal's own audio from the mix sent to that terminal).

7.3 Chair Control

The MCU allows a terminal with special authorization (**the "Chair"**) to control certain aspects of the conference in accordance with ANSI T1.800.07−1995. The control of the conference is accomplished by a Chair which uses a terminal interface to exercise chair control in accordance with ANSI Standard T1.800.07−1995.

7.3.1 Selecting a Chair

The user who defines the conference specifies whether or not the conference will allow chair control. Only one Chair at a time can control a conference. Control of the conference can be transferred from one eligible Chair to another. The MCU will be equipped with the appropriate software and hardware as specified in ANSI T1.800.07−1995 to support chair control. Any terminal that desires to be designated as Chair must be equipped with the capabilities specified in ANSI T1.800.07−1995. Any eligible terminal with Chair capabilities can request control of the conference; if there is no Chair, the MCU grants the request. The initial Chair for a conference is the first eligible Chair to request control.

7.3.2 Chair Function

The MCU will be equipped with the capability "multipoint chair control" (**CIC**) in order to perform the following functions:

- assign a number to each terminal
- assign the chair control token
- disconnect a terminal from a conference on command from the token holder
- switch video signals according to commands from the token holder
- stop data transmission by all other terminals
- initiate the conference
- terminate the conference

7.3.3 Terminal Chair Interface

The terminal Chair interface supports Chair Control by providing a user interface (e.g., touch panel) that the user may use to request Chair functions. The implementation of the user interface at the terminal is beyond the scope of this document. Table 3 show the Chair functions supported by a terminal Chair interface. The MCU and terminal exchange the information needed to implement conference control using the BAS portion of the ANSI T1.800.03−1995. All commands, indications, and other messages are sent using ANSI T1.800.05−1995 or ANSI T1.800.07−1995 Control and Indication signals. If the user desires to take advantage of the chair control capability, the terminal must support these Control and Indication signals.

Table 3 and the following sections describe how the MCU and terminal use the Control and Indication signals to implement Chair Control.

Function	Terminal	MCU
Initiate the conference	Yes	Yes
Display the sites participating in the conference	Yes	Yes
Control video switching mode	Yes	Yes
Control the Video Source	Yes	Yes
Block or unblock a data stream to a site	−−	Yes
Add additional terminals	−−	Yes
Disconnect a terminal	Yes	Yes
Terminate the conference	Yes	Yes
Cease all data transmission	Yes	−−
Give up Chair control	Yes	Yes

Table 3: Chair Function Support

7.3.4 Token assignment

A terminal wishing to assume chair control may proceed to claim the requisite token if its currently registered capset from the MCU includes the command Chair−control Indicate Capability (**CIC**).

A terminal requests assignment of the chair control token by sending the command Chair−control Command Acquire (**CCA**). On receipt of CCA from the terminal, the MCU if it has already assigned the token takes no action, if it has not assigned the token it replies with the command Chair−control Indicate Token (**CIT**).

7.3.5 Token withdrawal and release

A change of chair control should be negotiated between conference participants; the terminal holding the token may release it by sending the command Chair−control Indicate Stopped−using−token (**CIS**) to the MCU.

An MCU receiving CIS from the terminal holding the token will reassign the token if requested by another terminal.

An MCU receiving CIS from any terminal other than the one to which it previously assigned the token will ignore it.

A terminal receiving the command Chair−control Command Release/Refuse (**CCR**) while possessing the token must cease transmission of chair control commands and send CIS.

When the chair control token has been released or withdrawn the control of video switching reverts to voice activation.

7.3.6 Information available to the chair control terminal

The following information is available to a chair control terminal:

- the assigned numbers of terminals that have been connected − (TIA,num)
- the numbers of any terminals that have been dropped from the call − (**TID, num**)
- the terminal number associated with the incoming video − (**VIN, num**)
- requests from the floor − (**TIF, num**)

The chair control terminal may request to receive the current conference terminal numbers from the MCU by transmitting the command Terminal Command Update (**TCU**).

7.3.7 Terminal selection

In each outgoing signal the MCU transmits periodically (with each BAS command cycle) the terminal number of the video it is transmitting, using the double symbol (**VIN, num**). All terminals having suitable capabilities may thus display an identity with the video.

7.3.8 Chair control of broadcast video

By transmitting the double symbol (**VCB, num**) the chair control terminal determines which video signal shall be transmitted to all parties except the source of the video.

