FTR 1080A-1998

FEDERAL TELECOMMUNICATIONS

RECOMMENDATION

Video Teleconferencing Services at 56 to 1,920 kbit/s

Prepared and Published By:
Technology and Standards Division
National Communications System

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Federal Telecommunications Recommendation 1080A-1998

8 October 1998

VIDEO TELECONFERENCING SERVICES AT 56 TO 1,920 kbit/s

(This Recommendation supersedes FTR 1080-1997, dated 30 October 1997)

Federal Telecommunications Recommendations (FTR) are issued by the Technology and Standards Division, National Communications System (NCS), after approval by the Federal Telecommunications Standards Committee and the Deputy Manager, NCS, pursuant to Executive Order 12472,[1] NCS Directive 4-1,[2] and Public Law 104-113.[3]

1. Name of Recommendation. Video Teleconferencing Services at 56 to 1,920 kbit/s.

2. Category. Video Teleconferencing, Telecommunications Standards.

3. Explanation. This FTR, by adoption of International Telecommunication Union - Telecommunication Standardization Sector (ITU-T) Recommendations H.320, H.221, H.242, H.261, H.230, H.231, H.243, H.233, H.234, and H.244 defines the specifications for video teleconferencing and video telephony systems. This FTR supersedes FTR 1080-1997. The only change in this FTR is Appendix A & B that is updated.

4. Approving Authority. Deputy Manager, National Communications System.

5. Maintenance Agency. Technology and Standards Division, National Communications System.

6. Related Documents.

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[1]Executive Order 12472, "Assignment of National Security and Emergency Preparedness Telecommunications Functions," April 3, 1984.
[2]NCS Directive 4-1, "Federal Telecommunication Standards Program," February 21, 1991.
[3]Public Law 104-113, "The National Technology Transfer and Advancement Act of 1995," February 27, 1996.

a. American National Standards Institute (ANSI) T1.306-1990, American National Standard for Telecommunications - Digital Processing of Audio Signals - Algorithm and Line Format for Transmission of 7-kHz Audio Signals at 64/56 kbit/s.

b. ANSI T1.314-1991, American National Standard for Telecommunications - Video Coder/Decoder for Audiovisual Services at 56 to 1,536 kbit/s.

c. ANSI T1.800.01-1995, American National Standard for Telecommunications - Visual Telephone Systems and Terminal Equipment Using Digital Channels up to 1920 kbit/s.

d. ANSI T1.800.03-1995, American National Standard for Telecommunications - Frame Structure for Audiovisual Services at 56 to 1,920 kbit/s.

e. ANSI T1.800.04-1995, American National Standard for Telecommunications - Procedures for Establishing Communications Between Two Audiovisual Terminals Using Digital Channels up to 1,920 kbit/s.

f. ANSI T1.800.05-1995, American National Standard for Telecommunications - Frame Synchronous Control and Indication Signals for Audiovisual Systems.

g. ANSI T1.800.06-1995, American National Standard for Telecommunications - Multipoint Control Units for Audiovisual Systems Using Digital Channels up to 1,920 kbit/s.

h. ANSI T1.800.07-1995, American National Standard for Telecommunications - Procedures for Establishing Communication Between Three or More Audiovisual Terminals Using Digital Channels up to 1,920 kbit/s.

i. ANSI T1.802.03-1996, Digital Transport of One-way Video Signals - Parameters for Objective Performance Assessment.

j. The International Telegraph and Telephone Consultative Committee (CCITT) Recommendation G.711, Pulse Code Modulation (PCM) of Voice Frequencies, (1988).

k. CCITT Recommendation G.722, 7 kHz Audio-coding Within 64 kbit/s (1988).

l. CCITT Recommendation G.725, System Aspects for the Use of the 7 kHz Audio Code Within 64 kbit/s, (1989).

m. CCITT Recommendation G.728, Coding of Speech at 16 kbit/s Using Low-delay Code Excited Linear Prediction.

n. CCITT Recommendation G.821, Error Performance of an International Digital Connection Forming Part of an Integrated Services Digital Network, (1989).

o. CCITT Recommendation H.200, Framework for Recommendations for Audiovisual Services, (1989).

p. CCITT Recommendation I.464, Multiplexing, Rate Adaptation and Support of Existing Interfaces for Restricted 64 kbit/s Transfer Capability, (1989).

q. CCITT Recommendation T.35, Procedure for the Allocation of CCITT Members' Codes, (1989).

r. CCITT Recommendation V.120, Support by an ISDN of Data Terminal Equipment with V-Series Type Interfaces with Provision for Statistical Multiplexing, (1988).

s. CCITT Recommendation V.35, Data Transmission at 48 Kilobits Per Second Using 60-108 kHz Group Band Circuits, (1989).

t. CCITT Proposed Recommendation AV.253, Audio Coding at 24/32 kbit/s.

u. ITU-T Recommendation H.221 (1995), Frame Structure for a 64 to 1920 kbit/s Channel in Audiovisual Teleservices.

v. ITU-T Recommendation H.230 (1995), Frame-synchronous Control and Indication Signals for Audiovisual Systems.

w. ITU-T Recommendation H.231 (1996), Multipoint Control Units for Audiovisual Systems using Digital Channels up to 1920 kbit/s.

x. ITU-T Recommendation H.233 (1995), Confidentiality Systems for Audiovisual Services.

y. ITU-T Recommendation H.234 (1994), Encryption Key Management and Authentication System for Audiovisual Services.

z. ITU-T Recommendation H.242 (1996), System for

Establishing Communication between Audiovisual Terminals using Digital Channels up to 2 Mbit/s.

aa. ITU-T Recommendation H.243 (1996), Procedures for Establishing Communication between Three or More Audiovisual Terminals using Digital Channels up to 2 Mbit/s.

bb. ITU-T Recommendation H.244 (1995), Synchronized Aggregation of Multiple 64 or 56 kbit/s Channels.

cc. ITU-T Recommendation H.261 (1993), Video Codec for Audiovisual Services at p x 64 kbit/s.

dd. ITU-T Recommendation H.320 (1996), Narrow-band Visual Telephone Systems and Terminal Equipment.

ee. ITU-T Recommendation T.120 (1996), Data Protocols for Multimedia Conferencing.

ff. ITU-T Recommendation T.122 (1993), Multipoint Communication Service for Audiographics and Audiovisual Conferencing Service Definition.

gg. ITU-T Recommendation T.123 (1996), Network Specific Data Protocol Stacks for Multimedia Conferencing.

hh. ITU-T Recommendation T.124 (1995), Generic Conference Control.

ii. ITU-T Recommendation T.125 (1994), Multipoint Communication Service Protocol Specification.

jj. ITU-T Recommendation T.126 (1995), Multipoint Still Image and Annotation Protocol.

kk. ITU-T Recommendation T.127 (1995), Multipoint Binary File Transfer Protocol.

ll. ITU-T Recommendation T.130 (draft), Control for an Audio Visual Conference.

mm. ITU-T Recommendation P.30 (1988), Transmission Performance of Group Audio Terminals.

nn. ITU-T Recommendation P.34 (1993), Transmission Characteristics of Hands-Free Telephones.

oo. ITU-T Recommendation P.64 (1993), Determination of Sensitivity/Frequency Characteristics of Local Telephone Systems.

pp. ITU-T Recommendation P.79 (1993), Calculation of Loudness Ratings for Telephone Sets.

At the time of publication of this FTR, the editions indicated above were valid. All publications are subject to revision, and parties to agreements based on this FTR are encouraged to investigate the possibility of applying the most recent editions of these publications. You may obtain copies of the specifications and related documents from:

ANSI and ISO Documents - American National Standards Institute
11 West 42nd Street
New York, NY 10036
(212) 642-4900; FAX (212) 302-1286

ITU-T Recommendations - National Technical Information Service
US Department of Commerce
Springfield, VA 22161
(703) 487-4650

7. Objectives. This FTR is intended to facilitate interoperability among Federal video teleconferencing (VTC) and video phone systems employing video codecs at rates between 56 kbit/s and 1,920 kbit/s. Equipment designed for use over asynchronous transfer mode networks, local area networks, and public switched telephone networks are out of the scope of this standard.

8. Applicability. This FTR may be used by all Federal departments and agencies in the design and procurement of video teleconferencing and video phone systems. Appendix A, which contains a VTC profile, is normative (mandatory) for the Department of Defense (see Appendix B) and is informative (optional) for all other Federal departments and agencies. This FTR is used only for those audiovisual systems operating at rates between 56 kbit/s and 1,920 kbit/s using non-packet based networks. The FTR could be used in the planning, design, and procurement, including lease and purchase, of all new video communications systems that utilize video codecs.

The FTR which this paragraph references was designed primarily for use with Integrated Services Digital Networks (ISDN). Many ITU-T Recommendations specify service from 64 kbit/s through 1,920 kbit/s, and some ANSI standards specify service from 56 kbit/s through 1,536 kbit/s. To avoid confusion on applications within the Federal Government involving both national and international interoperability, this standard encompasses both ranges of data rates to specify service from 56 kbit/s through 1,920 kbit/s. It should be noted that most standard data networks in the United States carry data from 56 kbit/s to 1,536 kbit/s.

In an ISDN, the overall transmission channel may consist of one to six B (64 kbit/s) channels, one to four H_o (384 kbit/s) channels, an H_{10} (1,472 kbit/s) channel, or an H_{11} (1,536 kbit/s) channel. The framed video signal can also be carried on other switched or dedicated digital transmission facilities, such as one to six 56 kbit/s connections, a DS1 connection, or a fractional DS1 connection.

The technical parameters of this document may be exceeded in order to satisfy certain specific requirements, provided that interoperability is maintained. That is, the capability to incorporate features such as additional standard and nonstandard interfaces is not precluded.

Neither this nor any other standard in high technology fields such as telecommunications can be considered complete and ageless. Periodic revisions will be made as required.

The FTR is not intended to hasten the obsolescence of equipment currently existing in the Federal inventory; nor is it intended to provide systems engineering or applications guidelines.

9. Specifications. The following sections specify the requirements for video teleconferencing and video telephony terminals.

9.1 Overall Description. Specific requirements for different types of video terminals are defined in ITU-T Recommendation H.320. All terminals that meet FTR 1080-1997 shall follow the specifications of H.320. At a minimum, all terminals shall be capable of operating over one and two channels (p=1 and 2) at quarter common intermediate format (QCIF) resolution. If a terminal is able to operate at values for p greater than 2, then the terminal shall be able to operate at all p values in the set {1,2,6,12,23,24} less than the highest p value capable by the terminal.

Examples of a few terminal configurations are given below:

- **S** Terminal operating over two B channels of an ISDN.
- **S** Terminal operating over six B channels of an ISDN.
- **S** Terminal operating over an H0 channel of an ISDN.
- **S** Terminal operating over one switched 56 kbit/s channel.

9.2 Multiplexing/Framing. The different parts of a VTC call (video, audio, data) must be multiplexed into single or multiple channels.

9.2.1 Frame Structure. All terminals that meet this FTR shall use all the specifications defined in ITU-T Recommendation H.221. The H.221 framing structure multiplexes subchannels for audio, video, data, and telematic transmission, as well as in-channel terminal-to-terminal signaling information, within an overall transmission channel of 56 to 1,920 kbit/s.

This FTR addresses data channels at nominal bit rates of px64 kbit/s, where p is an integer that can range from 1 to 30. For unrestricted networks, such as provided by ISDN, each increment of data rate may actually be 64 kbit/s, but in restricted networks each increment may be only 56 kbit/s. Equipment that meets this FTR shall be capable of operating on unrestricted and/or restricted networks. Equipment that meets this FTR shall be capable of operating with other terminals on unrestricted and restricted networks. Equipment that meets this FTR shall be capable of operating over a network connection where a middle segment or segments of the network are restricted. Restricted networks are discussed in annex 2 of H.221 and section 3.6 of H.230. To help with the problem of operating over restricted networks, or operating with terminals not having network timing, it is recommended that the procedures described in annex A of ANSI T1.800.04 be used.

9.2.2 Channel Aggregation. It is possible for a VTC terminal or Multipoint Control Unit (MCU) to have a single channel interface to multiple channels using channel aggregation. An example is aggregating six B channels into a single 384 kbit/s channel. The use of channel aggregation increases interoperability between equipment on different networks and allows a high speed interface to low speed networks. Use of channel aggregation is optional for VTC, but when it is built into a VTC terminal or MCU, that equipment shall adhere to the requirements of H.244.

There are four different “cases” described in H.244. When channel aggregation is built into a terminal or MCU, it shall be capable of operating using the combination of Case B and Mode B1 as specified in H.244.

9.3 System for Establishing Communication Between Audiovisual Terminals. All terminals that meet this FTR shall use all specifications of ITU-T Recommendation H.242 for establishing communications between two audiovisual terminals. H.242 describes the in-channel terminal-to-terminal communications control procedures. The procedures allow audiovisual terminals with different capabilities to interwork and switch among compatible modes to support additional applications, for example, exchanging data.

9.4 Video Codec. All terminals that meet this FTR shall be capable of color and near-full motion operation using, at a minimum, the QCIF format defined in ITU-T Recommendation H.261. All terminals shall meet all specifications of H.261. An encoder shall be capable of coding at a minimum average of six frames per second. The decoder shall be capable of decoding at least 7.5 frames per second. This is the minimum picture interval and is discussed in H.261, H.221, and H.242. Higher rates can be negotiated using the procedures in H.242.

A terminal is not precluded from using coding algorithms other than H.261, but for every video coding rate the terminal is capable of, the terminal shall be capable of using the H.261 coding algorithm. The purpose of this requirement is to prevent two terminals which are capable of communicating at a high transmission rate, such as p = 24, from having to communicate at a lower rate to be interoperable.

A terminal is not precluded from having proprietary picture formats other than QCIF or CIF, but if a terminal has a picture format with more pixels than QCIF (176x144 = 25344 pixels), it shall also have the CIF picture format implemented using H.261. The purpose of this requirement is to prevent two terminals which are capable of CIF-like resolutions having to communicate at a QCIF resolution to be interoperable.

Motion compensation is optional in the encoder. Motion compensation is required in the decoder, where the reconstruction of the motion is relatively simple. The decoder shall accept one vector per macroblock.

NOTE: The video coding algorithm described in this FTR is a

variable-rate algorithm. Video transmission is not fixed at multiples of 56 or 64 kbit/s, but instead occupies all bandwidth available for video within an overall audiovisual communications system. A*p*x64 kbit/s@ are the nominal transmission rates of the overall system. ITU-T Recommendation H.221 provides for operating at multiples of 56 and 64 kbit/s.

9.5 Audio.

9.5.1 Audio Algorithms. All terminals that meet this FTR shall follow mandatory requirements in H.320. Further, terminals shall be capable of coding and decoding audio using G.711 framed F-law mode and G.728. If a terminal is capable of coding or decoding audio using G.722, it shall be capable of operating mode 2 and 3 of G.722.

9.5.2 Audio Arrangements. A terminal can have one or more of the following three functions:

a. Handset function,
b. Hands free function for up to three users,
c. Hands free function for more than three users.

The audio characteristics for each of these functions shall be as defined in H.320.

The principles used are identical with those for telephony terminals. That is, the sensitivity for handset function and hands-free function designed for personal use/a small group of users is specified in loudness ratings, and the sensitivity for conference terminals is specified as output levels.

9.6 Frame-Synchronous Control and Indication Signals for Audiovisual Systems. All terminals that meet this FTR shall use ITU-T Recommendation H.230. H.230 provides additional frame-synchronous control and indication signals such as freeze picture, video loopback, and simple multipoint controls. These control and indication signals are necessary to provide additional functionality and to provide extensibility to future standards.

9.7 Telematic Services. The ability to transmit freeze-frame images is optional within this FTR. If a terminal is capable of transmitting freeze-frame images, it shall be capable of transmitting the images according to the procedures described in Annex D of H.261.

Use of telematic services is optional within this FTR. If telematic services are used, beyond those defined as freeze-frame, the requirements of T.122 and T.123 recommendations shall be used.

9.8 Privacy and Secure Operation. The use of privacy and/or secure operation is optional. Privacy is defined as Type 3 protection and secure is defined as Type 1 or 2 protection.

If privacy or secure operation is required, it is recommended that National Security Agency (NSA) approved equipment be used and NSA approved procedures be followed. For security and privacy issues see annex B of appendix A.

VTC terminals that have privacy or secure capability should provide a real-time indication of the current level of protection. This indication can be a video overlay on the output image, or some other indication.

9.9 Multipoint Control Operation. Multipoint control operation is defined as the interconnection of 3 or more VTC terminals through an MCU. MCUs perform many tasks intended to allow many VTC terminals to see, hear, and exchange information with others in a conference.

9.9.1 Multipoint Control Operation in a Terminal. A VTC terminal can connect to a MCU using the same protocols as for connecting to another VTC terminal. Optionally, additional features can be added to a terminal to allow greater functionality when operating with a MCU. The specification for these features can be found in Recommendation H.230, H.231, and H.243.

9.9.2 Multipoint Control Operation in a MCU. All MCUs that meet this FTR shall meet all previous mandatory sections of this FTR, with the exception of coding and decoding of video. All MCUs that meet this FTR shall meet all mandatory specifications of ITU-T Recommendation H.231, H.243, H.320, H.221, H.230, and H.242. H.231 describes the functional representation of a MCU, and H.243 describes the in-channel terminal-to-MCU communications control procedures. These procedures allow MCUs to interwork with each other and with VTC terminals. These procedures also allow terminals and MCUs to switch among compatible modes of operation to support additional applications, for example, exchanging data.

MCUs should be able to connect and work with VTC terminals

that do not have specific MCU capability as stated in section 9.9.1.

MCUs should be capable of coding and decoding audio using G.711 framed F-law and A-law.

10. Where to Obtain Copies. Additional copies of this document can be obtained from the National Communications System, Technology and Standards Division (N6), 701 South Court House Road, Arlington, VA 22204-2198. When requesting copies, refer to Federal Telecommunications Recommendation 1080A-1998, Video Teleconferencing Services at 56 to 1,920 kbit/s.

Appendix A of FTR 1080A-1998

Video Teleconferencing Profile

Foreword

The Video Teleconferencing Profile (hereafter referred to as the Profile) was created through the cooperative efforts of members of industry and government. The Profile is mandatory for the Department of Defense (DoD) and optional for all other government agencies. In addition to the main body of FTR 1080A-1998, this Profile is the official VTC standards profile to be used by DoD per ASD (C^3I) direction, see Annex B paragraph B.8. Before using this document, DoD users should check with DISA Center for Standards, JIEO-JEBBA, to see if a more recent version has been approved.

The purpose of a video teleconferencing profile is to provide a standards-based reference document for users as an aid in the acquisition of video teleconferencing equipment, and for manufacturers as a guide to understand what features and functionality users may request.

This Profile is based on the international Recommendations from the International Telecommunications Union - Telecommunication Standardization Sector (ITU-T) for video teleconferencing, specifically the H.320 and T.120 series of Recommendations. It also includes the multipoint features and functionality of H.231.

Wherever possible, this Profile implements the ITU standards as ratified. There are a few exceptions to meet specific Government requirements, such as security that is not currently included or not clear in the ITU standards. Additionally, there are minimum requirements that are imposed by the Profile to ensure interoperability among Federal VTC systems.

The Profile also defines Protocol Implementation Conformance Statements (PICS) that may be found in Annex A. The users may require that PICS be completed prior to conformance or interoperability testing of equipment. On the basis of the completed PICS, the products may be tested to determine whether the features claimed in the PICS are implemented in the products tested. Users should feel free to request completed PICS as part of their acquisition process to determine if the features and functionality they require have been implemented.

There are certain situations of national security that government systems face that are not a concern for many users and such concerns are addressed in Annex B of this Appendix.

Future revisions of the Video Teleconferencing Profile may incorporate recommendations and guidance on Government implementation of ITU standards H.323, "Visual Telephone Systems and Equipment for Local Area Networks Which Provide a Non-Guaranteed Quality of Service," and H.324, "Terminal for Low Bit Rate Multimedia Communications."

Table of Contents

Video Teleconferencing Profile

1 Scope

The Video Teleconferencing Profile is applicable to end systems concerned with operating in the video teleconferencing environment. It specifies a combination of standards which cover national and international agreements for providing interoperable video teleconferencing services. It also specifies and recommends particular options within the individual standards.

The Profile is based primarily upon the ITU-T (International Telecommunications Union – Telecommunication Standardization Sector) H.320, H.231, and T.120 Recommendations for switched and dedicated digital circuits. Standards for operation over the following types of networks are also mentioned in paragraph B.7.6, but only as objective standards:

- Local Area Networks (LANs),
- Asynchronous Transfer Mode (ATM)
- Public Switched Telephone Network (PSTN), also known as Plain Old Telephone Service (POTS).

Further details for these objective standards will be provided in future versions of this profile.

For the purposes of this Profile, a Video Teleconferencing Unit (VTU) performs the following functions: coding/decoding of audio and video; multiplexing of video, audio, data, and control signals; system control; and end-to-end signaling. It does not include, but must process the necessary multimedia application protocol events for I/O devices, network interface equipment, end-to-network signaling, the network connections, or the network itself. It also does not include embedded and non-embedded cryptographic devices. The functions of the VTU do not need to be in a single physical box. They may be in one or more separate physical components. NOTE: The scope of this Profile is broader than the scope of the VTU because the Profile includes items which are not a part of the VTU. The solid lines of Figure 1-1 depict the scope of the VTC Profile.

It is the intention of this Profile to provide enough specificity, which, if followed, should insure baseline interoperability between VTUs. As ANSI and ITU-T Recommendations mature this document will be amended to include those changes. Proprietary features or algorithms are not precluded by this Profile, however, such features or algorithms are not supported by this Profile.

Certain functions and features of the ITU-T H.320 and T.120 suite of Recommendations are described in Section 5 to give users a high level overview of the Recommendations included in this Profile. Section 5 is not intended to be all encompassing. The Protocol Information Conformance Statements (PICS) given in Annex A are the definitive list of functions and features provided by the ITU-T H.320 and T.120 suite of protocols. The users may require that PICS be completed as part of an acquisition or prior to conformance or interoperability testing of equipment. Users planning the acquisition of video teleconferencing systems are directed to such completed PICS to determine which features and functions are supported by commercial video teleconferencing systems.

As used in this document, “shall” or “will” denotes a mandatory provision of the standard. “Should” denotes a provision that is recommended, but not mandatory. “May” denotes a feature whose

absence does not preclude compliance, that may or may not be present as an option of the implementor.

1.1 Block Diagram

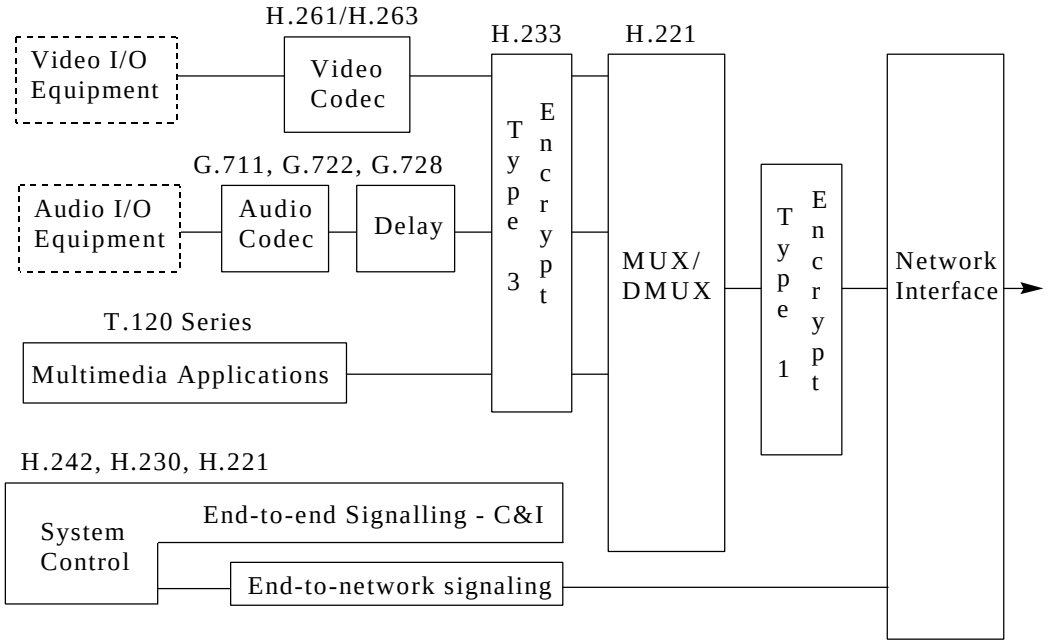


Figure 1.1. Video teleconferencing equipment block diagram (dashed boxes are not included in the scope of the Profile)

1.2 Comments

Beneficial comments (recommendations, additions, and deletions) and any pertinent data that may be of use in improving this VTC Profile should be addressed to the Defense Information Systems Agency (DISA), Joint Interoperability and Engineering Organization (JIEO), JEBBA (ATTN: FTR 1080 POC), Fort Monmouth, NJ 07703-5613.