7.3.9 Chair control of video received

By transmitting the double symbol (**VCS, num**) the chair control terminal determines which video signal shall be transmitted to itself. To return to the automatic selection of video, the chair control terminal transmits **Cancel−VCS**. Similarly other suitably equipped terminals can select the video to be transferred to themselves by transmitting the double symbol (**VCS, num**).

7.3.10 Connection dropping by chair terminal

The chair terminal can disconnect a terminal from the conference by transmitting the double symbol (**CCD, num**)

7.3.11 Request for floor

Any suitably equipped terminal may input a 'request for floor', by transmitting the symbol (**TIF**). The MCU will forward this request to the current chair, including the terminal number of the requesting terminal.

7.4 Data Distribution in Multipoint Conferences

Where it is available, the MCU will support the method for handling data channels as specified in ANSI T1.800.07−1995. A data channel can be opened once, then used by several transmitters in turn without disrupting video at each change of transmitter. A broadcast request/grant mechanism (i.e., data tokens) is used to determine which terminal can use the channel.

7.4.1 Terminals without Data Capability

Some of the terminals connected may not have the data capabilities to be used, and therefore procedures for dealing with this in BellSouth's MVCS Service are described in ANSI T1.800.04−1995.

7.4.2 Data Tokens

The control of data distribution is governed by means of data tokens. The description, capability and use of these data tokens are described ANSI T1.800.07−1995.

7.4.3 Opening/assigning the data channel

When the appropriate conditions in ANSI TI.800.07−1995 have been met, the MCU opens the data channel at an appropriate rate. If there is more than one data rate supported, the highest data rate common to all the terminals is used.

If there are terminals relegated to secondary status because they do not have data capability, the MCU sends them the Video Command "Freeze−Picture Request" (**VCF**) and then transmits 'video−off'.

Receiving the mode change from the MCU, each terminal must respond by symmetrising its transmission; that is it must open an identical data channel in the direction of the MCU, using the mode switching procedure with the requisite BAS commands and transmitting idle bits in the data channel itself.

7.4.4 Data channel closing and rate change

After a period of disuse, during which no data token has been claimed, an MCU may close the data channel. Until a channel is closed, terminals must transmit idle bits.

7.5 Loopback Detection

This capability is described in ANSI T1.800.07−1995.

7.6 Exception Condition Handling

The MCU handles exception conditions during the major phases of a terminal connection as specified in ANSI T1.800.04−1995.

7.7 Ending The Conference

When the time for the scheduled conference has ended, the MCU automatically disconnects all remaining terminals. The MCU sends each terminal a series of reminder messages at a configurable interval before termination.

8. MCU Configurations

8.1 Single MCU Configurations

The following table is a list of configurations for the number of conferences allowed and users per conference at various bit rates which a single MCU will support:

Line Speed kbit/s	Max Users in a Conference	Max Number of Conferences
1544/1536	16	8 (with 2 users/conference)
768	24	12 (with 2 users/conference)
384/336	40	20 (with 2 users/conference)
128/112	48	24 (with 2 users/conference)

Table 5: Single MCU Configurations

8.2 Cascaded MCU Configuration

Multipoint Video Conferencing Service will operate with the MCU cascaded with other MCU's to affect a video conference. Cascading of MCUs is accomplished in accordance with the guidelines specified in ANSI T1.800.07−1995. When a video conference requires the cascading of MCUs, a cascade link is required between the MCU concurrent active conference. The transfer rate of the cascade link must be the same as the ongoing conference.

9. Physical Interface

The user's point of connection to Spectrus MVCS will be the Network Interface to whatever transport channel is selected for access. Means of connection to such channels, as well as operational and performance characteristics, are contained in a separate Technical Reference appropriate to the selected type. See Section 12.1 for a list of these references. It is recommended that DS1 facilities be equipped with Extended Super Frame (ESF) format and B8ZS line coding for clear channel capability.

10. Synchronization

MCU timing shall be derived from the BellSouth Network Clock, which is traceable to a Primary Reference Source as specified in ANSI Standard T1.101−1987. It is recommended that the user's CPE terminal be loop−timed to the BellSouth Network. Alternately, if the user elects to provide external timing it must be traceable to a Primary Reference Source as specified in the above document to insure plesiochronous operation.