2 References

The following documents contain provisions, which, through reference in this text, constitute provisions of this part of this Profile. At the time of publication, the editions indicated were valid. All documents are subject to revision. Parties to agreements based on this Profile are warned against automatically applying any more recent editions of the documents listed below, since the nature of references made by the Profile to such documents may be specific to a particular edition. Members of the cited standards organizations maintain registers of currently valid national and international standards and the ITU maintains published editions of its current Recommendations.

2.1 Government documents

2.1.1 Specifications, standards, and handbooks

Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplements thereto, cited in the solicitation.

2.1.1.1 Federal standards

FED-STD-1037C *Glossary of Telecommunication Terms, August 7, 1996.*

Federal Standard 1037C is available from:

National Telecommunications and Information Administration (NTIA)
325 Broadway
Boulder CO 80303-3328 Telephone: 1-303-497-5216
Internet: http://ntia.its.bldrdoc.gov

2.1.1.2 Military standards

MIL-STD-188-198A *Joint Photographic Experts Group (JPEG) Image Compression for the National Imagery Transmission Format Standard, December 15, 1993.*

Military Standards are available from:

DOD Single Stock Point (DODSSP)
Standardization Document Order
700 Robbins Avenue, Bldg. 4D
Philadelphia, PA 19111-5094 Telephone: 1-215-697-2667/2179
Internet: http://www.dodssp.daps.mil or http://www-library.itsi.disa.mil

2.1.1.3 Federal Information Processing Standards

FIPS PUB 140-1 *Security Requirement for Equipment Using Data Encryption Standard, January 11, 1994.*

FIPS Publications are available from:

National Technical Information Service
U. S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161-2171 Telephone: 1-800-553-6847
Internet: http://www.itl.nist.gov/div897/pubs

2.1.1.4 Federal Telecommunications Recommendations

FTR 1080A-1998 *Video Teleconferencing Services at 56 to 1,920 kbits/s.*

Federal Telecommunications Recommendations are available from:

National Communications System
701 South Court House Road
Arlington, VA 22204-2198 Telephone: 703-607-6200
Internet: http://www.ncs.gov

2.1.2 Other government documents, drawings, and publications

The following Government documents, drawings, and publications also form a part of this Profile to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

2.1.2.1 DoD Instruction

4640.14	Base and Long-Haul Telecommunications Equipment and Services, *December 6, 1991.*

2.1.2.2 Other government documents

DoDISS	*Department of Defense Index of Specifications and Standards.*
DISA/JIEO Circular 9008	*NITFS Certification Test and Evaluation Program Plan*
NSTISS 4009	*National INFOSEC Glossary, National Security Telecommunications and Information Systems Security.*
NSTISSAM TEMPEST/2-95	*Red/Black Installation Guidance, National Security Agency, December 12, 1995*
OSD Memorandum	*Implementation of the Joint Technical Architecture, August 22, 1996.*
OSD Memorandum	*Video Teleconferencing (VTC) Standards Guidance, March 30, 1998.*
Warner Amendment	*Public Law 97-86, December 1, 1981.*
FAR 39.106	*Year 2000 Compliance, FAC 90-46, April 23, 1997.*

2.2 Non-government publication

The following documents form a part of this Profile to the extent specified herein. Unless otherwise specified, the issues of the documents that are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation. If not in the DoDISS and not in the solicitation, then use the latest approved version of the standard.

2.2.1 Telecommunication Industries Association (TIA)/Electronic Industries Association (EIA) publications

EIA-170-A	*Electrical Performance Standards Monochrome Television Studio Facility, with Revision IET NTS 1 Color Television Studio Picture Line Amplifier Output Drawing, November 1977.*
TIA/EIA-232-F	*Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange, October 1997.*
EIA-366-A	*Interface Between Data Terminal Equipment and Automatic Calling Equipment for Data Communication, March 1979.*
EIA-422-B	*Electrical Characteristics of Balanced Voltage Digital Interface Circuits, 1994.*
EIA-449	*General-Purpose 37-Position and 9-Position Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange, January 1985.*
EIA/TIA-530-A	*High-Speed 25-Position Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment, June 1992.*

Copies of EIA and TIA standards can be purchased from:

Global Engineering Documents
15 Inverness Way East
Englewood, CO 80112 Telephone: 800-854-7179
Internet: http://global.ihs.com

2.2.2 ANSI publications

ANSI T1.601	*American National Standard for Telecommunications - ISDN Basic Access Interface for Use on Metallic Loops for Application on the Network Side of the NT, February 7, 1992.*
ANSI T1.605	*American National Standard for Telecommunications - ISDN Basic Access Interface for S and T Reference Points, July 26, 1991.*
ANSI T1.801.01	*Digital Transport of Video Teleconferencing /Video Telephony Signals - Video Test Scenes for Subjective and Objective Performance Assessment, November 1995.*
ANSI T1.801.02	*Digital Transport of Video Teleconferencing/ Video Telephony Signals - Performance Terms, Definitions and Examples, May 1996.*

ANSI T1.801.03 *Digital Transport of One-Way Signals - Parameters for Objective Performance Assessment, February 1996.*

ANSI T1.801.04 Multimedia Communications Delay, Synchronization, and Frame Rate Measurement, 1997

Copies of ANSI and ISO documents are available from:

American National Standards Institute
11 West 42nd Street
New York, NY 10036
Telephone: 212-642-4900; Facsimile: 212-302-1286
Internet: http://www.ansi.org

2.2.3 ITU-T publications

ITU-T G.711 *Pulse Code Modulation (PCM) of Voice Frequencies, November 1988.*

ITU-T G.722 *7 kHz Audio-coding within 64 kbit/s, November 1988.*

ITU-T G.728 *Coding of Speech at 16 kbit/s using Low-Delay Code Excited Linear Prediction (LD-CELP), September 1992.*

ITU-T H.200 *Framework for Recommendations for Audiovisual services, March 1993.*

ITU-T H.221 *Frame Structure for a 64 to 1,920 kbit/s Channel in Audiovisual teleservices, July 1997.*

ITU-T H.222 *Coding of moving pictures and associated audio: Systems, July 1995.*

ITU-T H.224 *Real Time Control Protocol for Simplex Applications using the H.221 LSD/HSD/MLP Channels, November 1994.*

ITU-T H.230 *Frame-Synchronous Control and Indication Signals for Audiovisual Systems, July 1995.*

ITU-T H.231 *Multipoint Control Units for Audiovisual Systems Using Digital Channels up to 2 Mbit/s. March 1996.*

ITU-T H.281 *Far End Camera Control Protocol for Video Conferences Using H.224, November 1994.*

ITU-T H.234 *Encryption Key Management and Authentication System for Audiovisual Services, November 1994.*

ITU-T H.242	*System for Establishing Communication Between Audiovisual Terminals Using Digital Channels up to 2 Mbit/s, July 1997.*
ITU-T H.243	*Procedures for Establishing Communications Between Three or More Audiovisual Terminals Using Digital Channels up to 2 Mbit/s. July 1997.*
ITU-T H.244	*Synchronized Aggregation of Multiple 64 or 56 kbit/s Channels, July 1995.*
ITU-T H.261	*Video CODEC for Audiovisual Services at px64 kbit/s, March 1993.*
ITU-T H.263	*Video Coding for Low Bit Rate Communications, January 1998.*
ITU-T H.320	*Narrowband Visual Telephone Systems and Terminal Equipment, July 1997.*
ITU-T H.323	*Packet based Multimedia Communications Systems, January 1998.*
ITU-T H.324	*Terminal for low bitrate multimedia communication, January 1998.*
ITU-T P.30	*Subscribers' Lines and Sets, November 1988.*
ITU-T P.50	*Artificial Voices, March 1993.*
ITU-T P.51	*Artificial Ear and Artificial Mouth, August 1996.*
ITU-T P.64	*Determination of Sensitivity Frequency Characteristics of Local Telephone Systems to Permit Calculation of Their Loudness Ratings, April 1997.*
ITU-T P.79	*Calculation of Loudness Ratings for Telephone Sets, March 1993.*
ITU-T Q.922	*ISDN data link layer specification for frame mode bearer services, February 1992.*
ITU-T T.4	*Standardization of Group 3 Facsimile Apparatus for Document Transmission, July 1996.*
ITU-T T.6	*Facsimile Coding Schemes and Coding Control Functions for Group 4 Facsimile Apparatus, November 1988.*
ITU-T T.81 (JPEG)	*Information Technology - Digital Compression and Coding of Continuous Time Still Images - Requirements and guidelines, September 1992.*

ITU-T T.82 (JBIG)	*Information Theory - Coded Representation of Picture and Audio Information - Progressive Bi-level Image Compression, March 1993..*
ITU-T T.90	*Characteristics and protocols for terminals for telematic Services in ISDN, February 1992.*
ITU-T T.120	*Transmission Protocols for Multimedia Data, July 1996 (Annex C, January 1998).*
ITU-T T.122	*Multipoint Communication Service for Audiographics and Audiovisual Conferencing Service Definition, January 1998.*
ITU-T T.123	*Protocol Stacks for Audiographic and Audiovisual Teleconferencing Applications. October 1996.*
ITU-T T.124	*Generic Conference Control for Audiographic and Audiovisual Terminals and Multipoint Control Units, January 1998.*
ITU-T T.125	*Multipoint Communications Service Protocol Specification. April 1994.*
ITU-T T.126	*Multipoint Still Image and Annotation Conferencing Protocol Specification, July 1997.*
ITU-T T.127	*Multipoint Binary File Transfer Protocol, August 1995.*
ITU-T T.128	*Multipoint Application Sharing, January 1998.*
ITU-T V.35	*Data Transmission at 48 kbit/s Using 60-108 kHz Group Band Circuits, 1989.*
ITU-T V.42bis	*Data Compression Procedures for DCEs Using Error Correction procedures, January 1990.*
ITU-T V.120	*Support by an ISDN of data terminal equipment with V-series type interfaces with provision for statistical Multiplexing, October 1996..*
ITU-T X.21	*Interface Between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Synchronous Operation on Public Data Networks, September 1992.*

Copies of ITU-T and CCITT documents are available from:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Potomac, MD 20854 Telephone: 1-800-553-6847
Internet: http.www.ntis.gov or http://www.itu.int

2.2.4 Other Publications

ASAC	*Embeddable KG-84 COMSEC Module (KIV-7) User's Manual, Allied Signal Aerospace Corporation, September 1995.*
NIUF 426-93	*NIUF Video Conferencing Application Profile (89-007.4, 940007.0), October 1993.*
NIUF	*A Catalog of National ISDN Solutions for Selected NIUF Applications, Second Edition, February 11, 1994.*

Non-Government standards and other publications are normally available from the organizations that prepare or distribute them. These documents also may be available in or through libraries or other informational services.

2.3 Order of precedence

The references cited in each of these documents, the following order of precedence shall apply for DoD:

1) Annex B of Appendix A,
2) Main body of Appendix A,
3) Annex A of Appendix A,
4) Main body of FTR 1080A-1998,
5) References cited in these documents.

Nothing in this Annex, however, supersedes applicable laws and regulations, unless a specific exemption has been obtained.

3 Definitions

Definitions of terms used in this Annex shall be as specified in FED-STD-1037C. Those definitions unique to this Annex and not defined in FED-STD-1037C, are provided in this paragraph.

Annotation: Text, graphics, or free hand markings used to highlight or provide explanation to areas of interest on an image or whiteboard.

Audio: The voice or sound portion of a teleconference.

Audio Mixing: The process of combining two or more audio signals to produce a single composite audio signal. This allows each participant in a conference to hear all other participants simultaneously.

Audio Switching: The process of switching the audio that all participants hear to that of the designated speaker. No other participants can be heard until they are selected as the audio source.

Basic-rate interface (BRI): The basic ISDN service, consisting of two 64 Kbps B-channels (bearer channels), which carry data and voice in both directions, and one 16 Kpbs D-channel (data channel), which carries call-control information.

Bitmap: A two dimensional array of pixels representing an image.

Bit-rate Allocation Signal (BAS): An eight-bit word within the frame structure of ITU-T Recommendation H.221 which is used to transmit commands, control and indication signals, and capabilities.

Call Association: The process of associating multiple channel calls to an individual VTU by an MCU. In a dial-in MCU configuration in which each call is placed over multiple channels (i.e., 2B channels) and there is a single network access (phone) number for all ports in a conference, this provides the means of associating each channel to the VTU making the call.

Camera: In television, an electronic device using an optical system and a light-sensitive pickup tube or chip to convert visual signals into electrical impulses.

Cascading: The process of providing a conference involving more than one MCU, so that information must pass not only between VTU and MCU, but also from one MCU to another.

Chair Control: A method of providing the capability for one of the VTUs involved in a conference to exercise some measure of authority over the conference, particularly in making the decision of which video will be broadcast to the other VTUs.

Chair-control Port: That port of the MCU serving the VTU to which chair-control has been assigned.

Chair-control VTU: An enhanced VTU possessing the capability to exert a certain measure of authority over the operation of the multipoint conference. The chair-control assignment may be prearranged, assigned by an operator, or by protocol during the call. The person controlling need not be the actual chairperson of the meeting.

Chrominance: The color component of a pixel. The Cb and Cr components in YCbCr. The A and B components in CIElab.

Classified: Any information that has been determined to require protection against unauthorized disclosure to avoid harm to U.S. national security. The classifications TOP SECRET, SECRET, and CONFIDENTIAL are used to designate such information, referred to as "classified information".

CODEC: Acronym for Coder/Decoder. In video teleconferencing, an electronic device that converts analog signals, typically video, voice, and/or data, into digital form and compresses them into a fraction of their original size to save frequency bandwidth on a transmission path. It also performs the inverse operation, decompressing received signals and converting them back to analog.

Collaborative desktop data conferencing: The ability to instantly share files and data stored in a PC with all or any of the participants in a teleconference.

Common Intermediate Format: See *Full Common Intermediate Format* component in CIElab.

Compression: See *data compression*, FED-STD-1037C, definition 1.

Conferencing: Programs and meetings which may be for the purpose of presenting and exchanging information, comparing views, learning, planning, and decision-making. Conferences can be held in one location or conducted simultaneously at multiple locations and linked together by telecommunications systems contains images, annotations, or pointers.

Cryptographic resynchronization: The VTU having the capability to automatically send a signal for resynchronization to the cryptographic device whenever resynchronization is needed.

Data communications port: A port used to transfer information between functional units by means of data transmission, according to a protocol.

Data port: See *data communications port*.

Data rate: In digital data communications, the rate at which data (bits in this case) is transmitted, usually expressed in bits per second.

DB-25S: A standardized 25-pin connector used in EIA-232-E and EIA-530 data communications.

Desktop and individual workstation: An input/output display device with local computer capability that allows an individual to perform some computational work and/or data-base access from a local or remote location. This device may also have videophone and/or VTC capabilities.

Directly-connected VTU: A VTU that is directly connected to the MCU in question, that is, it is not connected through another MCU. It may or may not be collocated with the MCU.

Dithered Image: A still image where each pixel is made up of a block of fixed size pels (picture elements). This block of pels simulates a grayscale pixel using black and white pels, or it simulates a large color space pixel (24-bit RGB) using small color space pels (4-bit palletized).

Dumb-bell Configuration: A network configuration in which there are two MCUs that are connected to each other.

EIA-232-E (formerly RS-232): A serial interface standard for transmission of unbalanced signals between a variety of computer, media, and multimedia peripherals. EIA-232-E transmits at a maximum of 19.2 kbit/s for up to a distance of about 50 feet and uses a 25-pin connector.

EIA-422 (formerly RS-422): A serial electrical interface standard for transmission of balanced and unbalanced signals between a variety of higher-end computer, media, and multimedia peripherals. EIA-422 allows a maximum data rate of 10 Mbit/s.

EIA-449 (formerly RS-449): A serial mechanical interface standard for transmission of balanced and unbalanced signals between a variety of higher-end computer, media, and multimedia peripherals. EIA-449 allows a maximum data rate of 10 Mbit/s and uses a 37- or 9-pin connector.

EIA-530: A replacement for EIA-449 that uses a DB-25 (EIA-232-E) connector instead of a 37-pin connector, while keeping the most important electrical signals intact. EIA-530 is to be used in conjunction with EIA-422-B.

Electronic Industries Association: A U.S. commercial standards organization. The acronym EIA precedes a numerical designation, such as EIA-232-E, which replaces the now obsolete RS (Recommended Standard) designation, for example, RS-232.

Embedded encryption: Encryption integrated into the VTU box.

Encoder: A device that converts plain text to equivalent cipher text by means of a code.

Encryption: The process of converting plain text into unintelligible form by means of a cryptosystem.

Frame: 1. When referring to an image, the set of all the picture elements in an image. 2. When referring to ITU-T H.221, a frame consists of 80 octets (bytes) of multiplexed signals.

Frame alignment: In the Industry Profile, frame alignment refers to the ITU-T H.221 frame, not the image frame.

Frame Alignment Signal (FAS): In the transmission of data frames, a distinctive sequence of bits used to accomplish frame alignment. In ITU-T H.221, this signal also contains additional bits for status, control and error detection.

Freeze-Frame Video: A frame of visual information selected from a video signal and processed through the video CODEC, usually for transmission to remote sites. This is a subset of still image.

Full Common Intermediate Format (FCIF): A video format defined in ITU-T H.261 that is characterized by 352 luminance pels on each of 288 lines, with half as many chrominance pels in each direction.

Grayscale Image: A still image where each pixel represents one of 256 shades of gray.

Halftone Image: A still image where each pixel is made up of a group of variable sized pels. This block of pels simulates a grayscale pixel using black and white pels, or it simulates a large color space pixel (24-bit RGB) using small color space pels (2-bit palletized).

Hardcopy Image: A still image typically sent to a printer or facsimile machine.

High-resolution graphics: Graphics captured and displayed at a higher resolution than the NTSC standard (EIA-170-A).

Inverse multiplexer: A device used to create a single, higher-speed network data channel by combining, separating, and synchronizing multiple, independent 56- or 64-kbit/s network data channels. Also known as an *aggregator*.

ISDN: See FED-STD-1037C, *Integrated Services Digital Network*. Note: Access channels include a basic rate (two 64-kbit/s "B" channels + one 16-kbit/s "D" channel) and a primary rate (twenty-three 64-kbit/s "B" channels and one 64-kbit/s "D" channel).

KG-194/194A: National Security Ageency (NSA) cryptographic device nomenclature. The KG-194/194A is to be used for high speed data encryption on dedicated networks.

KIV-7: National Security Agency (NSA) cryptographic device nomenclature. The KIV-7 is to be used for high speed data encryption on dial-up and other non-dedicated networks.

Local MCU: When referring to a particular VTU, the local MCU is that MCU to which the particular VTU is directly connected. It may or may not be collocated with the VTU.

Luminance: The intensity component of a pixel. The Y component in YCbCr. The L component in CIElab.

m-law: The PCM coding and companding standard used in Japan and North America.

Mandatory feature: If the profile makes a given feature mandatory then the feature must be included in all DoD VTC acquisitions, unless a waiver is obtained.

Minimum Picture Interval: The minimum time between pictures selected for encoding. Allowable values, per ITU-T H.221, are 1/29.97, 2/29.97, 3/29.97, and 4/29.97 seconds per picture.

Motion Compensation: A type of interframe coding used by CODECs in the compression of motion video images. The process relies upon an algorithm that examines a sequence of image frames to measure the motion that occurs between frames.

Multipoint: A telecommunications system that permits three or more locations to intercommunicate in a conference call.

Multipoint Control Unit: A multi-port device, by means of which three or more VTUs may intercommunicate in a conference call. It can also be used with two VTUs, e.g., while beginning or ending a multipoint conference.

Network: See FED-STD-1037C. In this Profile, *network* infers the system of cables, microwave links, and switching centers that allow the transmission of data, as opposed to the terminal equipment (such as CODECs and I/O devices) connected to the cables.

Network interface equipment: The equipment connected between the network and the VTU. Such examples of this equipment include (a) the channel service unit (CSU), (b) the data service unit (DSU), and the (c) terminal adapters.

Network Terminator Type 1 (NT-1): A device that converts a two wire U-interface to a four wire S/T interface, allowing multiple VTU connections.

NITFS: National Imagery Transmission Format Standard. A set of military standards described in MIL-HDBK-1300, for secondary imagery dissemination.

Nondevelopmental item (NDI): NDIs are items procured from immediately available stock, with no development costs.

Optional feature: If a feature is optional in this Profile, the user must decide whether to acquire the Profile feature or not. If acquired, this feature shall meet the specifications in the Profile. (Anyone wanting to be exempt from this rule shall first obtain a waiver.) The purpose is to improve interoperability, without forcing users to buy unnecessary features. The Profile does not prevent the user from buying a particular feature implemented in a nonstandard way. However, if both standard and nonstandard modes are acquired, the feature must be easily switched back to the standard mode.

For example, if a high-resolution, still imagery mode is an optional feature in this Profile, it would be the user's decision to purchase the Profile high-resolution, still-image-mode or not. If purchased, the version shall meet the Profile specifications for the high-resolution, still image mode. This will allow for interoperability of high-resolution, still images among those users purchasing this Profile feature. If the procuring agency desires, it can also buy a nonstandard version of the high-resolution, still image mode, as long as the equipment can be easily switched back to the standard high-resolution, still image mode. For "mandatory optional" see B.7.1.3.

***p*:** An integer that can range from 1 to 30. It relates to VTUs that operate at nominal bit rates of integer multiples of 64000 bits per second (bit/s), where the integer is *p*. For unrestricted channels, such as provided by ISDN, each increment of data rate may actually be 64000 bit/s, but in restricted channels, each increment may be only 56000 bit/s.

Palletized Image: A digitized representation of an image where each pixel of the image has been converted to a number which is an index into a color lookup table. Any color can be represented in the table, however, only a limited number of colors can be present in the image depending on the size

of the index. For example, a 4-bit pixel can represent 16 different colors. The actual colors in the table can be customized for each picture.

Plane: A virtual area having the same dimensions as the workspace which contains images, annotations, or pointers.

Pointer : A small image (for example, an arrow) representing a cursor position that is moveable over the workspace.

Primary-rate interface (PRI): A high speed ISDN service, consisting of 23 B-channels (30 in Europe) and one D-channel.

Primary VTU: A VTU that fully participates in the conference.

Principal MCU: An MCU that has been assigned a superior controlling function in a call where two or more MCUs are interconnected. Called "master" MCU in ITU-T Recommendations.

Protocol Implementation Conformance Statements (PICS): A detailed table of all the features that are included in the standards covered by the VTC Profile. It clearly specifies whether each feature is mandatory or optional, which is not always clear in the international standards. It can be used as a screening device to determine if a manufacturer's video conferencing equipment meets all the mandatory features and those optional features that the user requires.

***p*x64:** Family of 5 ITU-T Recommendations. These include H.261, H.221, H.242, H.230, and H.320. These Recommendations form the basis for Video Teleconferencing (VTC) interoperability.

Quarter Common Intermediate Format (QCIF): A video format defined in ITU-T H.261 that is characterized by 176 luminance pels on each of 144 lines, with half as many chrominance pels in each direction. QCIF has 1/4 as many pels as FCIF.

Recommended standard: A prefix to EIA standards, such as RS-232. This designation is now obsolete; it has been replaced by the prefix EIA, for example, EIA-232-E.

Resolution: See FED-STD-1037C, definition 3. For video equipment, often measured in terms of pels.

Restricted Channel: A digital communications channel for which each increment of *p* gives a useful capacity of only 56000 bits per second, instead of 64000 bits per second. This is currently common in North America, and was originally due to a ones density limitation in T1 circuits.

Satellite MCU: An MCU that has been assigned a controlling function that is inferior to a Principal MCU in a call where two or more MCUs are interconnected. Called "slave" MCU in ITU-T Recommendations.

Secondary VTU: A VTU that participates in the conference, but perhaps without the full range of services that primary terminals receive. For example, a secondary VTU may not be able to send or receive video.

Segmentation: The procedure whereby an MCU can simultaneously be used in more than one conference.

Selected Communication Mode: The common mode of communication that is selected by the MCU for communication during the call. The mode includes the transfer rate, and the audio, video, and data rates.

Service Definition: A standards document which defines the scope of the standardization effort of commercial standards. Service definitions for video teleconferencing have been written by the ANSI T1A1.5 committee, and by ITU-T Study Group 1.

Shared Whiteboard: An application program that simulates a conference room whiteboard or chalkboard, allowing multiple users in a video conference to type in notes, make free hand drawings or otherwise mark-up the whiteboard area. All users can view the combined annotations.

Softcopy Image: A still image typically displayed on a monitor or CRT.

Star Configuration: A network configuration of MCUs in which there is one MCU to which all other MCUs are directly connected. A chain of three MCUs, a dumb-bell configuration, and a single MCU are all degenerate forms of the star configuration.

Still Image: Non-moving visual information such as graphs, drawings, pictures, or video frames.

Still image transfer with annotation capabilities: The capability to transfer images (graphics, photos, maps, etc.) to others in the conference and to annotate them (mark them up) to highlight or change portions of the image. The images and annotations show up simultaneously on the screens of others in the conference.

Teleconferencing: The use of teleconferencing to conduct a seminar.

Teleconferencing System: A collection of equipment and integral components (customer premises equipment and facilities) required to process teleconferencing programs and control data, less network interface devices.

TEMPEST-approved: See FED-STD-1037C. A TEMPEST-approved device that meets stringent requirements. The electromagnetic waves it emits have been reduced through shielding or other techniques to a point where it would be extremely difficult for a hostile force to gather information from the electromagnetic waves and disclose the classified information being transmitted.

Terminal Equipment: A device or devices connected to a network or other communications system used to receive or transmit data. It usually includes some type of I/O device.

Terminal ID: A form of identification that allows a VTU to be assigned an alpha-numeric string such as a name or location rather than just an arbitrary terminal number.

Terminal Number: A number assigned by an MCU to a VTU for identifying VTUs in a conference. Terminal numbering is necessary for call association, chair control, and video select capabilities.

Type 1: A classified or controlled cryptographic equipment, assembly, component, or item endorsed by the National Security Agency (NSA) for securing telecommunications and automated information systems for the protection of classified or sensitive U.S. Government information exempted by the Warner Amendment for use by the U.S. Government and its contractors, and subject to restrictions in accordance with the International Traffic in Arms Regulation.

Type 2: An unclassified cryptographic equipment, assembly, component, or item endorsed by the National Security Agency for use in telecommunications and automated information systems for the protection of unclassified but sensitive information. Type 2 equipment is exempted by the Warner Amendment. Type 2 is available to U.S. Government departments, agencies, sponsored elements of state and local government, sponsored U.S. Government contractors, and sponsored private sector entities. It is subject to restrictions in accordance with the International Traffic in Arms Regulation.

Type 3: An unclassified cryptographic equipment, assembly, component, or item that implements an unclassified algorithm registered with the National Institute of Standards and Technology (NIST) as a FIPS for use in protecting unclassified sensitive, or commercial, information. This definition does not include Warner-Amendment-exempt equipment.

Unclassified: Information that is not classified.

Unclassified sensitive: A designation for information that is not classified, but needs to be protected from unauthorized disclosure. Examples of types of information that fall under this category are For Official Use Only (FOUO), proprietary, contractor sensitive, limited distribution, and personal in nature.

Unrestricted Channel: A digital communications channel, in which for each increment of *p*, all 64000 bits per second (bit/s) are available for information transfer. ISDN is an example of a network that uses 64000 bit/s communication channels.

Variable sized pels: This block of pels simulates a grayscale pixel using black and white pels, or it s**i**mulates a large color space pixel (24-bit RGB) using small color space pels (2-bit palletized).

Video: That portion of a signal that is related to moving images.

Video CODEC: See *CODEC*.

Videoconferencing: See *Video Teleconferencing*.

Video Mixing: The process of combining two or more video signals to produce a single composite video image. This allows each participant in a conference to view more than one of the other participants in the conference simultaneously. For example, the composite video image may be a two by two array in which the video from four participants appear in four blocks within the array (i.e., Hollywood Squares).

Video Switching: The process of switching the video signal that a participant sees to one of the other participants. The participant that is seen can be determined by the chairman, the participants, or as a function of the audio signal (*see Voice Activated Switching*).

Video Teleconferencing (VTC): Two-way electronic form of communications that permits two or more people in different locations to engage in face-to-face audio and visual communication. Meetings, seminars, and conferences are conducted as if all of the participants are in the same room.

Video teleconferencing unit (VTU): VTC equipment that performs the following functions: coding/decoding of audio and video; multiplexing of video, audio, data, and control signals; system control; and end-to-end signaling. It does not include I/O devices, embedded and non-embedded cryptographic devices, network interface equipment, end-to-network signaling, network connections, or the network itself. NOTE: The scope of this Profile is broader than the scope of the VTU because the scope of the Profile includes cryptographic devices and other items that the VTU does not include.

Video Telephony: Relating to video phones and video teleconferencing.

Videophone: A VTC terminal where most of the equipment is integrated into a single desktop unit.

Voice Activated Switching: The process of determining the video seen by the participants in a conference based on the audio signal. Typically, the loudest speaker will be seen by all of the participants.

Warner Amendment: Title 10, United States Code, Section 2315, "Law inapplicable to the procurement of automatic data processing equipment and services for certain defense purposes." Enacted as Public Law 97-86, 1 December 1981. The Warner Amendment amends Section 111 of the Federal Property and Administrative Services Act of automatic data processing equipment (currently defined to include telecommunications services and equipment) if the function, operation, or use of the equipment or services:

(1) involves intelligence activities;
(2) involves cryptologic activities related to national security;
(3) involves the command and control (C2) of military forces;
(4) involves equipment that is an integral part of a weapon or weapons system; or
(5) subject to (6) is critical to the direct fulfillment of military or intelligence missions.
(6) subpart (5) does not include procurement of automatic data processing equipment or services to be used for routine administrative and business applications, including payroll, finance, logistics, and personnel management applications.

The Warner Amendment has the effect of exempting the above DoD applications from the mandatory-use provisions for FTS-2000. See DoD Directive 4640.14 for detailed instructions for Warner exemption determinations.

Warner-exempt: A telecommunications requirement that meets the stipulations as stated in the Warner Amendment, which thereby exempts that requirement from the mandatory-use provisions of FTS-2000.

Wideband: In the case of wideband audio, G.722 specifies a bandwidth of 7 kHz.

Windowing: Capability to divide the video display into two or more separate regions with displays from different sources in each region. For example, four separate windows on the same display could simultaneously show a) data, b) motion video of the remote site, c) a still image, and d) motion video of the home site.

Workspace: A collection of planes which together forms the complete T.126 display.

4 Abbreviations and acronyms

All of the abbreviations and acronyms used in this part of the Profile are defined either in the referenced base standards (see Section 2) or listed below. Those that are common with the terms in FED-STD-1037C have been included for the convenience of the reader.

AIA	Audio Indicate Active
AIM	Audio Indicate Mute
ANSI	American National Standards Institute
APU	Audio Processing Unit
AR	Army Regulation
ASCII	American Standard Code for Information Interchange
ATM	Asynchronous Transfer Mode
BAS	bit rate allocation signal
bit/s	bit(s) per second
BNC	bayonet Neill-Concelman
BRI	Basic Rate Interface
CCA	Chair Command Acquire
CCD	Chair Command Disconnect
CCITT	International Telegraph and Telephone Consultative Committee (now ITU-T)
CCK	Chair Command Kill
CCR	Chair Command Release/Refuse
CD-ROM	compact disk - read only memory
CIC	Chair-control Indicate Capability
CIF	common intermediate format
CIR	Chair Indicate Release/Refuse
CIS	Chair Indicate Stopped-using

CIT	Chair Indicate Token
CM	Conditional Mandatory
CODEC	coder-decoder
COMSEC	communications security
COTS	commercial off-the-shelf
CPU	Central Processing Unit
CSU	Channel Service Unit
dBm	decibel(s) referenced to 1 milliwatt
DCA	LSD/HSD Command Acquire Token
DCC	LSD/HSD Command Close
DCE	Data Circuit-Terminating Equipment
DCR	LSD/HSD Command Release/Refuse
DCT	discrete cosine transform
DCTN	Defense Commercial Telecommunications Network
DES	data encryption standard
DIS	LSD/HSD Indicate Stopped Using Token
DISA	Defense Information Systems Agency
DIT	LSD/HSD Indicate Token
DoD	Department of Defense
DoDISS	Department of Defense Index of Specifications and Standards
DPCM	Differential Pulse Code Modulation
DPU	Data Processing Unit
DSU	Data Service Unit
DTE	Data Terminal Equipment
ECS	Encryption Control Signal
EEG	Electroencephalogram
EIA	Electronic Industries Association
EKG	Electrocardiogram
EPROM	erasable programmable read only memory
FAS	Frame Alignment Signal
FCIF	full common intermediate format
FEC	forward error correction
FED-STD	federal standard
FHDR	file header
FIPS	Federal Information Processing Standards
FOUO	For Official Use Only
fps	frames per second
FSCLAS	File Security Classification field
GCC	Generic Conference Control
H-MLP	High Speed - Multilevel Protocol Channel
HSD	High speed data
Hz	hertz
I/O	input/output
IC	Image Compression field
IIS	Information Indicate String

IMUX	inverse multiplexer
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Sector (formerly CCITT)
JBIG	Joint Bilevel Image Experts Group
JIEO	Joint Interoperability and Engineering Organization
JPEG	Joint Photographic Experts Group
kbit/s	kilobits per second
kHz	kilohertz
LAN	Local Area Network
LCA	Loopback Command, Audio Loop Request
LCD	Loopback Command, Digital Loop Request
LCO	Loopback Command Off
LCV	Loopback Command, Video Loop Request
LOS	loss of synchronization
LSD	Low speed data
M	Mandatory
MBE	multi-byte extension
Mbit/s	megabits per second
MCC	Multipoint Command Conference
MCN	Multipoint Command Negating MCS
MCS	Multipoint Command Symmetrical Data-transmission
MCU	Multipoint Control Unit
MCV	Multipoint Command Visualization-forcing
MIL	Multipoint Indication - Loop
MIL-HDBK	military handbook
MIL-STD	military standard
MILDEP	military department, such as the Air Force, Army, Navy
MIM	Multipoint Indicate Master
MIS	Multipoint Indicate Secondary-status
MIV	Multipoint Indicate Visualization
MIZ	Multipoint Indicate Zero-communication
MLP	Multilayer Protocol
MMS	Multipoint command Mode-Symmetrize
MPI	Minimum Picture Interval
ms	milliseconds
NACSIM	National COMSEC Information Memorandum
NDI	nondevelopmental item
NIST	National Institute of Standards and Technology
NITFS	National Imagery Transmission format Standard
NIUF	North American ISDN Users Forum
NSA	National Security Agency
NSTISS	National Security Telecommunications and Information Systems Security

NSTISSAM	National Security Telecommunications and Information Systems Security Advisory Memorandum
NT1	Network Termination 1
NTISSI	National Telecommunications and Information Systems Security Instruction
NTISSP	National Telecommunications and Information Systems Security Policy
NTSC	National Television Standards Committee
O	Optional
OFB	Output feedback mode
OPNAVINST	Chief of Naval Operations Instruction
OPNAVNOTE	Chief of Naval Operations Note
PCM	pulse code modulation
POTS	Plain Old Telephone System
PSTN	Public Switched Telephone Network
PUB	publication
QCIF	quarter common intermediate format
RAN	Random Number
RD	Receive Data
RGB	Red-Green-Blue
RS	recommended standard
RT	receive timing
RTS	Request To Send
SB-ADPCM	sub-band adaptive differential pulse-code modulation
SBE	Single Byte Extension
SCIF	Sensitive Compartmented Information Facility
SCM	Selected Communication Mode
SD	Send Data
ST	Send Timing
TA	Terminal Adapter
TCI	Terminal Command Identify
TCP	Terminal Command Personal Identifier
TCS	Terminal Command String
TCU	Terminal Command Update
TEMPEST	compromising emanations
TIA	Terminal Indicate Assignment
TIC	Terminal Indicate Capability
TID	Terminal Indication Dropped
TIF	Terminal Indicate Floor-request
TII	Terminal Indicate Identity
TIL	Terminal Indicate List
TIN	Terminal Indicate Number
TIP	Terminal Indicate Personal Identifier
TIS	Terminal Indicate Secondary
TIX	Terminal Indicate Additional Channel X
TT	terminal timing
VCB	Video Command Broadcast

VCF	Video Command "Freeze-picture request"
VCR	Video Command Reject
VCS	Video Command Select
VCU	Video Command "fast Update request"
VIA	Video Indicate Active
VIN	Video Indicate Number
VIS	Video Indicate Suspend
VPU	Video processing unit
VTC	video teleconferencing
VTU	video teleconferencing unit
YCbCr	Luminance; Chroma:blue; Chroma:red

5 Subnetwork-type independent requirements

These requirements shall apply to all ITU-T H.320 based video teleconferencing (VTC) systems. For a list of the features or functions required from each recommendation or standard, as well as optional features, see Annex A. Note that certain options, e.g., *p*xn, are negotiable at connection time assuming the capability is implemented, while other options are non-negotiable, e.g., use of multipoint. VTU requirements are specified in Sections 5.1, 5.2, 5.3, 5.4, and 5.6. MCU requirements are specified in Section 5.5.

5.1 Video, communications and control

5.1.1 General

Except as noted, the VTU shall conform with the requirements set forth in the five ITU-T px64 Recommendations, H.221, H.230, H.242, H.261, and H.320.

5.1.2 Operating mode

The VTU shall provide point-to-point bi-directional operation. Operation in multi-point topologies is covered in Sections 5.5 and 5.6.

5.1.3 Data transmission rates

The Recommendations relate to VTUs that operate at nominal bit rates of *p*x64000 bits per second (bit/s), where *p* is an integer that can range from 1, 2, 3, 4, 5, 6, 12, 18, 24 and 30. For unrestricted channels, such as provided by ISDN, each increment of data rate may actually be 64000 bit/s, but in restricted channels, each increment may be only 56000 bit/s. VTUs shall be able to operate with other VTUs on unrestricted and restricted channels. VTUs shall provide operation at least for p=1 and p=2. Proprietary algorithms for video coding are allowed by FTR 1080A-1998. If a certain value of *p* is required, the VTU must operate at that value according to ITU-T H.261 and not just the proprietary video algorithm.

5.1.4 Video coding and decoding

The video CODEC subsystem used to provide VTC services within the scope of this Profile shall conform to the specifications set forth in ITU-T H.261. In addition to the mandatory requirements of ITU-T H.261, the video CODEC subsystem may optionally be provided in accordance with the specifications of ITU-T H.263. H.263 can provide higher picture quality than H.261, especially at data rates below 384 kbps.

5.1.5 Picture format (resolution)

The video CODEC shall provide full-color operation using at least the QCIF format in accordance with ITU-T H.261. If a resolution of 352 (horizontal) by 288 (vertical) or higher is required for motion video, then the standard algorithm of ITU-T H.261 shall be available at FCIF resolution.

5.1.6 Motion rendition

The decoder shall decode at least 7.5 pictures per second. This is equivalent to a Minimum Picture Interval (MPI) of 4/29.97 seconds per picture as described in ITU-T H.221, Annex 1, ITU-T H.261, section 3.1, and ITU-T H.263, section 4.1.

5.1.7 Forward error correction (FEC)

The use of the FEC code in the decoder, as specified in ITU-T H.261 section 5.4 and ITU-T H.263 Annex H, to correct transmission errors is optional.

5.1.8 Motion compensation

The requirement for Motion Compensation in the encoder is optional.

5.1.9 Freeze-frame video

All VTUs may optionally support a freeze-frame video transmission capability. Freeze-frame video is a frame selected from a video signal, and processed through the video CODEC for transmission to remote sites. Freeze-frame video is not the same as still image graphics. Motion video transmission is suspended until freeze-frame transmission is complete. If multimedia applications are used, beyond those defined as freeze-frame, the requirements of the T.120 series of recommendations shall be used as per 5.1.10.

The VTU may optionally have the capability to output video signals representing both motion video and freeze-frame video simultaneously, or provide a single video output which can be switched by the user between motion video and freeze-frame video. If the capability of coding of freeze-frame images is provided it shall be performed by means of the technique described in ITU-T H.261 Annex D. Optionally, it may also be provided per ITU-T H.263. This technique provides an image up to twice the resolution in each direction of the format currently being used for motion video, i.e. 352 x 288 pels for VTUs using QCIF motion video, and 704 x 576 pels for VTUs using FCIF motion video. VTUs capable of QCIF motion video may optionally provide QCIF freeze-frame video (176 x 144 pels) capability. Four times QCIF (FCIF) freeze-frame video (352 x 288) may be optional. VTUs capable of FCIF motion video may optionally provide FCIF freeze-frame video (352 x 288)

capability. Four times FCIF freeze-frame video (704 x 576) may be another option. Freeze-frame video having two times horizontal or two times vertical resolutions are also allowable.

5.1.10 Multimedia Teleconferencing Applications

Multimedia applications such as audiographic conferencing, facsimile, still image transfer, annotation, pointing, shared whiteboard, file transfer, and audio-visual control are optional. If any of these applications are required in the VTU, it is strongly recommended that the VTU comply with the T.120 series of Recommendations listed in Table 5.1. This includes the mandatory portions of T.120, T.122, T.123, T.124, and T.125, which define the basic protocols. It also includes the mandatory portions of T.126, T.127 and T.128 depending on the applications that are implemented. In the future it may also include T.130, which is still under development by the ITU. This will provide for interoperability of the application between different vendors' products.

Table 5.1 T.120 Series of Recommendations

Rec.	TITLE
T.120	Transmission Protocols for Multimedia Data
T.122	Multipoint Communications Service for Audiographic and Audio Visual Conferencing Service Definition
T.123	Protocol Stacks for Audiographic and Audio Visual Teleconferencing Applications
T.124	Generic Conference Control for Audiographic and Audio Visual Terminals and Multipoint Control Units
T.125	Multipoint Communications Service Protocol Specification
T.126	Multipoint Still Image and Annotation Conferencing Protocol Specification
T.127	Multipoint Binary File Transfer Protocol
T.128	Multipoint Application Sharing

T.120 is the umbrella Recommendation which provides an overview of the T.120 series. The T.120 Recommendations consist of protocols and applications that utilize those protocols. These are described in the following sections.

T.120 also allows for non-standard applications, such as application sharing, within the T.120 framework. These non-standard applications also use the T.120 protocol stack and procedures.

5.1.10.1 Protocols

The T.120 Protocol Suite consists of four Recommendations: T.123 Network Specific Data Protocol Stack, T.122 Multipoint Communications Service - Service Definitions, T.124 Generic Conference Control for Terminals and Multipoint Control Units, and T.125 Multipoint Communications Service - Protocol Definition. These Recommendations define a communications infrastructure which supports point-to-point and multipoint data communications within the MLP and/or H-MLP data channels.

All VTUs that implement T.120 shall implement the mandatory requirements of T.122, T.123, T.124 and T.125.

T.122 and T.125 together, define the services, messages, and procedures available within the T.120 Multipoint Communications Services .

T.123 specifies the Network Specific Data Protocol Stack for Multimedia Conferencing. A VTU supporting T.120 applications shall follow the recommendations of T.123 for the ISDN Basic Mode Profile using the physical sublayer formed by H.221 MLP channels. The Circuit Switched Digital Network Basic Mode Profile shall be used for non-ISDN circuit switched networks such as Switched-56.

T.124 provides mechanisms for the creation, control and the termination of conferences. It also makes provisions for the building and distributing the conference and application databases.

5.1.10.1.1 Multi-layer Protocol (MLP) Data Channels

A VTU implementing the T.120 series of Recommendations shall use the MultiLayer Protocol (MLP) and/or the High Speed MLP (H-MLP) data channels as described in H.242. These channels provide data rates from 4 kbps up to 448 kbps. MLP at 4 kbps is insufficient bandwidth for T.120 and shall not be used. All VTUs providing T.120 applications shall support the common MLP rate of 6.4 kbps. This data rate provides a common point of interoperability for VTUs using T.120. If higher data rates are provided, it is recommended that all lower data rates (down to 6.4 kbps), as specified in H.221, also be provided. This will allow VTUs to interoperate at the higher data rates. For example, if one VTU can provide a data channel at 32 kbps and 6.4 kbps, and the other VTU can provide a data channel at 64 kbps and 6.4 kbps. The two VTUs will only interoperate at 6.4 kbps. However, if the VTUs could provide data channels at all lower data rates, then the two VTUs could interoperate at 32 kbps. Higher data rates may provide higher speed operation for T.120 applications such as file transfer, whiteboarding, and screen sharing.

VTUs which implement T.120 may use either the MLP data channel, the H-MLP data channel or both channels for T.120 data. It is recommended that VTUs operating at 2B or lower, use the MLP data channel, while VTUs operating at higher than 2B, use the H-MLP data channel.

5.1.10.2 Conference Control

All VTUs that implement T.120 shall implement the mandatory requirements of T.124 Generic Conference Control (GCC) as per 5.1.10.2.1. A VTU may also implement any of the optional capabilities of T.124 which are described in sections 5.1.10.2.2, 5.1.10.2.3, and 5.1.10.2.4.

T.124 defines Generic Conference Control functions. It provides for conference management and control functions such as:

- Conference Establishment and Termination: Provides the capability to start a new conference, invite someone into an existing conference, join an existing conference, leave a conference, or terminate the entire conference. It also provides the capability to obtain a list of the currently active conferences.

- Manage the Conference Roster: Maintains a list of all VTUs in a conference. VTUs can then request copies of this list.

- Manage the Application Roster: Maintains a list of the T.120 applications (file transfer, Image transfer, whiteboard, etc.) that each VTU in a conference has the capability to run.

- Remote Actuation: Allows an application on one VTU to start the same applications on other VTUs in the conference.

- Conference Conductorship: A conference can have a conductor (chairman) which provides for the orderly control of the conference.

- Application Registry Services: Allows an application to access a central database for information which will aid in establishing communications with applications on other VTUs.

These functions are described in detail in sections 5.1.10.2.1 through 5.1.10.2.4.

A T.120 conference can be created (started) in point-to-point mode between two VTUs or in multipoint mode between several VTUs and an MCU.

5.1.10.2.1 Mandatory Conference Control Capabilities

A VTU having T.120 capability shall have the following mandatory capabilities defined in T.124 (specific command names are shown in *italics*):

- Start a new conference, specifying the characteristics of that conference (*GCC-Conference-Create*). The VTU which creates a new conference is the convener of that conference.
- Determine what conferences are currently in progress and the information needed to join them (*GCC Conference-Query*).*
- Join an existing conference (*GCC-Conference-Join*).
- Leave an existing conference (*GCC-Conference-Disconnect*).
- Announce its presence in the conference *(GCC-Conference-Announce-Presence, GCC-Conference-Roster-Report*).
- Enroll its applications with the conference (*GCC-Application-Permission-To-Enroll, GCC-Application-Enroll, GCC-Application-Roster-Report*).
- To be invited to Join a Conference (*GCC-Conference Invite*).
- Receive notification of Conference termination (*GCC-Conference Terminate*).
- To be ejected from a conference and receive notification of an ejection (*GCC-Conference-Eject-User*).
- Receive notification that selected nodes in a conference have been transferred (*GCC-Conference-Transfer*).