11. MVCS Service Performance Parameters and Specifications

11.1 Delay with MCU in Circuit

- Max Terminal−to−Terminal delay 300 msec
  (Applies only to connections via Earth Satellite)

- Typical Terminal−to−Terminal delay 10 msec

11.2 Audio

- Power level to initiate a switch 14dB above measured noise level

  Under the following conditions

  1. voice activated mode only
  2. no switch to a new speaker is initiated if there is already a current speaker
  3. the MCU is adjusted to prevent switching too often

- linear mixing of audio in the MCU has no affect on the frequency response

11.3 Audio/Video Synchronization

- Max delay of audio synchronization with video 10 msec

11.4 Digital Performance (end−to−end)

	Error Free Seconds (EFS)	
− Includes MCU in Circuit	DS1	97.5%
	DS3	99.9%
	High Capacity Digital Access	98.5%

11.5 Video Switch Delay

- Voice Activation 1 sec
- Chairman Control 10 msec

11.6 Video Switching (minimum time between sites)

- Voice Activation 2 sec
- Chairman Control 50 msec

- Conference Setup Delay (per site max) 30 sec
- Scheduled Time Between Conferences (minimum) 5 min

12. References

12.1 Domestic References

(a) ANSI Standards

- ANSI T1.800.01, "Narrow−Band Visual Telephone Systems and Terminal Equipment"
- ANSI T1.800.02, "Video Codec for Audiovisual Services at p x 64 kbits"
- ANSI T1.800.03, "Frame Structure for Audiovisual Services at 56 to 1920 kbit/s"
- ANSI T1.800.04, "Procedures for Establishing Communication between Two Audiovisual Terminals Using Digital Channels up to 1920 kbps"
- ANSI T1.800.05, "Frame Synchronous Control and Indication Signals for Audiovisual Systems"
- ANSI T1.800.06, "Multipoint Control Units for Audiovisual Systems Using Digital Channels up to 1920 kbps"
- ANSI T1.800.07,"Procedures for Establishing Three or More Audiovisual Terminals Using Digital Channels up to 1920 kbps"

(b) BellSouth References:

- BellSouth Technical Reference TR 73525, November 1988, "**MegaLink**® and **MegaLink® Channel Service Exchange Network Interface Specifications**"
- BellSouth Technical Reference TR 73501, Issue C, November 1990, "**LightGate® Service Channel Interface Specifications**"
- BellSouth Technical Reference TR 73545, Issue B, October 1990, "**SynchroNet® Service Network Interface Specifications**"

(c) Bellcore References:

- Bellcore Technical Reference TR−NPL−000054, Issue 1, April 1989, "**High Capacity Digital Service (1.544 Mbit/s)**"
- Bellcore Technical Reference TR−NPL−000341, Issue 1, March 1989, "**Digital Data Special Access (DSO)**"
- Bellcore Technical Reference TR−EOP−000277, Issue 1, September 1985, "**Datapath Network Access Interface Specification**"
- Bellcore Technical Reference TR−INS−000342, Issue 1, February 1991, "**High−Capacity Digital Special Access Service Transmission Parameter Limits and Interface Combinations**"

(d) AT&T Publication:

- AT&T Pub 41458, February 1990, "**Special Access Connection to AT&T Network−Public Switched Digital Service Advisory**"

Note: BellSouth's 4−wire access to AccuPulse® Service references the AT&T Publication

12.2 International References

The following ITU−T Recommendations in addition to the ANSI Standards were used as references for the compilation of this Technical Reference.

H.221 Frame structure for a 64 to 1920 Kbit/s Channel in Audiovisual Teleservices 1993

H.230 Frame−Synchronous Control and Indication Signals for Audiovisual Systems 1993

H.231 Multipoint Control Units For Audiovisual Systems Using Digital Channels up to 2 Mbit/s 1993

H.242 System for Establishing Communication Between Audiovisual Terminals using Digital Channels up to 2 Mbit/s 1993

H.243 Procedures for Establishing Communication Between Three or More Audiovisual Terminals Using Digital Channels up to 2 Mbit/s 1993

H.261 Video Codec for Audiovisual Services at p x 64 Kbit/s 1993

H.320 Narrow−Band Visual Telephone Systems and Terminal Equipment 1993

G.711 Pulse code modulation (PCM) of voice frequencies (1998 "Blue Book")

G.722 7 Khz audio−coding within 64 Kbit/s (1988 "Blue Book")

G.728 3 KHz audio−coding within 16 Kbit/s ITU−T Recommendation

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