5.1.10.2.2 Optional Conference Control Capabilities

A VTU having T.120 capability may have the following optional capabilities defined in T.124:

- Invite another VTU to join the conference (*GCC-Conference-Invite*).
- Ask how much time is remaining (*GCC-Conference-Time-Inquire*).
- Ask that the conference be extended beyond the allocated time (*GCC-Conference-Extend*).
- Request the list of all VTUs in a conference (*GCC-Conference-Roster-Inquire*).
- Request the list of VTUs that have the capability to run a particular application, group of applications, or any application (*GCC-Application-Roster-Inquire*).
- Request that a specific application be invoked in selected VTUs (*GCC-Application-Invoke*).
- Determine if the conference is in conductor mode. (*GCC-Conductor-Inquire*)
- Request permission from the conference conductor to take certain actions within a T.120 Application. (*GCC-Conductor-Permission-Ask*)
- Become the conference conductor. (*GCC-Conductor-Please, GCC-Conductor-Assign*)

5.1.10.2.3 Optional Conference Convener Capabilities

The VTU that created the conference is the convener. A VTU that has convened a T.120 conference has the following additional optional capabilities defined in T.124:

- Dial-out to add another VTU to the conference (*GCC-Conference-Add*).
- Prevent other VTUs from joining, or allow other VTUs to join the conference without being explicitly added by the convener (*GCC-Conference-Lock*, *GCC-Conference-Unlock*, *GCC-Conference-Lock-Report*).
- Terminate the entire conference (*GCC-Conference-Terminate*).
- Eject another VTU from the conference (*GCC-Conference-Eject-User*).
- Transfer VTUs to another conference (*GCC-Conference-Transfer*).
- Notify the other VTUs of the time remaining in the conference (*GCC-Conference-Time-Remaining*).

5.1.10.2.4 Optional Conference Conductor Capabilities

A VTU which has become the conference conductor may be granted the same capabilities as the convener, at the discretion of the convener. The conductor may also have the following optional capabilities defined in T.124:

- Give up Conductorship. (*GCC-Conductor-Release*)
- Give Conductorship to another VTU. (*GCC-Conductor-Give*)
- Give approval to other VTUs to take certain actions within a T.120 application. (*GCC-Conductor-Permission-Grant*)

5.1.10.3 Still Image Applications

T.126 specifies the requirements for facsimile, still image, annotation, and shared whiteboard applications within T.120. This Recommendation provides for five optional groups of features called T.126 profiles. If the acquisition calls for still image transmission capability, then profile 1 is mandatory. If the acquisition calls for still image transmission capability, other than freeze-frame, then at least one of profiles 2 and 3 are mandatory. If the acquisition calls for shared whiteboard, then profile 4 is mandatory. If the acquisition calls for image annotation, then profile 5 is mandatory.

A VTU conforms to a T.126 Profile if its capabilities are greater than or equal to the minimum mandatory requirements indicated below. Optional capabilities which are applicable to all T.126 profiles are listed in Table 5.2. Most of the T.126 Profiles provide both compressed and uncompressed image formats. Compressed formats reduce redundant information within the image, thereby reducing the transmission time and storage space required. See sections 5.1.10.3.1 and 5.1.10.3.2 for a discussion of image formats, including T.4 (Group 3 facsimile), T.6 (Group 4 facsimile), T.81 (JPEG), and T.82 (JBIG). The T.126 profiles are:

1) Facsimile: Using the T.126 *Hard-Copy-0* Profile. This T.126 Profile provides for the exchange of black and white images bound directly for hard copy devices such as facsimile machines or printers. This type of image is referred to as a hardcopy image.

> It shall support pixel counts of up to 1728 (wide) by 2300 (high) which are sufficient for A (8.5" x 11") size and A4 (8.27" x 11.69") size paper. Pixel counts up to 21845 in each direction are optional (Items 2 and 3 in Table 5.2). These optional larger pixel counts could be used for other paper sizes such as legal or B size.
>
> The uncompressed and T.4 (Group 3 facsimile) compressed image formats are mandatory. Typical T.4 facsimile resolution is 200 pixels per inch (width) and 100 pixels per inch (height). Other allowable resolutions are 200(w) x 200(h), 300 x 300, and 400 x 400. The T.6 (Group 4 facsimile) and T.82 (JBIG) compressed image formats are optional (Item 5 and 6 in Table 5.2). Typical T.6 facsimile resolution is 200 pixels per inch (width) and 200 pixels per inch (height) with optional resolutions of 300 x 300, and 400 x 400. Typical T.82 facsimile resolution is 400 pixels per inch (width) and 400 pixels per inch (height).

2) Still Image Transfer: Using the T.126 *Soft-Copy-Image-0* Profile. This T.126 Profile provides for the exchange of monochrome or color images for display. This type of image is referred to as a softcopy image.

> It supports a mandatory workspace size of 384(w) x 288(h) pixels and at least one image plane which shall support images having pixel counts of up to 384 (w) and 288 (h). Additional image planes and workspace and image pixel counts of up to 21845 in each direction are optional (Items 8 , 9, 10, 15 and 16 in Table 5.2).
>
> The uncompressed, T.82 (JBIG) compressed, and T.81 (JPEG) compressed image formats are mandatory. These formats have many options which affect image quality and transmission time (Items 18, 19, and 20 in Table 5.2).

3) High Resolution Still Image Transfer: Using the T.126 *Soft-Copy-Image-1* Profile. This T.126 Profile provides the same capability as Still Image Transfer (*Soft-Copy-Image-0* Profile) except that it shall support pixel counts up to 768 (w) and 576 (h).

4) Whiteboard: Using the T.126 *Soft-Copy-Whiteboard-0* Profile. This T.126 Profile provides an electronic whiteboard for annotations such as drawings, notes, or sketches. Annotation drawing

elements consist of point lines, poly lines, rectangles, and ellipses. Line color, style, thickness, and fill color are selectable. Annotations may be deleted or edited.

It supports a mandatory workspace size of 384(h) x 288(v) pixels and at least one annotation plane. The annotation plane keeps the annotations separate from any underlying image planes or other annotation planes. For example, an annotation plane can be used for each participant in a conference, keeping their annotations independent. The annotation plane supports annotation bitmaps having pixel counts of up to 384 (w) and 288 (h).

The uncompressed format is mandatory for the annotation bitmap. T.82 (JBIG) compressed image format is optional for the annotation bitmap (Item 29 in Table 5.2).

5) Image Annotation: Using the T.126 *Soft-Copy-Annotated-Image-0* Profile. Provides the combined capabilities of High Resolution Still Image Transfer (*Soft-Copy-Image-1* Profile) and Whiteboard (*Soft-Copy-Whiteboard-0* Profile) with the addition of pointing capability. This provides the ability to overlay annotation on images, and provides a movable pointer.

It supports a mandatory workspace size of 768(w) x 576(h) pixels, at least one image plane, at least one annotation plane, and a pointer plane. This supports annotation bitmaps and images having pixel counts of up to 768 (w) and 576 (h), and pointer bitmaps of up to 32 (w) x 32 (h) pixels.

The uncompressed format is mandatory for the pointer bitmap. T.82 (JBIG) compressed image format is optional for the annotation bitmap (Item 18 and 33 in Table 5.2).

As part of the T.126 initialization procedure, each VTU indicates its capabilities. Table 5.2 shows the wide range of optional capabilities that are available in the T.126 Recommendation. The column "VALUES" indicates the range of options to choose from, "Yes, No" indicates that a manufacturer can choose to implement that feature or not to implement it. The column "REQ. CAP." indicates the item number of other capabilities that are required to be implemented in order to implement this capability. The column "REQ. BY PROFILE" indicates that the capability is required by one of the five T.126 Profiles. The number refers to paragraph numbers (1 - 5) from the section above.

5.1.10.3.1 Hard Copy Image Format Options

Hard copy images can be represented in a variety of selectable formats. These include T.4 (Group 3 fax), T.6 (Group 4 fax), T.82 (JBIG) and uncompressed formats. T.4 has two formats, one-dimensional coding and two-dimensional coding. The two T.4 formats and the uncompressed format are mandatory; the T.6 and the T.82 formats are optional.

All hardcopy images are bilevel, that is, they consist of only full white and full black pixels. They do not provide color or shades of gray. All of the hardcopy image formats provide lossless image compression. This allows the image to be received exactly as it is scanned in, except for the losses due to limited pixel resolution.

The T.4 format is the standard Group 3 facsimile format used in most fax machines today. The two-dimensional coding format provides more compression than the one-dimensional format. The T.6 format is a two-dimensional coding algorithm and provides better compression than either of the T.4 formats.

Table 5.2 Still Image Optional Capabilities

ITEM	CAPABILITY	DESCRIPTION	VALUES	REQ. CAP.	REQ. BY PROFILE
1	Hard-Copy-Image	Capability to exchange hard copy images	Yes, No	None	1
2	Hard-Copy-Image-Bitmap-Max-Width	Maximum hardcopy image width	1,728 to 21,845 pixels	1	
3	Hard-Copy-Image-Bitmap-Max-Height	Maximum hardcopy image height	2,301 to 21,845 pixels	1	
4	Hard-Copy-Image-Bitmap-Any-Aspect-Ratio	Capability to handle any arbitrary pixel aspect ratios	Yes, no	1	
5	Hard-Copy-Image-Bitmap-Format-T.6	Capability to handle T.6 compressed image formats	Yes, no	1	
6	Hard-Copy-Image-Bitmap-Format-T.82	Capability to handle T.82 compressed image formats	Yes, no	1	
7	Soft-Copy-Workspace	Capability to have a workspace for soft copy images	Yes, No	None	2, 3, 4, 5
8	Soft-Copy-Workspace-Max-Width	Maximum softcopy workspace width	385 to 21845 pixels	7	3*, 5*
9	Soft-Copy-Workspace-Max-Height	Maximum softcopy workspace height	289 to 21845 pixels	7	3*, 5*
10	Soft-Copy-Workspace-Max-Planes	Maximum number of planes allowed in the workspace	2 to 256 planes	7	
11	Soft-Copy-Color-16, Soft-Copy-Color-202, Soft-Copy-Color-True	Capability to use a color palette in the workspace	16 colors, 202 colors, 24-bit true color (16 million colors)	7	
12	Soft-Copy-Plane-Editing	Capability to declare a workspace plane to be editable	Yes, no	7	
13	Soft-Copy-Scaling	Capability to scale softcopy images	Yes, no	7	
14	Soft-Copy-Image	Capability to exchange softcopy images	Yes, No	7	2, 3, 5
15	Soft-Copy-Image-Bitmap-Max-Width	Maximum softcopy image width	385 to 21845 pixels	7, 14	3*, 5*
16	Soft-Copy-Image-Bitmap-Max-Height	Maximum softcopy image height	289 to 21845 pixels	7, 14	3*, 5*

ITEM	CAPABILITY	DESCRIPTION	VALUES	REQ. CAP.	REQ. BY PROFILE
17	Soft-Copy-Image-Bitmap-Any-Aspect-Ratio	Capability to handle any arbitrary pixel aspect ratios	Yes, no	7, 14	
18	Soft-Copy-Image-Bitmap-Format-T.82-	Capability to handle T.82 compressed image formats	Various parameters, See 5.1.10.3.1	7, 14	
19	Soft-Copy-Image-Bitmap-Format-T.81-	Capability to handle T.81 compressed image formats	Various parameters, See 5.1.10.3.1	7, 14	
20	Soft-Copy-Image-Bitmap-Format-Uncompressed-	Capability to handle uncompressed image formats	Various parameters, See 5.1.10.3.1	7, 14	
21	Soft-Copy-Annotation	Capability to use annotation on softcopy workspaces	Yes, No	7	4, 5
22	Soft-Copy-Annotation-Bitmap-Max-Width	Maximum annotation image width	385 to 21845 pixels	7, 21	
23	Soft-Copy-Annotation-Bitmap-Max-Height	Maximum annotation image height	289 to 21845 pixels	7, 21	
24	Soft-Copy-Annotation-Drawing-Pen-Min-Thickness	Minimum thickness of the annotation pen	1 to 2 pixels	7, 21	
25	Soft-Copy-Annotation-Drawing-Pen-Max-Thickness	Maximum thickness of the annotation pen	17 to 255 pixels	7, 21	
26	Soft-Copy-Annotation-Drawing-Ellipse	Capability to use ellipse drawing types	Yes, no	7, 21	
27	Soft-Copy-Annotation-Drawing-Pen-Square-Nib	Capability to use a square nib shape when drawing lines	Yes, no	7, 21	
28	Soft-Copy-Annotation-Drawing-Highlight	Capability to use a highlight line style	Yes, no	7, 21	
29	Soft-Copy-Annotation-Bitmap-Format-T.82	Capability to handle T.82 compressed annotation image formats	Yes, no	7, 21	
30	Soft-Copy-Pointing	Capability to use pointer bitmaps	Yes, No	7	5
31	Soft-Copy-Pointing-Bitmap-Max-Width	Maximum pointer bitmap width	33 to 21845 pixels	7, 30	
	Soft-Copy-Pointing-Bitmap-Max-Height	Maximum pointer bitmap height	33 to 21845 pixels	7, 30	
33	Soft-Copy-Pointer-	Capability to handle	Yes, no	7, 30	

ITEM	CAPABILITY	DESCRIPTION	VALUES	REQ. CAP.	REQ. BY PROFILE
	Bitmap-Format-T.82	T.82 compressed pointer image formats			
* - Indicates required values are specified in Section 5.1.10.3.					

The uncompressed format provides no compression and thus represents an image with the most amount of data. These images will require more storage capacity, and take longer to transmit. This format may be appropriate for small images (i.e. 64 x 64) where the transmission time may not be significant. With this format, delays for compression and decompression are avoided.

On dithered or halftone images, the T.4 and T.6 formats perform poorly, and may even result in negative compression. In this case, the T.4 one-dimensional format may be better than the others. Also providing better performance for these types of images is T.82 (JBIG). The T.82 format is usually better for all image types including text and line drawings, but is significantly better for dithered and halftone images. The T.82 hardcopy format uses the bilevel image format on a single bitplane and prediction with no resolution reduction. See 5.1.10.3.2 for more details on T.82.

5.1.10.3.2 Soft Copy Image Format Options

Soft copy images can be represented in a variety of selectable formats. These include uncompressed, T.82, and T.81 formats. All three formats are mandatory for soft copy images, however, each format has several options.

5.1.10.3.2.1 Uncompressed Format

The uncompressed format represents each pixel in the image with between one bit and 24 bits depending on the color space used. This format may be appropriate for small images (i.e. 64 x 64) where the transmission time may not be significant, and delays for compression and decompression are avoided. A VTU with softcopy capability shall be able to transmit and receive uncompressed images in 8-bit grayscale, RGB 4:4:4, YCbCr 4:2:2, or palletized 1, 4, or 8 bit per pixel formats. Optionally it may also handle YCbCr 4:2:0, YCbCr 4:4:4, CIElab 4:2:0, CIElab 4:2:2, or CIElab 4:4:4 formats. These are described in detail at the end of 5.1.10.3.2.4 and 5.1.10.3.2.5.

5.1.10.3.2.2 T.82 Joint Bi-level Image Experts Group (JBIG)

T.82 (JBIG) is designed to compress bilevel images, grayscale images, and palletized color images. A VTU with softcopy capability shall transmit and receive T.82 images in bilevel, 8-bit grayscale, RGB 4:4:4, YCbCr 4:2:2, and palletized 1, 4, and 8 bit per pixel formats. Optionally, it may also handle 12-bit grayscale, YCbCr 4:2:0, YCbCr 4:4:4, CIElab 4:2:0, CIElab 4:2:2, or CIElab 4:4:4 formats. The 12-bit grayscale mode could be used for high detail medical or military images. It allows for 4096 shades of gray as opposed to only 256 shades for 8-bit grayscale. The T.82 algorithm use three types of pixel prediction: prediction with no resolution reduction, differential prediction with resolution reduction, and deterministic differential prediction with resolution reduction. Prediction with no resolution reduction is the default. The other modes increase the compression that can be achieved, and also allow for progressive transmission. In progressive transmission, a lower resolution

image appears quickly and is then progressively refined with detail until the full resolution image is transmitted.

5.1.10.3.2.3 T.81 Joint Photographic Experts Group (JPEG)

T.81 (JPEG) is designed to compress color images. It usually offers better performance than JBIG for color images. A VTU with softcopy capability shall transmit and receive T.81 images in 8-bit grayscale, and YCbCr 4:2:2 formats. Optionally it may also handle 12-bit grayscale, RGB 4:4:4, YCbCr 4:2:0, YCbCr 4:4:4, CIElab 4:2:0, CIElab 4:2:2, or CIElab 4:4:4 formats. As a default, the color components are interleaved, optionally, they can be non-interleaved.

The T.81 algorithm has several compression modes: DPCM, Sequential DCT, and Progressive DCT. Lossless compression can be selected using DPCM modes. Lossy compression is selected using DCT modes. Lossy compression may be visually lossless, providing useful images at increased compression. Sequential DCT mode compresses and transmits the entire image in a single pass. This is the default mode. Progressive DCT mode compresses the image and transmits the low frequency components of the entire image first, followed by lower frequency components. This allows the image to be transmitted and decoded progressively.

The T.81 algorithm allows two different entropy coding techniques: Huffman and arithmetic. The default is Huffman coding. The arithmetic coding mode may provide improved compression over the standard Huffman encoding. The T.81 algorithm allows prediction techniques called differential modes, which produce difference images for coding. Differential modes offer improved compression over the standard non-differential modes when there is large areas of special similarity in the images. These compression improvements may not be significant, however, they may increase the complexity and delay of the compression/decompression process.

T.81 makes use of quantization tables which must be defined by the manufacturer or user in order to compress and decompress the images. In T.126, the tables are always transmitted along with the image data. The contents of these tables are not addressed in T.126; rather it is left to the manufacturer to determine the manner in which they are defined.

5.1.10.3.2.4 Color Mapping

The next option for all uncompressed, T.82 and T.81 formats is color mapping, which is how color is represented. There are three types of color mapping: grayscale, palletized, and color component. Grayscale formats represent an image in 256 shades of gray, with no other colors being represented. This format provides more detail than bilevel (black and white) images and requires less data than color images. Palletized formats represent color using lookup tables. Each entry of the table represents a color. Only the index of the color within the table is coded and transmitted. This index may be a 1-bit, 4-bit, or 8-bit value. Palletized formats are more efficient than the color component formats, however, the actual number of colors that can be represented is limited to a small number (2, 16, or 256). For the third type of color mapping, there are three color component formats: RGB, YCbCr, and CIElab. These formats use three 8-bit values to represent each pixel. The RGB formats are typical for computer generated pictures, while the YCbCr formats are typical for video capture devices and cameras. The YCbCr format is more efficient than RGB because the chroma components

(Cb and Cr) can be sampled at a lower resolution than the luminance component (Y) without a significant perceptual loss. This is called subsampling. The CIElab format can also be subsampled, but it provides better color quality than YCbCr in the presence of the quantization errors that may result from the compression algorithm.

5.1.10.3.2.5 Chroma Sampling

An option for the RGB, YCbCr, and CIElab color mappings is chroma sampling. This option applies to the uncompressed, T.82 and T.81 image formats. RGB can only be sampled in 4:4:4 format where each Red, Green, and Blue component is sampled at the same resolution. YCbCr can be sampled in a) 4:4:4 format where all components are sampled at the same resolution, b) 4:2:2 format where the Cb and Cr components are sampled at half the horizontal resolution of the Y component, and c) 4:2:0 format where the Cb and Cr components are sampled at half the horizontal and half the vertical resolution of the Y component. This subsampling usually results in imperceptible errors in the color of the image while increasing the compression of the image. Subsampled formats may not be appropriate for images which require precise color detail, such as high resolution medical images. The same subsampling formats are available for the CIElab format. In this case, L is the luminance component with A and B being the chroma components.

5.1.10.4 File Transfer

T.127 specifies the requirements for Multipoint Binary File Transfer applications within T.120. T.127 defines three profiles for binary file transfer. These are *File Receive Only*, *File Transmit Only*, and *File Transmit/Receive*. A VTU having file transfer capability shall comply with the mandatory requirements of any one of these T.127 Profiles.

The *File Receive Only* profile provides the capability to accept files transmitted from other VTUs and to request that files from other VTUs be transmitted to it.

The *File Transmit Only* profile provides the capability to initiate transmission of files to all other VTUs and to respond to requests that it transmit files to all other VTUs.

The *File Transmit/Receive* profile provides the capability of both the *File Receive Only* and *File Transmit Only* profiles.

A VTU which is a T.127 transmitter shall be capable of transferring a file to all receivers. A transmitter may have the optional capability to concurrently transfer multiple files. A transmitter shall be capable of broadcasting a file to all receivers in the conference. A transmitter may have the optional capability to transfer files to a subset of the receivers in a conference. This capability allows private file transfers within the conference.

A VTU may have the optional capability to request a directory listing of the remote VTU. A VTU receiving a request to provide a directory listing, shall respond to that request, however, it may decline to provide the listing.

A VTU shall be capable of transmitting and/or receiving files in uncompressed format. A VTU may have the optional capability to transmit and/or receive files in V.42bis data compressed format. The compressed format may reduce the amount of data required to represent the file which will result in reduced transmission time. If the file already contains compressed information, the V.42bis compressed format may not result in a significant reduction in data.

5.1.10.5 Multipoint Application Sharing

The T.128 Multipoint Application Sharing is an optional protocol that supports multipoint computer application sharing. It allows a view onto a computer application, such as a word processing or a spreadsheet, executing at one site to be simultaneously viewed at other sites within a conference. Each site can, under specified conditions, take control of the shared computer application by sending remote keyboard and pointing device information. This style of application sharing does not require and does not make provision for synchronizing multiple instances of the same computer application running at multiple sites. Instead, it enables remote viewing and control of a single application instance to provide the illusion that the application is running locally.

Recommendation T.128 uses services provided by Recommendations T.122 (MCS) and T.124 (GCC). Further details may be provided in future versions of the Profile.

5.1.11 Real-Time Control Protocol for Far-end Camera Control

The capability for a VTU to control one or more far-end cameras is optional. The capability for a VTU to allow far-end control of its local camera(s) is optional. Far-end camera control requires that both VTUs have the far-end camera control capability. Far end camera control may be desirable even if the near end camera is fixed, since the far end VTU may have the capability to have its camera controlled.

5.1.11.1 Control Protocols

If far-end camera control is required, the VTU shall have the capability to use the H.224 Real Time Control Protocol for Simplex Applications Using the H.221 LSD/HSD/MLP Channels and H.281 Far End Camera Control Protocol for Video Conferences Using H.224. The H.224 Recommendation specifies the protocols for low delay, low latency broadcast services using the H.221 data channels. The H.281 Recommendation specifies the procedures and messages to be used to provide far-end camera control using H.224.

A VTU implementing the H.224 protocol shall use the LSD and MLP data channels as described in H.242, and may optionally use the HSD data channel. These channels provide data rates from 4 kbps up to 448 kbps. All VTUs providing far-end camera control shall support the common LSD and MLP rate of 6.4 kbps. This data rate provides a common point of interoperability for VTUs using H.224. If higher data rates are provided, it is recommended that all lower data rates (down to 6.4 kbps), as specified in H.221, also be provided. This will allow VTUs to interoperate at the higher data rates.

Use of the LSD and/or HSD channels for H.224 is recommended for far end camera control since these channels use a token system to assure that there is only one VTU transmitting at a time. The MLP channel does not have this capability, so other measures are required to assure that only one VTU is attempting to control a camera.

5.1.11.2 Remote Camera Positioning

A VTU may have the optional capability to have the camera position of one or more of its video sources changed by a remote VTU. A VTU that has this capability may allow the following action operations:

- Pan (Right or Left)
- Tilt (Up or Down)
- Zoom (In or Out)
- Focus (In or Out)

A VTU may allow one or more of these operations simultaneously. A VTU which cannot perform multiple operations simultaneously shall perform one or more of the operations and disregard the others. Visual feedback to the user will indicate that the commands were ignored.

A VTU may have the optional capability to attempt to control the position of a far-end camera. A VTU that has this capability may attempt to perform the action operations indicated above, if the remote VTU has indicated the capability to perform these operations. These actions may be performed individually or simultaneously.

5.1.11.3 Remote Camera Selection

A VTU may have the optional capability to have the video source that it transmits, selected by a remote VTU. A VTU shall have at least one video source and may have up to 16 video sources. The following sources are pre-defined:

- 1 Main Camera
- 2 Auxiliary Camera
- 3 Document Camera
- 4 Auxiliary Document Camera
- 5 Video Playback Source e.g, a Video Cassette Recorder

Other sources (6 to 15) may have an identifier assigned. The identifier consists of up to 16 ASCII characters. A request to select a non existent source shall result in no change in source. As an option, a VTU may indicate to the other VTUs in a conference that is has changed the video source. If A VTU makes this indication it shall use the H.230 *Video Indicate Active* (VIA) message.

A VTU may have the optional capability to attempt to select the far-end video source to be transmitted. A VTU having this capability may attempt to select a source, if the remote VTU has indicated that the source exists in its capabilities.

5.1.11.4 Remote Video Mode Selection

A VTU may have the optional capability to allow a remote VTU to select the video mode of the near end video source that it transmits. The video modes are motion video, normal resolution still image and high resolution still image. Normal resolution still images are at the current motion video resolution (i.e., CIF or QCIF). High resolution still images are at twice the horizontal and vertical resolution of the current motion video (i.e., 4xCIF or 4xQCIF = CIF). Still images are sent within the H.261 video stream following the procedures in H.261 section 4.2.1.3 and Annex D. A request to select an unsupported mode shall result in no change in mode.

A VTU may have the optional capability to attempt to select a video mode for the remote video source being transmitted to it. A VTU having this capability may attempt to select a mode, if the remote VTU has indicated, in its capabilities, that the remote VTU can support the desired mode.

5.1.11.5 Camera Presets

A VTU may have the optional capability to set camera presets for its video sources. A VTU having this capability will store this information when commanded. A VTU that supports camera presets will select the video source and camera position previously stored for that preset when activated by the remote VTU. A VTU may support up to 16 presets.

A VTU may have the optional capability to attempt to store the current remote video source and camera position as a preset, if the remote VTU has indicated the capability to support presets. A VTU may attempt to activate a previously stored remote preset selection, if the remote VTU has indicated the capability to support presets.

5.1.12 Transparent Data

There are four H.221 data channels: Low Speed Data (LSD), High Speed Data (HSD), MLP Data, and H-MLP Data. A VTU may use any of the 4 data channels to provide a transparent channel for other applications to use. An application used in this way would require both VTUs in the conference to contain the application, which may be proprietary to a single manufacturer. An example of this type of application is the real-time transmission of medical data such as EKG or EEG.

The ability to open and use data channels is optional, however, it is recommended that VTUs that do not have a data capability, still be able to open dummy-data channels as described in H.242. In multipoint conferences where several VTUs are using a data channel, other VTUs not able to open a data channel may be relegated to secondary status (audio only). If those VTUs can open dummy data channels, they will be able to continue to participate in the video communications even without having the full data capability.

5.2 Control and Indication signals

The VTUs shall provide additional information which is needed for the proper functioning of the system. This additional information will contain ITU-T H.221 frame-synchronous control signals and indication signals such as freeze picture, video loopback, simple multipoint controls, etc., as specified in ITU-T H.230.

Among these Control and Indication (C&I) signals are AIM and AIA which indicate whether the remote VTU has audio muted or active. The VIS, VIA and VIR signals perform similar functions for the video stream. The loopback C&I signals are LCV (video), LCA (audio), LCD (digital) and LCO (loopback off). Note that there is no requirement in the Recommendation for the receiving VTU to display this information.

5.2.1 Call control (handshaking)

The VTUs shall interoperate with each other and the existing telecommunications system as specified in ITU-T H.242 and H.320.

5.2.2 Frame structure

The VTUs shall comply with the ITU-T H.221 frame structure for audiovisual teleservices in single or multiple channels as specified in ITU-T H.221. This requirement allows for the synchronization of multiple connections and the control of multiplexing audio, video, data, and other signals. Use of the unframed mode as per ITU-T H.221 is outside the scope of this Profile.

5.2.3 Camera interface

All systems shall support the capture of motion video and freeze frame video images using video cameras. For VTC equipment intended for use in North America that has external cameras, the electrical interfaces between the cameras and the VTU may optionally meet the NTSC (EIA-170-A) standard. The mechanical interface may optionally be BNC, F-type, or RCA connectors.

5.2.4 Monitor interface

For VTC equipment intended for use in North America that has external video display monitors, the electrical interface between the monitors and the VTU may optionally meet the NTSC (EIA-170-A), RGB, VGA, SVGA or S-VHS standards. The mechanical interface may optionally be BNC, F-type, RCA, or 15-pin D-sub connectors.

5.3 Audio

5.3.1 General

The audio coder/decoder (codec) subsystem shall be an integrated subsystem of the VTU equipment used for the purpose of video teleconferencing. This means the audio signal shall be transmitted in-band as per ITU-T H.221, and not out-of-band.

5.3.2 Speech quality modes

The audio subsystem shall be capable of operating in the speech modes as specified in section 5.3.2.1, and may optionally support the speech modes in sections 5.3.2.2 and 5.3.2.3.

5.3.2.1 Narrowband speech mode

Capability to operate in this mode is mandatory. This narrowband (3 kHz analog bandwidth) speech mode shall conform to the specifications set forth in ITU-T G.711, H.221, H.230, H.242, and H.320.

This audio mode is known as Mode 0 in ITU-T H.221. Mode 0 is further broken out into four submodes, as specified in Annex 1 of ITU-T H.221: Mode 0U(A-law), Mode 0F(A-law), Mode 0U(μ-law), and Mode 0F(μ-law).

The audio subsystem shall be capable of operating in Mode 0F(μ-law). Mode 0F(A-law) is optional. See B.7.15 for a further recommendation. The use of the unframed modes (0U) is outside the scope of the Profile and is not recommended.

5.3.2.2 Wideband speech at 48-56 Kbit/s

Wideband speech is optional and if provided shall conform to the specifications set forth in ITU-T G.722, H.221, H.230 and H.242.

The audio subsystem shall be capable of operating in the following two modes as specified in ITU-T G.722 and H.221:

Mode 2: 56 Kbit/s audio (unrestricted network)
Mode 3: 48 Kbit/s audio (restricted or unrestricted network)

The indication signals for identifying the mode of operation shall conform to the specifications set forth in ITU-T G.722, H.242, and H.221 (Table H.221/A1).

The audio subsystem shall have the capability of automatically switching over from Mode 0 (see 5.3.2.1) to one of the higher quality Modes 2 or 3 if the other VTU to which it is connected has the capability for Modes 2 or 3.

5.3.2.3 Narrowband speech at 16 Kbit/s

ITU-T G.728 is mandatory and shall be available at all the data rates at which the VTU is capable of operating.

5.3.3 Encoding and decoding

For Mode 0 narrowband speech, using the mandatory Mode 0F (μ-law), the characteristics of the Pulse Code Modulation (PCM) converter shall conform to the specifications set forth in G.711. The optional mode 0F (A-law) shall conform to G.711.

For wideband speech (G.722), the analog speech signal shall be encoded into and decoded from a digital bit stream using sub-band adaptive differential pulse code modulation (SB-ADPCM) for Modes 2 and 3. The characteristics of the SB-ADPCM converter shall conform to the specifications set forth in ITU-T G.722.

5.3.4 Lip synchronization

In order to conform to this Profile, synchronization between the video and audio signals shall be addressed in both the encoding and decoding processes of the audio subsystem. While delay compensation is not required, if it is used, the compensation for delay between the video signal and audio signal introduced during the encoding process shall be compensated for at the encoding process. Likewise, compensation for delay introduced at the decoding process shall be compensated for during the decoding process. The time delay between audio and video signal shall be measured as specified in Annex C of H.261.

5.3.5 Electrical and mechanical interfaces

The requirements in 5.3.5.1 and 5.3.5.2 are optional if the audio system is completely integrated into the VTU (i.e., videophone, PC-based desktop system, integrated rollabout system).

5.3.5.1 Electrical specification

Input and output line level room audio interfaces shall be provided that meet the following specifications. They shall have a 600 ohm balanced impedance, with a nominal signal level of -3 dBm ±1 dB. The digital overload point shall be +7 dBm ±1 dB. The audio gain from input to output, measured using digital loop-back, shall be 0 dB ±0.5 dB. All level measurements are made using pink noise. See Section B.7.1.7 in Annex B for further information on the audio subsystem.

5.3.5.2 Mechanical specification

The VTU shall provide mechanical connections for the room audio system. The room audio system connection shall provide either

a. one XLR male/female pair, or
b. one pair RCA Phono jacks, one for input and one for output.

For the XLR pair, the female connector shall be the input to the VTU from the room audio system. The male connector shall be the output of the VTU to the room audio system.

5.3.6 Loudness

Sensitivity, loudness ratings and volume control are specified in ITU-T H.320. There are three options to choose from. A VTU can have one or more of the following three functions:

a. Handset function (meant for a single user, such as an ordinary telephone handset);
b. Hands-free function for up to three users (for example, a desktop speakerphone);
c. Hands-free function for more than three users (for example, a room audio system).

The audio requirements are different for each of these functions and shall be as defined in ITU-T H.320.

5.4 Confidentiality and secure operation

As an option VTUs may provide confidentiality or secure operation. The requirements of Section B.5.4 in Annex B shall apply.

5.5 Multipoint Control Unit (MCU)

5.5.1 General

The MCU shall enable three or more VTU systems to participate in an audiovisual conference. Two or more MCUs can be cascaded to provide conferencing between additional VTUs or for network considerations (See 5.5.6). The MCU shall provide audio mixing and video switching capability as described in the following sections. This Profile defines the requirements for interactive multipoint video teleconferencing. Multipoint broadcast audiovisual transmission is outside the scope of this Profile.

In general, the MCU shall comply with the same requirements as the VTU. This includes ITU-T Recommendations H.221, H.320, H.230, and H.242 except as noted in the following sections. In addition, the MCU shall comply with the requirements of ITU-T Recommendation H.231 which defines the functional representation of the MCU. The MCU and participating VTUs shall comply with ITU-T Recommendation H.243 which describes the detailed specifications and procedures for communications between two or more audiovisual terminals.

The various MCU functions and capabilities are enabled and disabled by transmission and reception of a set of digitally encoded commands. In the ITU Recommendations, each command is designated an acronym, typically three capital letters, such as VCF, which stands for Video Command Freeze-picture request.

5.5.2 Video, Communications and Control

5.5.2.1 General

In general, each port of the MCU must meet the provisions of section 5.1 of this Profile, unless otherwise indicated. The following are the applicable sections that must be met, replacing VTU with MCU in each section:

5.1.1 General. However, the requirements of H.261 do not have to be met, unless video mixing is used. See 5.5.2.3. Note that if FEC reframing is performed (see 5.5.2.2.5) the requirements of section 5.4 of Recommendation H.261 or Annex H of H.263 dealing with FEC Coding shall apply. The ability to switch video is mandatory. The MCU shall also comply with the requirements set forth in ITU-T H.231 and H.243.
5.1.2 Operating Mode. The MCU shall provide bi-directional point-to-point operation with three or more VTUs.
5.1.3 Data Transmission Rates. This Profile mandates p=1 and p=2.
5.2 Control and Indication Signals. Note that MCUs have a somewhat different set of C&I signals from the VTUs.
5.2.1 Call Control (Handshaking).
5.2.2 Frame Structure.

5.5.2.2 Video Switching (Selective Presence)

In the video switching mode of multipoint, the video displayed at each VTU is the video from one other VTU. This is in contrast to Video Mixing (5.5.2.3) where the video from more than one source may be seen. Several methods are available for selecting whose video is seen by each VTU.

5.5.2.2.1 Voice Activated Switching

The ability of the MCU to conduct a conference using voice activation to determine which VTU's video to broadcast to the other VTUs is mandatory. See section 5.5.3.3. The video to send to the selected VTU is at the discretion of the MCU manufacturer. The previously selected video is a good candidate. Voice activated switching can be overridden by action of the chair VTU (VCB), or a user control VTU (VCS or MCV).

5.5.2.2.2 User Broadcast Control

The ability of the MCU to allow a user to broadcast its video to the other VTUs is mandatory. The MCU shall recognize and obey MCV and Cancel-MCV from the user VTU.

Multipoint Command Visualization-forcing (MCV) allows a VTU to request that an MCU broadcast its video to the other VTUs. Cancel-MCV returns the conference to voice activated switching mode. See ITU-T H.243 for a detailed description.

5.5.2.2.3 User Select Control

The ability of the MCU to allow a user to select the video that the user's VTU receives is optional. When this capability is provided in the MCU, the MCU shall recognize and, if there is no conflict with other modes, obey VCS and Cancel-VCS from the user VTU.

Video Command Select (VCS) allows a VTU to request that the MCU send the video of a specific VTU to it. Cancel-VCS returns the conference to voice activated switching mode. See ITU-T H.243 for a detailed description.

5.5.2.2.4 Chair Control

The ability of the MCU to conduct a Chair Control conference is optional. This is indicated by the signal Chair-control Indicate Capability (CIC).

An MCU having Chair Control capability shall provide a conference with the following capabilities:

a) Allow a VTU to display the terminal numbers of other VTUs. (TCU, TIN, TID, TIL, VIN)
b) Allow a Chair Control VTU to request the Chair (CCA)
c) Allow a Chair Control VTU to release the Chair (CIS)
d) Broadcast one VTU's video to all other VTUs as directed by the chair (VCB)
e) Return the conference to voice activated switching mode as directed by the chair (Cancel-VCB)
f) Drop a VTU from the conference (CCD)
g) Drop the entire conference (CCK)

When the chair VTU indicates which VTU's video should be seen by the other VTUs (VCB), the video seen by the chair selected VTU is at the discretion of the MCU manufacturer unless it is currently selected by VCS. The previously selected video is a good candidate.

A conference participant who wishes to speak during a chair control conference should request the floor from the conference chair. The conference participants action, e.g., pressing a floor request button on the VTU, will cause the request for the floor (TIF) to be sent from the VTU to the MCU. The TIF shall be relayed to the chair control VTU by the MCU. The chair control VTU will indicate to the conference chair that another VTU requests the floor. The action taken in response to the request is at the chair's discretion, possible actions could be:

1) Ignore the request.
2) Defer the request while handling a request for the floor from another VTU.
3) Turn over the floor to the requesting VTU by broadcasting the requesting VTU's video to all other VTUs (VCB) and assuring that the VTU's audio is distributed to all other VTUs either by audio mixing or audio switching.

The following feature is optional.

a) Request to see a specified VTU's video. In a chair control conference, this command provides a roam capability allowing the chairman (or instructor) to selectively view the

conference participants while they view the video selected by a previous VCB command or voice activated selection (VCS)

5.5.2.2.5 FEC Framing on Switching

The capability to do FEC re-framing is optional. When the source of the video signal is changed, due to any of the above procedures, video bit streams that are simply switched will cause a delay before a useful picture becomes available at the receiving VTU. Part of this delay is due to the fact that the FEC incorporated as part of H.261 or H.263 must be reframed by the decoder. At low bit rates, this could take about half a second. This delay could be eliminated if the MCU performs FEC reframing. To perform FEC reframing, the MCU must always decode the incoming FEC framed video data and re-encode the selected video stream with its own FEC. This process occurs all the time, even when the video is not being switched. When the video source is switched, the FEC framing will not be lost. If this is done, the MCU must also be able to detect fill FEC frames, strip out the fill, and insert the fill in the outgoing bit stream, in order to keep the same bit rates.

5.5.2.2.6 Terminal Identifiers

An MCU may optionally provide enhanced identification of the VTUs by using Terminal ID. Terminal ID allows VTUs to be assigned alpha-numeric sequences such as names or locations, rather than arbitrary numbers. An example of the use of the Terminal ID would be that an MCU could merge the ID of the selected video source with the video so that the resulting video contains an alphanumeric overlay. This would allow all receiving VTUs to see the ID of the source of the video. Another example would be for the chair control terminal to request the terminal IDs from the MCU in order to present a list of participants to the chair. This would aid the chair in selecting the proper VTU for various chair control functions. The MCU requests the Terminal ID from a VTU using either TCI or TCS. The VTU responds with TII or IIS. A VTU may request the Terminal ID of another VTU using TCP. The MCU responds with TIP. TCS and IIS (MBE) is the recommended method.

5.5.2.3 Video Mixing (Continuous Presence)

Video mixing involves spatially multiplexing the selected images into a single image in "split screen" format. This is an optional feature. It requires the decoding and encoding of the video code, and therefore requires meeting the requirements of H.261 or H.263. The number of images that are mixed, the method of selection and control, and the video format used are left to the discretion of the manufacturer.

Standards for video mixing have not yet been defined. They will be added to this Profile when they are mature. While it may be possible to implement a video mixing scheme within the current standards, control of the scheme must be automatic or out-of-band since there is no facility in the current standards for the terminal to provide this control to the MCU.

5.5.2.4 Selection of Selected Communications Mode (SCM)

The Selected Communication Mode (SCM) is the set of bit-rates, total, video, audio, and data, that the MCU attempts to maintain during the conference. In order to communicate with the MCU, the bit-rates must be common between all Primary VTUs, although different audio algorithms may be used if they have the same bit-rate.

The MCU shall determine the SCM for a conference. The SCM may also change during a conference as VTUs join or leave the conference. It is suggested that the user fully understand the impact that the SCM selection method provided by the MCU may have on conference operation. For example, if the user expects operation at 384 kbit/s using G.722 audio then he should make sure the SCM can support that capability. The following methods may be used to determine the SCM. Other methods are possible.

a) The SCM is fixed as a permanent feature of the MCU.
b) The SCM is determined automatically by the MCU from the capabilities of the connected VTUs.
c) Several SCMs are provided. One is selected by the MCU service provider at the time the conference is setup.
d) The SCM is determined using procedures defined in MLP (T.120).

5.5.2.4.1 Minimum SCM

The SCM determination method must include those modes that will enable at least minimum interoperability with VTUs having only the mandatory capabilities. For unrestricted VTUs, this would be p=2, 1.6 Kbit/s FAS/BAS, 56 Kbit/s G.711 audio, 0 Kbit/s data, with the remainder of the available bit rate allocated to H.261 or H.263 video. For restricted VTUs, this would be p=2, 1.6 Kbit/s FAS/BAS, 48 Kbit/s G.711 audio, 0 Kbit/s data with the remainder of the available bit rate allocated to H.261 or H.263 video.

5.5.2.4.2 Secondary Video Teleconferencing Units (VTUs)

In determining the SCM, the MCU may determine that many VTUs have a common capability set that is greater (more capable) than the remaining VTUs. The former VTUs are called Primary VTUs, while the latter are called Secondary VTUs. An optional capability is that the MCU can allow these Secondary VTUs to participate in the conference, but with a limited functionality. For example, a VTU on a network that can carry only p=1, might participate in a conference in which all other VTUs have video, but it does not. Without this optional capability, the Secondary VTUs would be dropped from the conference. The method of selection of the primary and secondary VTUs is left to the discretion of the manufacturer.

5.5.3 Audio

5.5.3.1 General

The MCU shall meet the requirements of sections 5.3.2.1, 5.3.2.2, 5.3.2.3, and 5.3.3 of this Profile. These sections state that G.722, and G.728 are optional, however it is highly recommended that they be included.

The MCU shall have both G.711 A-law and μ-law audio capability. This permits conferences with European VTUs which might have only A-law audio.

5.5.3.2 Audio Mixing

Audio mixing shall be the default mode of operation of the MCU. Audio mixing shall be accomplished by the summation of the linear (PCM or analog) audio signals received. In general, all the received audio signals are summed, but small signals may be suppressed in order to minimize interference in large conferences. The actual method is left to the discretion of the manufacturer.

Audio switching connects the audio from only one VTU to the other VTUs. In this case, audio signals from the other VTUs are not mixed. Audio switching may be desirable in some applications such as remote training where spurious sound from the non-speaking sites is unwanted. Audio switching may also be used to connect VTUs in private conversations. The control for audio switching may follow the results of video switching commands, such as VCB, or it may be out of band.

Because the audio must be decoded and recoded, and video is switched, there may be more delay in the audio channel than in the video channel. While delay compensation is not required, a delay in the video channel is allowable to maintain audio and video synchronization. The time delay between audio and video signals shall be measured as specified in Annex C of H.261.

5.5.3.3 Voice Activated Switching

The MCU shall analyze the audio inputs to determine which participant will have the floor next. The algorithm for this determination is up to the discretion of the manufacturer. The result of this algorithm shall be used to determine which video signal to transmit to each VTU or MCU in the absence of VCB, VCS or MCV. The video to be sent to the VTU having the floor is up to the discretion of the manufacturer. The previously selected video is a good candidate.

5.5.4 MCU Data Communications

An MCU may provide the optional capability to support H.221 data channels. These channels may be used for the applications described in 5.1.10, 5.1.11, 5.1.12, or other non-standard applications.

5.5.4.1 MCU Multimedia Teleconferencing Applications

An MCU may have the optional capability to support T.120 audiographic conferencing within the data channel. An MCU that has T.120 capability shall implement the T.122, T.123, and T.125 protocols as described in 5.1.10.2. The MCU shall implement T.124 as described below. An MCU may also implement any of the optional capabilities of T.124 as described below. Typically, the MCU does not contain any application protocols and it is not an end-point for T.120 applications.

The MCU shall be the Top Generic Conference Control (GCC) Provider as described in T.124. In a multipoint conference, all VTUs establish a point-to-point T.120 data connection with the MCU.

5.5.4.1.1 Mandatory MCU Conference Control Capability

An MCU having T.120 capability shall have the following mandatory capabilities defined in T.124 (for further explanation, see 5.1.10.2 and 5.1.10.2.1):

- Respond to a request from a VTU to create a new conference, specifying the characteristics of that conference (*GCC-Conference-Create*).
- Respond to a query regarding what conferences are currently in progress and the information needed to join them (*GCC-Conference-Query*).
- Respond to a request from a VTU to join an existing conference (*GCC-Conference-Join*).
- Invite a VTU to join an existing conference and respond to a request from a VTU to invite another VTU to join the an existing conference (*GCC-Conference-Invite*).
- Respond to a request from a VTU to leave an existing conference (*GCC-Conference-Disconnect*).
- Announce its presence in the conference (*GCC-Conference-Announce-Presence*, *GCC-Conference-Roster-Report*).
- Request the list of VTUs that have a particular application, group of applications, or any application (*GCC-Application-Roster-Inquire*).
- Respond to a request to terminate the entire conference (*GCC-Conference-Terminate*).
- Respond to a request to eject another VTU from the conference (*GCC-Conference-Eject-User*).
- Respond to a request to transfer a VTU to another conference (*GCC-Conference-Transfer*).

5.5.4.1.2 Optional MCU Conference Control Capability

An MCU Having T.120 capability may have the following optional capabilities defined in T.124 (for further explanation, see 5.1.10.2 and 5.1.10.2.2):

- Respond to an inquiry for the list of VTUs that have a particular application, group of applications, or any application (*GCC-Application-Roster-Inquire*).
- Respond to a request by the conductor VTU to prevent other VTUs from joining, or allow other VTUs to join the conference without being explicitly added by the convener (*GCC-Conference-Lock*, *GCC-Conference-Unlock*, *GCC-Conference-Lock-Report*).
- Dial-out to add another VTU to the conference (*GCC-Conference-Add*).
- Respond to a request for how much time is remaining (*GCC-Conference-Time-Inquire*).
- Respond to a request to extend the conference beyond the allocated time (*GCC-Conference-Extend*).
- Support application roster and registry (*GCC-Application-*, *GCC-Registry-*).
- Support conference Conductorship (*GCC-Conductor-*).

5.5.4.2 MCU Protocol for Far-end Camera Control

An MCU may optionally support the H.224 Real Time Protocol for Simplex Applications Using the H.221 LSD/HSD/MLP channels. This allows VTUs in a multipoint conference to use H.281 Far End Camera Control Protocol (See Section 5.1.11).

An MCU which supports H.224 and receives an H.224 message from a VTU or MCU shall broadcast that message to all other VTUs and MCUs in the conference. The MCU does not examine or act on the message.

An MCU implementing the H.224 protocol shall use either the LSD channel or the MLP channel, or both as described in H.242. The MCU may optionally use the HSD data channel. The MCU shall support the common LSD or MLP data rate of 6.4 kbps. This data rate provides a common point of interoperability with VTUs using H.224. If higher data rates are provided, it is recommended that all lower data rates (down to 6.4 kbps), as specified in H.221, also be provided. This will allow VTUs and MCUs to interoperate at the higher data rates.

Use of the LSD and/or HSD channels for H.224 is recommended for far end camera control since these channels use a token system to assure that there is only one VTU transmitting at a time. An MCU which supports the LSD or HSD data channels shall follow the procedures of H.243 for data token operations. The MLP channel does not have this capability, so other measures are required to assure that only one VTU is attempting to control a camera.

5.5.4.3 MCU Transparent Data

An MCU may allow the H.221 data channels to provide a transparent channel for other applications within the VTUs to use. See Section 5.1.12. The MCU shall support the H.243 data token procedures for the LSD and HSD channels to assure that only one VTU is transmitting at a time.

Any data received from one VTU or MCU shall be broadcast to all other VTUs and MCUs in the conference. These Recommendations do not provide a mechanism for selectively routing data to a specific VTU. This type of selective control may be available in the T.130. Selective routing of files can be accomplished using T.127 as per 5.1.10.4. Selective routing of images can be accomplished using T.126 as per 5.1.10.3.

5.5.5 Confidentiality and Security

As an option, the MCU may provide confidentiality or secure operation. When required, confidentiality shall be provided as described in 5.4. Security for classified information shall be provided as described in B.5.4.4.

5.5.6 Cascading

The ability of an MCU to participate in a conference involving more than one MCU is optional and is called cascading. There are two optional types of cascading, Simple and Principal/Satellite. If the maximum number of MCUs to be connected is two, the Simple cascading capability is all that is needed. If three or more MCUs need to be connected, then Principal/Satellite cascading is required, but note that the Principal/Satellite method will also work with just two MCUs.

The maximum number of MCUs between any two VTUs shall not exceed three. For a star configuration, the Principal MCU shall be designated before the call as the MCU at the center of the star. In Principal/Satellite cascading the Principal MCU shall transmit the MIMcommand to the Satellite MCU. In the case of contention for Principal designation, the RAN command may also be used as in the contention resolution procedure in ITU-T H.243. The RAN command is mandatory for MCUs that do not support administration of Principal/Satellite status. The RAN command is recommended where the customer does not wish to make use of the administration of Principal/Satellite status feature.

5.5.7 Simultaneous Conference Operation

An MCU may be used in more than one conference at a time. This is also known as segmentable operation. The number of simultaneous conferences that can be held is not a matter for standardization, but may be specified in the acquisition document.

A Classified MCU shall have special requirements imposed in order to support multiple simultaneous independent classified conferences. See B.5.4.5.4.1.

5.5.8 Value Added Services

An MCU may optionally offer value added services that are not within the scope of the ITU-T H.320 Recommendations. Some of these services may be activated by the VTU using SBE characters. Value added services offer additional capability to the conference that are accessed by the VTU. These services might include conference access codes (passwords), request an operator, access the reservation system, add another party, etc. These services would be accessed by character sequences such as #0 (# and zero on the keypad) for the conference operator. The appropriate character sequences may be obtained by audio prompt or other means. These character sequences are currently not standardized. Other value added services are also possible.

5.6 VTU Control of Multipoint Conference

The following sections describe the various capabilities that a VTU may have in a multipoint conference. Three types of capabilities are defined. They are Normal VTU Multipoint Capability, VTU User Control Capability, and VTU Chair Control Capability. The capabilities defined below are specified in ITU-T H.230 and H.243.

Under VTU User Control capabilities, User Broadcast Control is the least capable technique, User Select Control is more capable and User Chair Control is the most capable multipoint control technique.

5.6.1 Normal VTU Multipoint Capability

Note: In the following sections the use of the word 'display' is dependent upon the system configuration. If the VTU consists only of the CODEC then it cannot 'display'.

5.6.1.1 Basic Capability

All VTUs shall have the capability to participate in multipoint conferences. These VTUs shall have the following capabilities in a multipoint conference.

a) See the video sent by the MCU.
b) Have the MCU broadcast its video to other VTUs when determined by the MCU.
c) Hear and be heard by the other VTUs.
d) Verbally request the floor in a voice controlled or chair controlled conference.
e) Freeze its display during video switching to minimize corruption of the video display (VCF)
f) Fast update its video when it is selected as the video source by the MCU in order to initialize the displays of the other VTUs (VCU)
g) Unfreeze the other VTU's displays when doing a fast update by inserting Freeze Picture Release in the H.261 or H.263 picture header.
h) It is recommended that all VTUs be able to open data channels and obey MCS and MCN even if they cannot process the data.
i) All VTUs must equalize their incoming and outgoing rates or be relegated to Secondary VTU status (MCC).

Some of these capabilities may not be available if the VTU is designated as a Secondary VTU by the MCU. See 5.6.2.4.1.

5.6.1.2 Optional Capabilities

The following optional capability is recommended for a VTU that has a direct network interface consisting of more than one physical channel (such as ISDN BRI). This VTU should recognize TIA and transmit TIC and TIX. This will allow call association to take place in dial-in MCUs that use a single network access (phone) number per conference or per MCU. VTUs not having this capability may not be able to participate in multipoint conferences in certain network configurations.

Any VTU may also have the following optional capabilities that will enhance its multipoint conferencing capability.

a) Display an ON AIR indication that its video is being broadcast to other VTUs (MIV)
b) Display an indication that it is the only VTU connected in a multipoint conference. This indicates why the VTU may not have any video or audio until other participants join the conference (MIZ)

c) Display an indication that it is a Secondary VTU in the conference. This indicates that the VTU may not be participating as fully as other VTUs in the conference (MIS)
d) Receive a terminal number assignment from the MCU (TIA)
e) Request a list of the terminal numbers of all VTUs participating in the conference (TCU)
f) Obtain and display a list of the terminal numbers of all VTUs participating in the conference (TIL)
g) Obtain and display the terminal number of a VTU added to the conference (TIN)
h) Obtain and display the terminal number of a VTU dropped from the conference (TID)
i) Obtain and display the terminal number of the current video source (VIN)
j) Request the floor in a chair control conference (TIF)
k) Respond to the MCU request (TCI) for a Terminal ID with a Terminal ID alpha-numeric string identifier, such as a name or location of the VTU (TII)
l) Respond to the MCU request (TCS) for a Terminal ID with a Terminal ID alpha-numeric string identifier, such as a name or location of the VTU (IIS)
m) Request the Terminal ID of another terminal (TCP)
n) Obtain and display the Terminal ID of another terminal (TIP)
o) Access value added services provided by the MCU using SBE characters. Many MCUs provide value added services such as entering password, accessing an operator, or requesting changes to the conference configuration. These services are not subject to standardization, but, they require the VTU to accept user input and issue SBE characters.

5.6.2 VTU User Control Capability

VTUs with User Control capability have all of the mandatory capabilities of the normal VTU, plus some additional capabilities that enable them to exercise some degree of control, including being able to request that its video signal be broadcast to other VTUs and that it view a particular VTU's video.

5.6.2.1 User Broadcast Control

As an option, the user may want to broadcast its video to all other VTU's in a multipoint conference. This is useful for distributing the video from a document camera to all of the participants without having the video switch to the loudest speaker. This function is called User Broadcast Control.

A VTU intended for user broadcast control shall have all of the capabilities of a normal VTU as described in 5.6.1.1 plus the following additional capabilities which are described in H.230 and H.243. The VTU may also have any of the optional capabilities of a normal VTU as described in 5.6.1.2. The VTU shall follow the procedures for user control using BAS codes as described in H.243.

These commands provide the VTU with the following capabilities:

a) Request that all other VTUs see its video (MCV)
b) Return to automatic video switching mode (Cancel-MCV)

User Broadcast Control capability is mandatory in all MCUs but is optional in the VTU. See 5.6.2.2.2. This command does not need to be honored when the conference is under chair control. Whether or not it is honored depends on the manufacuter’s implenmentation.

5.6.2.2 User Select Control

As an option, the user may want to control the video that the user's VTU receives in a multipoint conference. This function is called User Select Control. This capability is only effective if the MCU also supports User Select Control (VCS) option. See 5.6.2.2.3.

A VTU intended for user control shall have all of the capabilities of a normal VTU as described in 5.6.1.1 plus the following additional capabilities which are described in H.230 and H.243. The VTU may also have any of the optional capabilities of a normal VTU as described in 5.6.1.2. The VTU shall follow the procedures for user control using BAS codes as described in H.243.

A VTU intended for user control shall have a means of obtaining terminal numbers associated with the other VTUs in the conference. This information is received from the MCU in VIN, TIN, TID, and TIL. See 5.6.1.2. This is necessary to indicate to the user the terminal number associated with each participant. At least one of these commands is necessary to indicate to the users the terminal associated with each VTU.

These commands provide the User Select Control VTU with the following capabilities:

a) Obtain and display the terminal numbers of other VTUs (TCU, TIN, TID, TIL, VIN)
b) Request to see a specified VTU's video (VCS)
c) Return to automatic video switching mode (Cancel-VCS)

5.6.3 VTU Chair Control Capability

5.6.3.1 Basic Capability

A VTU may optionally have the capability to perform the function of the chairman in a multipoint conference. This VTU shall be capable of exercising control over the conference. This function is called chair control.

A VTU intended for chair control shall have all of the capabilities of a normal VTU as described in 5.6.1.1 plus the following additional capabilities which are described in H.230 and H.243. The VTU shall follow the procedures for chair control using BAS codes as described in H.243.

A VTU intended for chair control shall have a means of obtaining terminal numbers associated with the other VTUs in the conference. This information is received from the MCU in VIN, TIN, TID, TIL, and TIF. See 5.6.1.2. This is necessary to indicate to the chairman the terminal number associated with each participant. The VTU shall have a means of accepting input commands from the chairman so that the chairman can command the MCU. At least one of these commands is necessary to indicate to the users the terminal associated with each VTU.

These commands provide the VTU with the following capability:

a) Obtain and display the terminal numbers of other VTUs (TCU, TIN, TID, TIL, VIN)
b) Request the Chair (CCA)

c) Release the Chair (CIS)
d) Broadcast one VTU's video to all other VTUs (VCB)
e) Return the conference to voice activated switching mode (Cancel-VCB)
f) Drop a VTU from the conference (CCD)
g) Drop the entire conference (CCK)

5.6.3.2 Optional Capabilities

Additional optional Chair Control capabilities can be provided. These capabilities provide additional control over the conference. This includes the following:

a) Request to see a specified VTU's video. In a chair control conference, this command provides a roam capability allowing the chairman (or instructor) to selectively view the conference participants while they view the video selected by voice activation or a previous VCB command (VCS)

The VTU may also have any of the optional capabilities of a normal VTU as described in 5.6.1.2.

5.7 Year 2000 Compliance

All VTC equipment shall be Year 2000 compliant as per the Federal Acquisition Regulation (FAR). Year 2000 compliant means information technology that accurately processes date/time data (including to, calculating, comparing, and sequencing) from into, and betwen the twentieth and twenty-first centuries, and years 1999 and 2000, and leap year calculations. Furthermore, Year 2000 compliant information technology, when used in combination with other information technology, shall accurately process date/time data if the other information technology properly exchanges date/time data with it.

6 Subnetwork-type dependent requirements

6.1 General

VTUs and MCUs shall be capable of operating on unrestricted and/or restricted networks. They shall also be capable of operating with other terminals on unrestricted and restricted networks. If both terminals are set to restricted operations, then they shall be capable of operating over a network connection where a middle segment or segments of the network are restricted. Restricted networks are discussed in Annex A of ITU-T H.221, Section 3.6 of ITU-T H.242, and Section 3.6 of ITU-T H.230. There are currently no standard means for terminals to detect such a restricted middle segment. A new draft recommendation is in the process of being prepared and is expected to be available in January 1998 to address operating over restricted network segments.

6.2 VTU network interface

The VTU to network interface is entirely dependent upon the type of underlying sub-network used. Examples of point-to-point VTU interconnection include leased digital circuits, switched digital circuits, or Integrated Services Digital Network (ISDN).

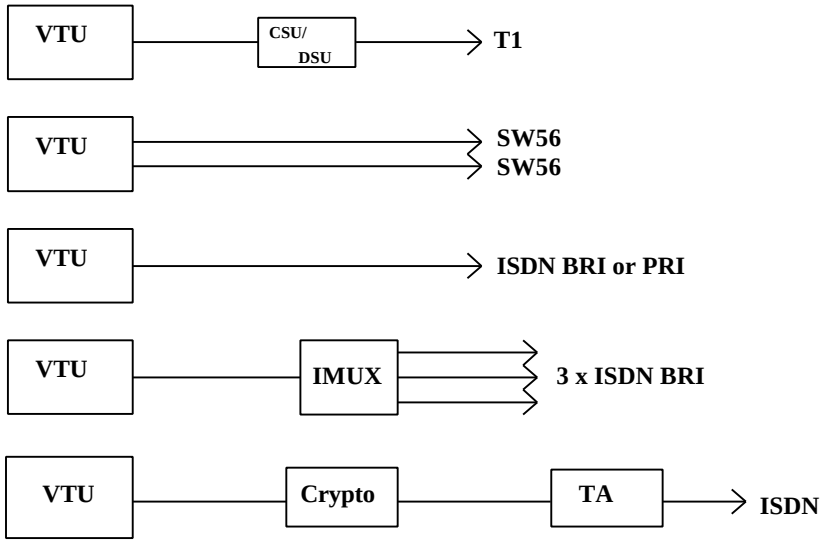


Figure 6.1 Examples of some network connections

6.3 Integrated Services Digital Network

ISDN is a popular network service for video teleconferencing, however, given the range of services and network interface possibilities, this Profile does not specify any single approach. An ISDN transmission channel may consist of 1 to 6 B (64 kb/s) channels, 1 to 4 HO (384 kb/s) channels, an H10 (1,472 kb/s) channel, or an H11 (1,536 kb/s) channel.

6.3.1 ISDN Basic rate interface (BRI)

ISDN interfaces are optional. Two optional BRI ISDN interface configurations are provided for information. See 6.3.1.1 and 6.3.1.2. Included in the scope of this Profile are ISDN BRI interfaces between the VTU and the terminal adapter (TA).

All of the configurations in 6.3.1 are in accordance with the North American ISDN Users Forum (NIUF) profile, *NIUF Video Conferencing Application Profile 940007*, and the NIUF catalog, *A Catalog of National ISDN Solutions for Selected NIUF Applications*. Any of these configurations may be chosen, depending on the needs of the user. The use of D-channel signaling is permitted for unclassified and unclassified sensitive operation. The use of D-channel signaling originating from the VTU is not permitted with classified operation. See Section B.6.1 of Annex B for ISDN BRI configurations.

6.3.1.1 Option 1, external terminal adapter

Option 1 is for unclassified and Type 3 unclassified sensitive operation. The VTU shall have one or two ports. These shall be used to connect to an external ISDN Terminal Adapter (TA). See Figure 6.2. The TA is outside the scope of this Profile. Note that if the VTU user specifies the one port version, and two B channels are used, the necessary aggregation (IMUX) function to go from a single port to two B channels must be performed by the TA. In the dual port version, the aggregation function is performed within the VTU. See Section B.7.5.2 of Annex B for other possible configurations.

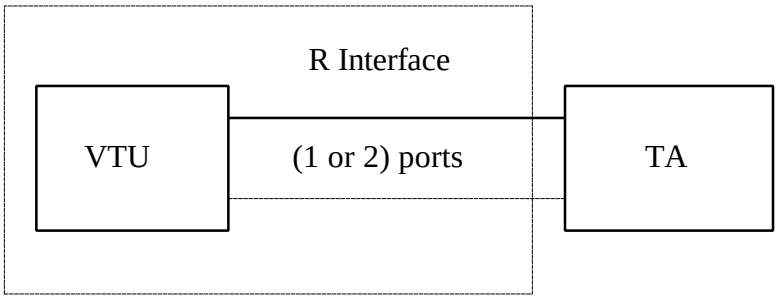


Figure 6.2. Option 1, external TA (Interior of dashed box indicates scope of the Profile)

6.3.1.2 Option 2, external terminal adapter with dialing interface

Option 2 is for unclassified and Type 3 unclassified sensitive operation. In addition to requirements of option 1, the VTU shall have two dialing interfaces (EIA-366-A), one for each B channel, for convenient dialing through the VTU.

Existing VTUs, or VTUs that require the use of specific non-ISDN interface connectors, will require the use of Terminal Adapters.

Other VTUs may be designed to attach at the user side of the Network Termination (S/T reference point on NT1).

Still other VTUs may incorporate the NT1 function. Such design decisions are as much a financial as an engineering choice and are beyond the scope of this Profile.

6.3.2 VTU network interface (BRI)

As an option, a two-channel network interface to the VTU is recommended. This is needed for interoperability at p=2 unless an inverse multiplexer (aggregator) is used to interface to the network.

6.4 Channel Aggregation

It is possible for a VTC terminal or MCU to have a single channel interface to multiple channels using channel aggregation. Channel aggregation is also known as inverse multiplexing. An example is aggregating 6 B channels into a single 384 kb/s channel using an Inverse Multiplier (IMUX). The use of channel aggregation increases interoperability between equipment on different networks, and allows a high speed interface to low speed networks. Use of channel aggregation is optional for VTC, but when it is built into a VTU or MCU, that equipment shall adhere to the requirements of ITU-T H.244.
There are four different "cases" described in ITU-T H.244. Case "B" has been commonly called BONDING. When channel aggregation is build into a VTU or MCU, it shall be capable of operating using the combination of case "B" and Mode B1 as specified in ITU-T H.244.

6.5 MCU Network Interface

6.5.1 Physical and Electrical Interface

An MCU may have any appropriate network interface for the network to which it is connected. The network interface may consist of one or more channels. The MCU may be able to be configured with different network interfaces on different ports. This provides a video teleconferencing gateway capability between different networks. See 6.2 and 6.3 for possible configurations of network interface ports.

Alternatively, the MCU may be configured with a wideband interface to the network such as a PRI or T1. In this configuration, the MCU must demultiplex the individual channels from the wideband interface and route them to the appropriate MCU ports. This approach reduces the number of physical ports required on the MCU because a single interface carries calls from multiple VTUs.

If an external inverse multiplexer is needed for networks with more than 1 channel, such as ISDN and dual-switched 56-kbit/s networks, see B.7.5.2.

An MCU intended for Classified operation shall have a network interface as described in B.6.1.3.

Table 6.1. MCU - Network Interface.

Requirement	M/CM/O*	Transmit	Receive	Notes
BRI	O	X	X	
PRI	O	X	X	
E1/T1	O	X	X	
RS-449	CM	X	X	Mandatory for Classified MCU
V.35	O	X	X	
X.21	O	X	X	
RS-366	O	X	X	
Switched-56	O	X	X	
OTHER	O	X	X	
Restricted Operation	M	X	X	

(* - M: Mandatory; CM: Conditional Mandatory; O: Optional)

6.6 VTU and MCU Restricted Operation

All VTUs and MCUs shall implement the mandatory restrict capabilities and commands defined in ITU-T H.221 and follow the procedures for restricted operation in ITU-T H.242.

A VTU or an MCU connected to an unrestricted network and having a network interface that does not provide network octet timing should implement the procedure described in Section 13 of ITU-T H.242. This will provide for interoperation with VTUs or MCUs on a network with a restricted segment. A VTU or MCU connected to an unrestricted network and having a network interface that does not provide network octet timing may not be able to communicate with a VTU or MCU on a restricted network. It may also not be able to communicate with a VTU or MCU connected to an unrestricted network but passing through a restricted segment. The latter is quite common in long distance connections in North America. Restricted mode operation is primarily a North American problem, however, systems outside of North America may need to interoperate with North American systems.

Annex A of Appendix A - VTC Protocol Implementation Conformance Statements (PICS)

A.1 Introduction

The PICS specify requirements for implementations of this Profile. They are used to determine areas where interoperability testing may be carried out and as a screening device to determine if a VTU or MCU meets all mandatory requirements. The PICS are also recommended for use by purchasers of video teleconferencing systems to determine which features have been implemented. This Annex is to be used in conjunction with Section 5 of the Profile. If there is any disagreement between this Annex and Section 5, Section 5 takes precedence.

The columns of the PICS are as follows: *Protocol Feature* refers to the features of the protocol in question. *Std. Clause* indicates the clause of the standard where the feature is described. *Std. Status* indicates whether the feature is mandatory, optional, etc. *Implemented* has two ballot boxes where the manufacturer may indicate support or non-support for a feature.

A.1.1 Symbols and conventions used in Std. Status column

M = Mandatory. In those cases where the entire standard is optional "Mandatory" indicates those portions of the standard that must be implemented to meet tne minimum requirements associated with that standard.

O = Optional.

O.<n> = Optional, but support of at least one of the group of options labeled by the same numeral <n> is required.

C = Conditional.

CM = Conditionally Mandatory, i.e., if the terminal or MCU is capable of entering the given state, then it must transmit the given code and, when leaving that state, the complementary code. If it has no such capability it can ignore both.

NS = Not within scope of this profile.

Y = Supported.

N = Not supported.

A.2 Identification

A.2.1 Manufacturer information

Manufacturer Company:

Contact Name:

Street:

City/State:

Voice telephone:

FAX telephone:

e-mail address:

A.2.2 Device identification

Product name:

Product number:

Revision number:

Other:

A.3 H.221 PICS

Protocol Feature	Std. Clause	Std. Status	Implemented?
Frame Alignment Signal	1.1	M	Y[ ] N[ ]
Bit-rate Allocation Signal	1.2	M	Y[ ] N[ ]
Encryption Control Signal	1.3	O	Y[ ] N[ ]
Remaining capacity	1.4	M	Y[ ] N[ ]
Frame Alignment - General	2.1	M	Y[ ] N[ ]
Multiframe structure	2.2	M	Y[ ] N[ ]
Loss & recovery of frame alignment.	2.3	M	Y[ ] N[ ]
Loss & recovery of multiframe align	2.4	M	Y[ ] N[ ]
Timing recovery	2.5	O	Y[ ] N[ ]
Description of the CRC-4 procedure	2.6	O	Y[ ] N[ ]
Computation of the CRC-4 bits	2.6.1	O	Y[ ] N[ ]
Frame alignment monitoring	2.6.2.2	O	Y[ ] N[ ]
Error rate monitoring	2.6.2.3	O	Y[ ] N[ ]
Multiple B-connections	2.7.1	O	Y[ ] N[ ]
Multiple H0-connections	2.7.2	O	Y[ ] N[ ]
Encoding of the BAS	3.1	M	Y[ ] N[ ]
Values of the BAS	3.2	M	Y[ ] N[ ]
Procedures for use of the BAS	3.3	M	Y[ ] N[ ]
Trans. of generic SBE characters	3.4	O	Y[ ] N[ ]
Audio command - neutral	Annex A.1	O	Y[ ] N[ ]
Audio command - Au-off, U	Annex A.1	NS	
Audio command - Au off, F	Annex A.1	O (1)	Y[ ] N[ ]
Audio command - A-law, OU	Annex A.1	NS	
Audio command - A-law, OF	Annex A.1	O (1)	Y[ ] N[ ]

A.3. H.221 PICS (Continued)

Audio command - μ-law, OU	Annex A.1	NS	
Audio command - μ-law, OF	Annex A.1	M	Y[ ] N[ ]
Audio command - G.722, m1	Annex A.1	O	Y[ ] N[ ]
Audio command - G.722, m2	Annex A.1	O	Y[ ] N[ ]
Audio command - G.722, m3	Annex A.1	O	Y[ ] N[ ]
Audio command - Au-40k	Annex A.1	NS	
Audio command - Au-32k	Annex A.1	NS	
Audio command - Au-24k	Annex A.1	NS	
Audio command - G.728	Annex A.1	M	Y[ ] N[ ]
Audio command - Au -<16k	Annex A.1	NS	
Audio command - Au-ISO-64 to 256	Annex A.1	NS	
Audio command - Au-ISO-384	Annex A.1	NS	
Xfer rate command - 64	Annex A.2	M	Y[ ] N[ ]
Xfer rate command - 2 x 64	Annex A.2	M	Y[ ] N[ ]
Xfer rate command - 3 x 64	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 4 x 64	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 5 x 64	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 6 x 64	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 384	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 2 x 384	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 3 x 384	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 4 x 384	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 5 x 384	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 1536	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 1920	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 128k	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 192k	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 256k	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 512k	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 768k	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 1152k	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - 1472k	Annex A.2	O	Y[ ] N[ ]
Xfer rate command - Loss-i.c.	Annex A.2	O	Y[ ] N[ ]
Channel No. 2-6	Annex A.2	O	Y[ ] N[ ]
Video, etc. cmd - Video-off	Annex A.3	O	Y[ ] N[ ]
Video, etc. cmd - H.261, H.263	Annex A.3	O	Y[ ] N[ ]
Video, etc. cmd - Video-imp.(R)	Annex A.3	NS	
Video, etc. cmd - Video-ISO	Annex A.3	NS	
Video, etc. cmd - AV-ISO	Annex A.3	NS	
Video, etc. cmd - Freeze-picture.	Annex A.3	M	Y[ ] N[ ]
Video, etc. cmd - Fast-update	Annex A.3	M	Y[ ] N[ ]
Video, etc. cmd - Encrypt-on	Annex A.3	O	Y[ ] N[ ]
Video, etc. cmd - Encrypt-off	Annex A.3	O	Y[ ] N[ ]
Video, etc. cmd - Au-loop	Annex A.3	O	Y[ ] N[ ]
Video, etc. cmd - Video-loop	Annex A.3	O	Y[ ] N[ ]
Video, etc. cmd - Dig-loop	Annex A.3	O	Y[ ] N[ ]
Video, etc. cmd - Loop-off	Annex A.3	O	Y[ ] N[ ]
Video, etc. cmd - SM-comp	Annex A.3	O	Y[ ] N[ ]

A.3. H.221 PICS (Continued)

Video, etc. cmd - Cancel SM-comp	Annex A.3	O	Y[ ] N[ ]
Video, etc. cmd - 6B-H0-comp	Annex A.3	O	Y[ ] N[ ]
Video, etc. cmd - Not-6B-H0-comp	Annex A.3	O	Y[ ] N[ ]
Video, etc. cmd - Restrict	Annex A.3	M	Y[ ] N[ ]
Video, etc. cmd - Derestrict	Annex A.3	M	Y[ ] N[ ]
LSD/MLP cmd - LSD off	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 300	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 1200	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 4800	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 6400	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 8000	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 9600	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 14400	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 16k	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 24k	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 32k	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 40k	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 48k	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 56k	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 62.4k	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - 64k	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - Var-LSD	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - DTI(r)	Annex A.4	NS	
LSD/MLP cmd - MLP-off	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - MLP-4k	Annex A.4	O	Y[ ] N[ ]
LSD/MLP cmd - MLP-6.4k	Annex A.4	O	Y[ ] N[ ]
Audio cap - G.722-64	Annex A.5	O	Y[ ] N[ ]
Audio cap - G.722-48	Annex A.5	O	Y[ ] N[ ]
Audio cap - G.728	Annex A.5	M	Y[ ] N[ ]
Audio cap - Au-ISO	Annex A.5	O	Y[ ] N[ ]
Video etc. cap - QCIF	Annex A.6	M	Y[ ] N[ ]
Video etc. cap - CIF	Annex A.6	O	Y[ ] N[ ]
Video etc. cap - 1/29.97	Annex A.6	O	Y[ ] N[ ]
Video etc. cap - 2/29.97	Annex A.6	O	Y[ ] N[ ]
Video etc. cap - 3/29.97	Annex A.6	O	Y[ ] N[ ]
Video etc. cap - 4/29.97	Annex A.6	M	Y[ ] N[ ]
Video etc. cap - Video-imp(R)	Annex A.6	NS	
Video etc. cap - Video-ISO	Annex A.6	NS	
Video etc. cap - AV-ISO	Annex A.6	NS	
Video etc. cap - MBE-cap	Annex A.6	O	Y[ ] N[ ]
Video etc. cap - Esc-CF(R)	Annex A.6	NS	
Video etc. cap - Encrypt	Annex A.6	O	Y[ ] N[ ]
Trans rate cap - B, H0	Annex A.7	O (2)	Y[ ] N[ ]
Trans rate cap - 2B	Annex A.7	M	Y[ ] N[ ]
Trans rate cap - 6B	Annex A.7	O	Y[ ] N[ ]
Trans rate cap - 2 x H0	Annex A.7	O	Y[ ] N[ ]
Trans rate cap - 5 x H0	Annex A.7	O	Y[ ] N[ ]
Trans rate cap - H11/H12	Annex A.7	O	Y[ ] N[ ]

A.3. H.221 PICS (Continued)

Trans rate cap - Restrict	Annex A.7	M	Y[ ] N[ ]
Trans rate cap - 6B-H0-comp	Annex A.7	O	Y[ ] N[ ]
Trans rate cap - 128k	Annex A.7	O	Y[ ] N[ ]
Trans rate cap - 192k	Annex A.7	O	Y[ ] N[ ]
Trans rate cap - 256k	Annex A.7	O	Y[ ] N[ ]
Trans rate cap - 512k	Annex A.7	O	Y[ ] N[ ]
Trans rate cap - 768k	Annex A.7	O	Y[ ] N[ ]
Trans rate cap - 1152k	Annex A.7	O	Y[ ] N[ ]
Trans rate cap - 1472k	Annex A.7	O	Y[ ] N[ ]
LSD/MLP cap - 300(to 64k)	Annex A.8	O	Y[ ] N[ ]
LSD/MLP cap - Var-LSD	Annex A.8	O	Y[ ] N[ ]
LSD/MLP cap - MLP-4k	Annex A.8	O	Y[ ] N[ ]
LSD/MLP cap - MLP-6.4k	Annex A.8	O	Y[ ] N[ ]
LSD/MLP cap - Var-MLP	Annex A.8	O	Y[ ] N[ ]
Escape table values - HSD	Annex A.9	O	Y[ ] N[ ]
Escape table values - H.230	Annex A.9	O	Y[ ] N[ ]
Escape table values - Start-MBE	Annex A.9	O	Y[ ] N[ ]
Escape table values - NS-cap	Annex A.9	O	Y[ ] N[ ]
Escape table values - NS-comm.	Annex A.9	O	Y[ ] N[ ]
Escape table values - Cap-mark	Annex A.9	O	Y[ ] N[ ]
Escape table values - Data-apps	Annex A.9	O	Y[ ] N[ ]
HSD/H-MLP values - 64k to 1536k	Annex A.10	O	Y[ ] N[ ]
HSD/H-MLP values - HSD-other	Annex A.10	O	Y[ ] N[ ]
HSD/H-MLP values - Var-HSD	Annex A.10	O	Y[ ] N[ ]
HSD/H-MLP values - H-MLP-62.4k	Annex A.10	O	Y[ ] N[ ]
HSD/H-MLP cmds - 192k	Annex A.11	O	Y[ ] N[ ]
HSD/H-MLP cmds - 256k	Annex A.11	O	Y[ ] N[ ]
HSD/H-MLP cmds - 320k	Annex A.11	O	Y[ ] N[ ]
HSD/H-MLP cmds - 384k	Annex A.11	O	Y[ ] N[ ]
HSD/H-MLP cmds - HSD-other	Annex A.11	O	Y[ ] N[ ]
HSD/H-MLP cmds - H-MLP-off	Annex A.11	O	Y[ ] N[ ]
HSD/H-MLP cmds - H-MLP-62.4k	Annex A.11	O	Y[ ] N[ ]
HSD/H-MLP cmds - H-MLP-64k	Annex A.11	O	Y[ ] N[ ]
HSD/H-MLP cmds - H-MLP-128k	Annex A.11	O	Y[ ] N[ ]
HSD/H-MLP cmds - H-MLP-192k	Annex A.11	O	Y[ ] N[ ]
HSD/H-MLP cmds - H-MLP-256k	Annex A.11	O	Y[ ] N[ ]
HSD/H-MLP cmds - H-MLP-320k	Annex A.11	O	Y[ ] N[ ]
HSD/H-MLP cmds - H-MLP-384k	Annex A.11	O	Y[ ] N[ ]
HSD/H-MLP cmds - Var-H-MLP	Annex A.11	O	Y[ ] N[ ]
LSD/HSD appl. - Still image H.261	Annex A.12	O	Y[ ] N[ ]
LSD/HSD appl. - V.120 LSD	Annex A.12	O	Y[ ] N[ ]
LSD/HSD appl. - V.120 HSD	Annex A.12	O	Y[ ] N[ ]
LSD/HSD appl. - ISO-SP on LSD	Annex A.12	NS	
LSD/HSD appl. - ISO-SP on HSD	Annex A.12	NS	
LSD/HSD appl. - ISO-SP spatial	Annex A.12	NS	
LSD/HSD appl. - ISO-SP progressive	Annex A.12	NS	
LSD/HSD appl. - ISO-SP arithmetic	Annex A.12	NS	
LSD/HSD appl. - Graphics cursor	Annex A.12	NS	
LSD/HSD appl. - Group 3 fax	Annex A.12	NS	

A.3. H.221 PICS (Concluded)

LSD/HSD appl. - Group 4 fax	Annex A.12	NS	
LSD/HSD appl. - ISO-SP on in LSD	Annex A.13	NS	
LSD/HSD appl. - ISO-SP on in HSD	Annex A.13	NS	
LSD/HSD appl. - Cursor data LSD	Annex A.13	NS	
LSD/HSD appl. - Fax on in LSD	Annex A.13	NS	
LSD/HSD appl. - Fax on in HSD	Annex A.13	NS	
LSD/HSD appl. - V.120 LSD	Annex A.13	O	Y[ ] N[ ]
LSD/HSD appl. - V.120 HSD	Annex A.13	O	Y[ ] N[ ]

Note 1: A-law audio is not mandatory but is strongly recommended.
Note 2: The transmission rate capability for one B-channel is mandatory, the capability for 384 kbit/s H0 is optional.

A.4 H.230 PICS

The following tables summarize some requirements for H.230 compliance. The Transmit and Receive columns indicate that the Protocol Feature is transmitted or received by the VTU or MCU. The Notes column provides other information related to the requirements. The numbers in the table headers refer to sections in this profile that are related to the group of protocol features in that table.

A.4.1. MCU General Capability

5.5.1 MCU General Capability (also see 5.6.1.1 and 5.6.1.2)						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
MCC	3.5	M	X	Note 2		Y[ ] N[ ]
CANCEL -MCC	3.5	M	X	Note 2		Y[ ] N[ ]
MCS	3.5	CM	X	Note 2	Mandatory if MCU has Data Channel Capability	Y[ ] N[ ]
MCN	3.5	CM	X	Note 2	"	Y[ ] N[ ]
MMS	3.5	CM	X	Note 2	Mandatory only when H.263 is supported in addition to H.261.	Y[ ] N[ ]
CANCEL MMS	3.5	CM	X	Note 2	Mandatory only when H.263 is supported in addition to H.261	Y[ ] N[ ]
MIZ	3.5	O	X	Note 2	Indication only	Y[ ] N[ ]
CANCEL -MIZ	3.5	O	X	Note 2	"	Y[ ] N[ ]
MIV	3.5	O	X		"	Y[ ] N[ ]
CANCEL -MIV	3.5	O	X		"	Y[ ] N[ ]
MIL	3.5	O	X	X		Y[ ] N[ ]
TIC	3.5	O	X	X	Related to Call Association	Y[ ] N[ ]
TIX*	3.5	O		X	"	Y[ ] N[ ]

A.4.1 MCU General Capability (Concluded)

TIA*	3.5	O	X		Related to Call Association and Terminal Numbering	Y[ ] N[ ]
TIN*	3.5	O	X	Note 2	Related to Terminal Numbering	Y[ ] N[ ]
TIL*	3.5	O	X	Note 2	"	Y[ ] N[ ]
TID*	3.5	O	X	Note 2	"	Y[ ] N[ ]
TCU	3.5	O	Note 1	X	"	Y[ ] N[ ]
VIN*	3.5	O	X		"	Y[ ] N[ ]

Note 1: This code may have to be transmitted by the MCU in the cascaded case.
Note 2: This code may have to be received by the MCU in the cascaded case.
* - These features require the use of terminal numbers.

A.4.2. MCU Voice Activation

5.5.2.2.1 MCU Voice Activated Switching						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
Voice Activated	H.243 5.2	M	X	X		Y[ ] N[ ]
VCF	3.1	M	X	X		Y[ ] N[ ]
VCU	3.1	M	X	X		Y[ ] N[ ]

A.4.3. MCU User Broadcast Control

5.5.2.2.2 MCU User Broadcast Control						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
MCV	3.5	M	Note 1	X		Y[ ] N[ ]
CANCEL -MCV	3.5	M	Note 1	X		Y[ ] N[ ]
VCR	3.5	M	X	Note 2		Y[ ] N[ ]

Note 1: This code may have to be transmitted by the MCU in the cascaded case.
Note 2: This code may have to be received by the MCU in the cascaded case.

A.4.4. MCU User Select Control

5.5.2.2.3 MCU User Select Control						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
VCS*	3.5	CM		X	Mandatory if MCU has User Select Control	Y[ ] N[ ]
CANCEL -VCS	3.5	CM		X	"	Y[ ] N[ ]
VCR	3.5	CM	X		"	Y[ ] N[ ]

* - This features require the use of terminal numbers.

A.4.5. MCU Chair Control Capability

5.5.2.2.4 MCU Chair Control Capability (also see 5.6.1.2)						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
CIC	3.5	CM	X	X	Mandatory if MCU has Chair Control	Y[ ] N[ ]
CCA	3.5	CM	Note 1	X	"	Y[ ] N[ ]
CIS	3.5	CM	Note 1	X	"	Y[ ] N[ ]
CIR	3.5	CM	X	Note 2	"	Y[ ] N[ ]
CIT	3.5	CM	X	Note 2	"	Y[ ] N[ ]
CCR	3.5	CM	X	Note 2	"	Y[ ] N[ ]
VCB*	3.5	CM	Note 1	X	"	Y[ ] N[ ]
CANCEL -VCB	3.5	CM	Note 1	X	"	Y[ ] N[ ]
VCR	3.5	CM	X	Note 2	“	Y[ ] N[ ]
CCD*	3.5	CM	Note 1	X	"	Y[ ] N[ ]
CCK	3.5	CM	Note 3	X	"	Y[ ] N[ ]
TIF*	3.5	CM	X	Note 2	"	Y[ ] N[ ]
TCU	3.5	CM		X	“	Y[ ] N[ ]
TIA*	3.5	CM	X		“	Y[ ] N[ ]
TIL*	3.5	CM	X		“	Y[ ] N[ ]
TIN*	3.5	CM	X		“	Y[ ] N[ ]
TID*	3.5	CM	X		“	Y[ ] N[ ]
VIN*	3.5	CM	X		“	Y[ ] N[ ]
VCS	3.5	O		X		Y[ ] N[ ]
CANCEL -VCS	3.5	O		X		Y[ ] N[ ]

Note 1: This code may have to be transmitted by the MCU in the cascaded case.
Note 2: This code may have to be transmitted by the MCU in the cascaded case.
Note 3: CCK in a cascaded environment is for further study in ITU-T H.243.
* - These features require the use of terminal numbers.

A.4.6. MCU Terminal Identifiers

5.5.2.2.6 MCU Terminal Identifiers						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
TCI	3.5	O	X	Note 2		Y[ ] N[ ]
TII	3.5	O	Note 1	X	Related to TCI	Y[ ] N[ ]
TIS	3.5	O	Note 1	X	"	Y[ ] N[ ]
TCS	3.5	O	X	Note 2		Y[ ] N[ ]
IIS	3.5	O	Note 1	X	Related to TCS	Y[ ] N[ ]
TCP*	3.5	O	Note 1	X		Y[ ] N[ ]
TIP	3.5	O	X	Note 2	Related to TCP	Y[ ] N[ ]

Note 1: This code may have to be transmitted by the MCU in the cascaded case.
Note 2: This code may have to be received by the MCU in the cascaded case.
* - This features require the use of terminal numbers.

A.4.7. MCU Selection of SCM

5.5.2.4 MCU Selection of SCM (also see 5.6.1.2.c)						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
Minimum SCM	H.243 4.0	M				Y[ ] N[ ]
Secondary VTUs	H.243 4.0	O				Y[ ] N[ ]
MIS	3.5	O	X	X	Indication only	Y[ ] N[ ]
CANCEL -MIS	3.5	O	X	X	"	Y[ ] N[ ]

A.4.8. MCU Audio General

5.5.3 MCU Audio						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
G.711 m-law	G.711	M	X	X		Y[ ] N[ ]
G.711 A-law	G.711	M	X	X		Y[ ] N[ ]
G.722	G.722	O	X	X	Highly recommended	Y[ ] N[ ]
G.728	G.728	M	X	X	"	Y[ ] N[ ]
Audio Mixing	H.243	M	X	X		Y[ ] N[ ]
Voice Activated Switching	H.243	M	X	X		Y[ ] N[ ]

A.4.9. MCU Data Communications

5.5.4 MCU Data Communications						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
DCA-L	3.5	O	X	X		Y[ ] N[ ]
DIT-L	3.5	O	X	X		Y[ ] N[ ]
DIS-L	3.5	O	X	X		Y[ ] N[ ]
DCR-L	3.5	O	X	X		Y[ ] N[ ]
DCC-L	3.5	O	X	X		Y[ ] N[ ]
DCA-H	3.5	O	X	X		Y[ ] N[ ]
DIT-H	3.5	O	X	X		Y[ ] N[ ]
DIS-H	3.5	O	X	X		Y[ ] N[ ]
DCR-H	3.5	O	X	X		Y[ ] N[ ]
DCC-H	3.5	O	X	X		Y[ ] N[ ]
T.120	---	O	X	X		Y[ ] N[ ]

A.4.10. MCU Confidentiality and Security

5.5.5 MCU Confidentiality and Security						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
DES Encryption	H.233	O	X	X		Y[ ] N[ ]
OFB-64	H.233	CM	X	X	Mandatory if DES Encryption is used.	Y[ ] N[ ]

A.4.11. MCU Cascading

5.5.6 MCU Cascading						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
Simple Cascading	H.243	O	X	X		Y[ ] N[ ]
Principle /Satellite Cascading	H.243	O	X	X		Y[ ] N[ ]
MIM	3.5	CM	X	X	Mandatory for Principle/Satellite Cascading	Y[ ] N[ ]
RAN	3.5	CM	X	X	Mandatory for MCUs without administered P/S status	Y[ ] N[ ]

A.4.12. MCU Simultaneous Conference Operation

5.5.7 MCU Simultaneous Conference Operation						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
Simultaneous Conferences	H.243	O	X	X		Y[ ] N[ ]

A.4.13. MCU Value Added Services

5.5.8 MCU Value Added Services						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
SBE Characters	3.4	O		X		Y[ ] N[ ]

A.4.14. Other MCU Capabilities

Other MCU Capability						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
AIM	3.2	O	X	X	Indication only	Y[ ] N[ ]
AIA	3.2	O	X	X	"	Y[ ] N[ ]
VIS	3.1	O	X	X	"	Y[ ] N[ ]
VIA	3.1	O	X	X	"	Y[ ] N[ ]
VIA2	3.1	O	X	X	"	Y[ ] N[ ]
VIA3	3.1	O	X	X	"	Y[ ] N[ ]
VIR	3.1	O	X	X	"	Y[ ] N[ ]
LCV	3.3	O	X	X		Y[ ] N[ ]
LCA	3.3	O	X	X		Y[ ] N[ ]
LCD	3.3	O	X	X		Y[ ] N[ ]
LCO	3.3	O	X	X		Y[ ] N[ ]

A.4.15. Normal VTU Basic Multipoint Capability

5.6.1.1 Normal VTU Basic Multipoint Capability						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
VCF	3.1	M		X		Y[ ] N[ ]
VCU	3.1	M		X		Y[ ] N[ ]
Freeze Picture Release	H.261 H.263	M	X		In H.261 or H.263Picture Header	Y[ ] N[ ]
MCC	3.5	M		X		Y[ ] N[ ]
Cancel-MCC	3.5	M		X		Y[ ] N[ ]
MCS	3.5	CM		X	Mandatory if VTU has Data Channel Capability	Y[ ] N[ ]
MCN	3.5	CM		X	"	Y[ ] N[ ]

A.4.16. Normal VTU Optional Multipoint Capability

5.6.1.2 Normal VTU Optional Multipoint Capability						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
TIC	3.5	O	X			Y[ ] N[ ]
TIA*	3.5	O		X	Related to TIC	Y[ ] N[ ]
TIX*	3.5	O	X		"	Y[ ] N[ ]
MIV	3.5	O		X	Indication only	Y[ ] N[ ]
Cancel-MIV	3.5	O		X	"	Y[ ] N[ ]
MIZ	3.5	O		X	"	Y[ ] N[ ]
Cancel-MIZ	3.5	O		X	"	Y[ ] N[ ]
MIS	3.5	O		X	"	Y[ ] N[ ]
Cancel-MIS	3.5	O		X	"	Y[ ] N[ ]
TCU	3.5	O	X		Related to Terminal Numbering	Y[ ] N[ ]
TIA*	3.5	O		X	"	Y[ ] N[ ]
TIL*	3.5	O		X	"	Y[ ] N[ ]
TIN*	3.5	O		X	"	Y[ ] N[ ]
TID*	3.5	O		X	"	Y[ ] N[ ]
VIN*	3.5	O		X	"	Y[ ] N[ ]
TIF*	3.5	O	X			Y[ ] N[ ]
TCI	3.5	O		X		Y[ ] N[ ]
TII	3.5	O	X		Related to TCI	Y[ ] N[ ]
TIS	3.5	O	X		"	Y[ ] N[ ]
TCS	3.5	O		X		Y[ ] N[ ]
IIS	3.5	O	X		Related to TCS	Y[ ] N[ ]
TCP*	3.5	O	X			Y[ ] N[ ]
TIP	3.5	O		X	Related to TCP	Y[ ] N[ ]
SBE	3.4	O	X			Y[ ] N[ ]

* - These features require the use of terminal numbers.

A.4.17. VTU User Broadcast Control Capability

5.6.2.1 User Broadcast Control VTU Capability						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
MCV	3.5	CM	X		Mandatory if VTU has User Broadcast Control	Y[ ] N[ ]
CANCEL-MCV	3.5	CM	X		"	Y[ ] N[ ]

A.4.18. VTU User Select Control Capabilities

5.6.2.2 User Select Control VTU Capability						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
VCS*	3.5	CM	X		Mandatory if VTU has User Select Control	Y[ ] N[ ]
CANCEL-VCS	3.5	CM	X		"	Y[ ] N[ ]
VCR	3.5	CM		X	"	Y[ ] N[ ]
TCU	3.5	O	X		“	Y[ ] N[ ]
TIN*	3.5	O.1		X	“	Y[ ] N[ ]
TID*	3.5	O.1		X	“	Y[ ] N[ ]
TIL*	3.5	O.1		X	“	Y[ ] N[ ]
VIN*	3.5	O.1		X	“	Y[ ] N[ ]

* - These features require the use of terminal numbers.

A.4.19. VTU Chair Control Basic capability

5.6.3.1 VTU Chair Control Basic Capability						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
CIC	3.5	CM		X	Mandatory if VTU has Chair Control Capability	Y[ ] N[ ]
CCA	3.5	CM	X		"	Y[ ] N[ ]
CIS	3.5	CM	X		"	Y[ ] N[ ]
CIR	3.5	CM		X	"	Y[ ] N[ ]
CIT	3.5	CM		X	"	Y[ ] N[ ]
CCR	3.5	CM		X	"	Y[ ] N[ ]
CCD*	3.5	CM	X		“	Y[ ] N[ ]
CCK	3.5	CM	X		“	Y[ ] N[ ]
VCB*	3.5	CM	X		"	Y[ ] N[ ]
CANCEL VCB	3.5	CM	X		"	Y[ ] N[ ]
VCR	3.5	CM		X	"	Y[ ] N[ ]
TIF*	3.5	CM		X	“	Y[ ] N[ ]
TCU	3.5	CM	X		“	Y[ ] N[ ]
TIN*	3.5	CM		X	“	Y[ ] N[ ]
TID*	3.5	CM		X	“	Y[ ] N[ ]
TIL*	3.5	CM		X	“	Y[ ] N[ ]
VIN*	3.5	CM		X	“	Y[ ] N[ ]

* - These features require the use of terminal numbers.

A.4.20. VTU Chair Control Optional Capability

5.6.3.2 VTU Chair Control Optional Capability						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
VCS*	3.5	O	X			Y[ ] N[ ]
Cancel VCS	3.5	O	X			Y[ ] N[ ]

* - This features require the use of terminal numbers.

A.4.21. VTU Data Communications

5.1.10.1.1 MLP Data Channels						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
DCA-L	3.5	O	X	X		Y[ ] N[ ]
DIT-L	3.5	O	X	X		Y[ ] N[ ]
DIS-L	3.5	O	X	X		Y[ ] N[ ]
DCR-L	3.5	O	X	X		Y[ ] N[ ]
DCC-L	3.5	O	X	X		Y[ ] N[ ]
DCA-H	3.5	O	X	X		Y[ ] N[ ]
DIT-H	3.5	O	X	X		Y[ ] N[ ]
DIS-H	3.5	O	X	X		Y[ ] N[ ]
DCR-H	3.5	O	X	X		Y[ ] N[ ]
DCC-H	3.5	O	X	X		Y[ ] N[ ]
T.120	---	O	X	X		Y[ ] N[ ]

A.4.22. Other VTU Capability

Other VTU Capability						
Protocol Feature	**Std. Clause**	**Std. Status**	**Transmit**	**Receive**	**Notes**	**Implemented?**
AIM	3.2	CM	X	X	Mandatory if the VTU has audio mute capability, indication only for the receive VTU	Y[ ] N[ ]
AIA	3.2	CM	X	X	"	Y[ ] N[ ]
VIS	3.1	CM	X	X	Mandatory if the VTU has video mute capability, indication only for the receive VTU	Y[ ] N[ ]
VIA	3.1	CM	X	X	"	Y[ ] N[ ]
VIA2	3.1	CM	X	X	"	Y[ ] N[ ]
VIA3	3.1	CM	X	X	"	Y[ ] N[ ]
VIR	3.1	O	X	X	Indication only	Y[ ] N[ ]
LCV	3.3	O		X		Y[ ] N[ ]
LCA	3.3	O		X		Y[ ] N[ ]
LCD	3.3	M		X		Y[ ] N[ ]
LCO	3.3	M		X		Y[ ] N[ ]

A.5. H.224 PICS

Real-Time Control Protocol for Simplex Applications Using the H.221 LSD/HSD/MLP Channels

Protocol Feature	Std. Clause	Std. Status	Implemented?
H.224 Capabilities	6.1.1	M	Y [ ] N [ ]
H.224 Commands	6.1.2	M	Y [ ] N [ ]
Operation	6.1.3	M	Y [ ] N [ ]
Relationship to T.120 Protocols	6.2	M	Y [ ] N [ ]
Major Features	7	M	Y [ ] N [ ]
Physical Layer Transmission Over H.221	7.1	M	Y [ ] N [ ]
Client Bata Block Segmentation	7.2	M	Y [ ] N [ ]
Maximum Information Field Size	7.2.1	M	Y [ ] N [ ]
Maximum Transmission Time	7.2.2	M	Y [ ] N [ ]
Segment Numbering	7.2.3	M	Y [ ] N [ ]
Terminal Address Resolution	7.3	M	Y [ ] N [ ]
Client ID Assignments	7.4	M	Y [ ] N [ ]
Data Layer Protocol Frame Structure	7.5	M	Y [ ] N [ ]
Field Descriptions	8	M	Y [ ] N [ ]
Client Management Entity	9	M	Y [ ] N [ ]
CME Client List Message	9.1	M	Y [ ] N [ ]
CME Extra Capabilities Message	9.2	O	Y [ ] N [ ]
CME Client List Command	9.3	O	Y [ ] N [ ]
CME Extra Capabilities Command	9.4	O	Y [ ] N [ ]
CME Standard Command Codes	9.5	M	Y [ ] N [ ]
CME Standard Response Codes	9.6	M	Y [ ] N [ ]
List of Standard Client IDs	10	M	Y [ ] N [ ]
Extended Client IDs	10.1	M	Y [ ] N [ ]
Non-Standard Client IDs	10.2	O	Y [ ] N [ ]

A.6. H.231 PICS

Multipoint Control Units for Audiovisual Systems Using Digital Channels up to 2 Mbit/s

Protocol Feature	Std. Clause	Std. Status	Implemented?
Audio mixing MCU	4.3a	O.1	Y[ ] N[ ]
Audio switching MCU	4.3a	O.1	Y[ ] N[ ]
Video	4.3b	O	Y[ ] N[ ]
Transfer rate (see H.221)	4.3c	O(1)	Y[ ] N[ ]
Restricted-network capability	4.3d	M	Y[ ] N[ ]
Data	4.3e	O	Y[ ] N[ ]
MLP - highest rates	4.3f	O	Y[ ] N[ ]
Encryption	4.3g	O	Y[ ] N[ ]
MBE capability	4.3h	CM	Y[ ] N[ ]
Non-MLP chair control	4.3i	O	Y[ ] N[ ]
Ports and configurability	4.4a	O	Y[ ] N[ ]
Network aspect	4.4b	O	Y[ ] N[ ]
Communication mode selection	4.4c	O	Y[ ] N[ ]
Terminal identification	4.4d	O	Y[ ] N[ ]

Note 1: H.231 stipulates that an MCU may provide any of the transfer rates specified in H.221. In the case of this Profile *p=1* and *p=2* are mandatory.

A.7. H.242 PICS

System for Establishing Communications Between Audiovisual Terminals Using Digital channels up to 2 Mbit/s

Protocol Feature	Std. Clause	Std. Status	Implemented?
Audio capabilities	2.1	M	Y[ ] N[ ]
Video capabilities	2.2	M	Y[ ] N[ ]
Transfer rate capabilities	2.3	M	Y[ ] N[ ]
Data capabilities	2.4	O	Y[ ] N[ ]
Terminals on restricted ntwks capab.	2.5	M	Y[ ] N[ ]
Capability exchange - Sequence A	5.1	M	Y[ ] N[ ]
Mode switching - Sequence B	5.2	M	Y[ ] N[ ]
Frame reinstatement Sequence C	5.3	M	Y[ ] N[ ]
Mode initialization - $p = 1$	6.1.1	M	Y[ ] N[ ]
Mode initialization - $p > 1$	6.1.2	M	Y[ ] N[ ]
Dynamic switching - F to F	6.2.1	M	Y[ ] N[ ]
Dynamic switching - F to U	6.2.2	O	Y[ ] N[ ]
Dynamic switching - U to F/U	6.2.3	O	Y[ ] N[ ]
Mode 0 forcing - single channel	6.3.1	M	Y[ ] N[ ]
Mode 0 forcing - two or more chans.	6.3.2	M	Y[ ] N[ ]
Mode mismatch recovery	6.4	M	Y[ ] N[ ]
Frame alignment loss	7.1.1	M	Y[ ] N[ ]
Frame synchronization loss	7.1.2	M	Y[ ] N[ ]
Channel renum. - loss of 1 channel	7.2.1	O	Y[ ] N[ ]
Channel renum - loss of add'l chan.	7.2.2	O	Y[ ] N[ ]
Channel renum - loss of initial chan	7.2.3	O	Y[ ] N[ ]
Initial channel	8.1.1	M	Y[ ] N[ ]
Additional channels	8.1.2	M	Y[ ] N[ ]
Terminal disconnection	8.2	M	Y[ ] N[ ]
Call transfer	8.3	O	Y[ ] N[ ]
Conferencing	8.4	O	Y[ ] N[ ]
PCM Format conversion	8.5	O	Y[ ] N[ ]
Act/deact data channels	9.1	O	Y[ ] N[ ]
MLP	9.2	O	Y[ ] N[ ]
Simultaneous LSD and MLP	9.3	O	Y[ ] N[ ]
Restricted networks	10	M	Y[ ] N[ ]
56 to 64 kbit/s interworking	10.2.6	M(1)	Y[ ] N[ ]
Framing signal (56 kbit/s)	10.3.1	M	Y[ ] N[ ]
Transmission formats (56 kbit/s)	10.3.2	M	Y[ ] N[ ]
n x 56 kbit/s operation	10.3.3	O	Y[ ] N[ ]
n x H0 operation	10.3.4	O	Y[ ] N[ ]
Procedures for use of BAS codes	11	M	Y[ ] N[ ]
Bit occupancy and BAS codes	12	M	Y[ ] N[ ]
6B-H0 interconnect	13	NS	
Encryption control signal channel	14	O	Y[ ] N[ ]

Note 1: But see Section 6.5.

A.8. H.243 PICS

Procedures for Establishing Communications Between Three or More Audiovisual Terminals Using Digital channels up to 2 Mbit/s

Protocol Feature	Std. Clause	Std. Status	Implemented?
SCM - permanent	2.1	O.1	Y[ ] N[ ]
SCM - Per call selection	2.2	O.1	Y[ ] N[ ]
SCM - automatic	2.3	O.1	Y[ ] N[ ]
SCM - selected using MLP	2.4	O.1	Y[ ] N[ ]
First terminal capabilities	3.1	M	Y[ ] N[ ]
Second terminal capabilities (A/V)	3.2	M	Y[ ] N[ ]
Third terminal capabilities (A/V)	3.3	M	Y[ ] N[ ]
Fourth and subsequent terminals	3.4	M	Y[ ] N[ ]
Multiple channels	3.5	M	Y[ ] N[ ]
MCU-MCU initialization - G.722/56	3.6.1a	O.2	Y[ ] N[ ]
MCU-MCU initialization - G.722/48	3.6.1b	O.2	Y[ ] N[ ]
MCU-MCU initialization - G.728	3.6.1c	M	Y[ ] N[ ]
Designation of Master - prior to call	3.6.2.1	O.3	Y[ ] N[ ]
Designation of Master - negotiated	3.6.2.2	O.3	Y[ ] N[ ]
Closure of conference	3.7	O	Y[ ] N[ ]
Video switching - no video procs'ng	4.1.1	M	Y[ ] N[ ]
Video switching - errored frames	4.1.2	NS	
Automatic switching	4.2	M	Y[ ] N[ ]
Multipoint cmd visualization	4.2.2	O	Y[ ] N[ ]
Video cmd select	4.2.3	O	Y[ ] N[ ]
Numbering of terminals	5	O	Y[ ] N[ ]
Numbering method	5.1	CM	Y[ ] N[ ]
Term.-MCU interconn. w/o assoc.	5.21	CM	Y[ ] N[ ]
Term.-MCU interconn. with assoc.	5.22	O	Y[ ] N[ ]
MCU interconnection	5.3	O	Y[ ] N[ ]
Assignment of MCU numbers	5.3.1.1	CM	Y[ ] N[ ]
Fwd No. of term. added or dropped	5.3.1.2	CM	Y[ ] N[ ]
Storage and dissem. of term. Nos.	5.3.1.3	CM	Y[ ] N[ ]
Identity information	5.4	O	Y[ ] N[ ]
General mode switching	6.1	M	Y[ ] N[ ]
Bit rate symmetry	6.1.1	M	Y[ ] N[ ]
Changing the video rate	6.1.2	M	Y[ ] N[ ]
Mode changes in multi MCU calls	6.1.3	M	Y[ ] N[ ]
Mode switching for data distribution	6.2	CM	Y[ ] N[ ]
Range of data channel provisions	6.2.1.1	CM	Y[ ] N[ ]
Idle bits	6.2.1.2	CM	Y[ ] N[ ]
Terminals w/o data capability	6.2.1.3	CM	Y[ ] N[ ]
Data tokens - assignment	6.2.2.1	CM	Y[ ] N[ ]
Data tokens - release & reassign.	6.2.2.2	CM	Y[ ] N[ ]
Data tokens - withdrawal	6.2.2.3	CM	Y[ ] N[ ]
Opening, etc. of data channel	6.2.3	CM	Y[ ] N[ ]
Chair-control procedures BAS codes	7	O	Y[ ] N[ ]
Chair-control token - assignment	7.2.1	CM	Y[ ] N[ ]
Chair-control token - release	7.2.2	CM	Y[ ] N[ ]
Chair-control token - withdrawal	7.2.3	CM	Y[ ] N[ ]
Info available to Chair-ctl term.	7.3	CM	Y[ ] N[ ]

A.8. H.243 PICS (Concluded)

Chair-control of broadcast video	7.4.1	CM	Y[ ] N[ ]
Term. dropping by Chair-control	7.5	CM	Y[ ] N[ ]
Withdrawal of data token by C-ctl.	7.6	CM	Y[ ] N[ ]
Request for floor	7.7	CM	Y[ ] N[ ]
Dropping entire conference	7.8	CM	Y[ ] N[ ]
Dial-out facility	7.9	O	Y[ ] N[ ]
Identification of token assignment	7.10	CM	Y[ ] N[ ]
BAS sequencing	8	O(1)	Y[ ] N[ ]
Capability exchange during a call	9	M	Y[ ] N[ ]
Procedure for loop detect at MCU	10	O	Y[ ] N[ ]
Term. does not indicate SCM cap.	11.1	M	Y[ ] N[ ]
Contention resolution principle	11.2	O	Y[ ] N[ ]

Note 1: It is recommended that the procedures of H.242 clause 12 be followed.

A.9. H.261 PICS
Video CODEC for Audiovisual Services at px64 kbit/s.

Protocol Feature	**Std. Clause**	**Std. Status**	**Implemented?**
Source format - CIF	3.1	O	Y[ ] N[ ]
Source format - QCIF	3.1	M	Y[ ] N[ ]
Prediction	3.2.1	O	Y[ ] N[ ]
Motion compensation - encoder	3.2.2	O	Y[ ] N[ ]
Motion compensation - decoder	3.2.2	M	Y[ ] N[ ]
Loop filter - encoder	3.2.3	O	Y[ ] N[ ]
Loop filter - decoder	3.2.3	M	Y[ ] N[ ]
Transformer	3.2.4	M	Y[ ] N[ ]
Quantization	3.2.5	M	Y[ ] N[ ]
Clipping	3.2.6	M	Y[ ] N[ ]
Forced updating	3.4	M	Y[ ] N[ ]
Data structure	4.1	M	Y[ ] N[ ]
Video multiplex arrangement	4.2	M	Y[ ] N[ ]
Multipoint considerations	4.3	M	Y[ ] N[ ]
Transmission coder	5	M	Y[ ] N[ ]
Inverse transform accuracy spec.	Annex A	M	Y[ ] N[ ]
Hypothetical Reference Decoder	Annex B	M	Y[ ] N[ ]
Codec delay measurement method	Annex C	-	-
Still Image Transmission	Annex D	O	Y[ ] N[ ]

A.10. H.263 PICS
Video Coding for Low Bitrate Communications.

Protocol Feature	Std. Clause	Std. Status	Implemented?
Source format - CIF	4.1	O	Y[ ] N[ ]
Source format - QCIF	4.1	M	Y[ ] N[ ]
Prediction	4.2.2	O	Y[ ] N[ ]
Motion compensation - encoder	4.2.3	O	Y[ ] N[ ]
Motion compensation - decoder	4.2.3	M	Y[ ] N[ ]
Transformer	6.2.4	M	Y[ ] N[ ]
Quantization	4.2.4	M	Y[ ] N[ ]
Clipping	6.3.1	M	Y[ ] N[ ]
Forced updating	4.4	M	Y[ ] N[ ]
Data structure	5.1.1	M	Y[ ] N[ ]
Video multiplex arrangement	5	M	Y[ ] N[ ]
Multipoint considerations	Annex C	M	Y[ ] N[ ]
Transmission coder	Annex H	M	Y[ ] N[ ]
Inverse transform accuracy spec.	Annex A	M	Y[ ] N[ ]
Hypothetical Reference Decoder	Annex B	M	Y[ ] N[ ]

A.11 H.281 PICS
Far-End Camera Control Protocol for Video Conferences Using H.224

Protocol Feature	Std. Clause	Std. Status	Implemented?
Elements of Procedure	5	O	Y [ ] N [ ]
Action Messages	5.1	O	Y [ ] N [ ]
Action Message Examples	5.2	O	Y [ ] N [ ]
Select Video Source	5.3	O	Y [ ] N [ ]
Select Video Source Examples	5.4	O	Y [ ] N [ ]
Store Preset	5.5	O	Y [ ] N [ ]
Activate Preset	5.6	O	Y [ ] N [ ]
General	5.7	O	Y [ ] N [ ]
FECC Message Structure	6	M	Y [ ] N [ ]
FECC Capability Fields	6.2	M	Y [ ] N [ ]

A.12 G.711 PICS
Pulse Code Modulation (PCM) of voice frequencies.

Protocol Feature	Std. Clause	Std. Status	Implemented?
Can the implementation work at 64kbit/s - A-law?	3.1	O	Y[ ] N[ ]
Can the implementation work at 64kbit/s - m-law?	3.1	O	Y[ ] N[ ]
Can the implementation work at 56kbit/s - A-law?	H.221 Annex A.1	O	Y[ ] N[ ]
Can the implementation work at 56kbit/s - m-law?	H.221 Annex A.1	M	Y[ ] N[ ]

A.13 G.722 PICS
7 kHz Audio-coding within 64 kbit/s.

Protocol Feature	Std. Clause	Std. Status	Implemented?
Can the implementation work at 64kbit/s?	1.3	O	Y[ ] N[ ]
Can the implementation work at 56kbit/s	1.3	O	Y[ ] N[ ]
Can the implementation work at 48kbit/s?	1.3	O	Y[ ] N[ ]

A.14 G.728 PICS
Coding of Speech at 16 kbit/s using Low-Delay Code Excited Linear Prediction (LD-CELP).

Protocol Feature	Std. Clause	Std. Status	Implemented?
Can the implementation work at 16kbit/s?	All	M	Y[ ] N[ ]

A.15 T.122 PICS
Multipoint Communication Service for Audiographics and Audiovisual Conferencing Service Definition.

Protocol Feature	Std. Clause	Std. Status	Implemented?
Establishing Connections and binding them to the Domain	7.1	M	Y [ ] N [ ]
Attaching Application Users to a Domain	7.2	M	Y [ ] N [ ]
MCS Domain Parameters	7.3	M	Y [ ] N [ ]
MCS Channels	8	M	Y [ ] N [ ]
Multicast Channels	8.1	M	Y [ ] N [ ]
Single-Member Channels	8.2	M	Y [ ] N [ ]
Private Channels	8.3	M	Y [ ] N [ ]
Channel Id Numbering	8.4	M	Y [ ] N [ ]
MCS Data Transfer	9	M	Y [ ] N [ ]
Simple Send	9.1	M	Y [ ] N [ ]
Uniformly Sequenced data transfer	9.2	M	Y [ ] N [ ]
Send Data with Responses (For Further Study)	9.3	O	Y [ ] N [ ]
Token Management	10	O	Y [ ] N [ ]
Exclusive Event Control and Transfer	10.1	O	Y [ ] N [ ]
Event Coordination	10.2	O	Y [ ] N [ ]
Token Id Numbering	10.3	O	Y [ ] N [ ]
MCS Connect Provider	12.1	M	Y [ ] N [ ]
MCS Disconnect Provider	12.2	M	Y [ ] N [ ]
MCS Attach User	12.3	M	Y [ ] N [ ]
MCS Detach User	12.4	M	Y [ ] N [ ]
MCS Channel Join	13.1	M	Y [ ] N [ ]
MCS Channel Leave	13.2	M	Y [ ] N [ ]
MCS Channel Convene	13.3	M	Y [ ] N [ ]
MCS Channel Disband	13.4	M	Y [ ] N [ ]
MCS Channel Admit	13.5	M	Y [ ] N [ ]
MCS Channel Expel	13.6	M	Y [ ] N [ ]
MCS Send Data	14.1	M	Y [ ] N [ ]
MCS Send Data	14.1	M	Y [ ] N [ ]

A.15 T.122 PIC S (Concluded)

MCS Uniformly Sequenced Send Data	14.2	M	Y [ ] N [ ]
MCS Token Grab	1 5.1	O	Y [ ] N [ ]
MCS Token Inhibit	15 .2	O	Y [ ] N [ ]
MCS Token Give	15. 3	O	Y [ ] N [ ]
MCS Token Please	15.4	O	Y [ ] N [ ]
MCS Token Release	15.5	O	Y [ ] N [ ]
MCS Token Test	15.6	O	Y [ ] N [ ]
MCS Domain Establishment phase	A.1	M	Y [ ] N [ ]
MCS Data Transfer phase	A.2	M	Y [ ] N [ ]
MCS Connection Release phase	A.3	M	Y [ ] N [ ]

A.16 T.123 PICS

Protocol Stacks for Audiographic and Audiovisual Teleconferencing Applications.

Protocol Feature	**Std. Clause**	**Std. Status**	**Implemented?**
ISDN call setup	1.4	O	Y [ ] N [ ]
Multipoint configuration	5	O	Y [ ] N [ ]
Profile overview	6	M	Y [ ] N [ ]
ISDN basic mod e profile	7.1	M	Y [ ] N [ ]
CSDN basic mod e profile	7.2	O	Y [ ] N [ ]
PSDN basic mode profile	7.3	O	Y [ ] N [ ]
PSTN basic mode profile	7.4	O	Y [ ] N [ ]
B-ISDN basic mode profile	7.5	O	Y [ ] N [ ]
LAN basic mode profile	7.6	O	Y [ ] N [ ]
Extended mode profiles	8	O	Y [ ] N [ ]
SCF overview	9.1	M	Y [ ] N [ ]
SCF procedures	9.2	M	Y [ ] N [ ]
SCF messages	9.3	M	Y [ ] N [ ]
Quality of service parameters	9.4	M	Y [ ] N [ ]
Q.922 protocol parameters and options	10	M	Y [ ] N [ ]
Data link frame structure transparency for start-stop transmission	11	O	Y [ ] N [ ]
Physical sublayer formed by H.221 MLP channels	12	M	Y [ ] N [ ]
Alternative profiles	13	O	Y [ ] N [ ]
Alternative: ISDN based on Q.922	13.1	O	Y [ ] N [ ]
Alternative: ISDN based on T.90	13.2	O	Y [ ] N [ ]
Alternative: ISDN based on V.120	13.3	O	Y [ ] N [ ]
Alternative: PSTN based on H.324	13.4	O	Y [ ] N [ ]
Alternative: B-ISDN based on H.222	13.5	O	Y [ ] N [ ]
Alternative: LAN based on data unit transfer	13.6	O	Y [ ] N [ ]
Integration of multimedia signals framed according to H.221	ANNEX A	M	Y [ ] N [ ]
Audiographic conference setup in the ISDN	APPENDIX I	O	Y [ ] N [ ]

A.17 T.124 PICS
Generic Conference control for Audiographic and Audiovisual Terminals and Multipoint Control Units.

Protocol Feature	Std. Clause	Std. Status	Implemented?
System Model For a Conference Node	6.1	M	Y [ ] N [ ]
Conference Establishment and Termination	6.2	M	Y [ ] N [ ]
The Conference Roster	6.3	M	Y [ ] N [ ]
The Application Roster	6.4	M	Y [ ] N [ ]
The Application Registry	6.5	M	Y [ ] N [ ]
Conference Conductorship	6.6	O	Y [ ] N [ ]
Miscellaneous Functions	6.7	O	Y [ ] N [ ]
Summary of GCC Abstract Services	6.8	M	Y [ ] N [ ]
Conference Establishment and Termination	7.1	M	Y [ ] N [ ]
The Conference Profile	7.1.1	M	Y [ ] N [ ]
Conference Establishment Requirements	7.1.3	M	Y [ ] N [ ]
Examples of Conference Establishment Procedures	7.1.4	O	Y [ ] N [ ]
Meet-me Conference Establishment	7.1.4.1	M	Y [ ] N [ ]
Call-out Conference Establishment	7.1.4.2	O	Y [ ] N [ ]
Call-through Conference Establishment	7.1.4.3	O	Y [ ] N [ ]
Point-to-Point Conference Establishment	7.1.4.4	M	Y [ ] N [ ]
Conference Establishment among Multiport Terminals	7.1.4.5	O	Y [ ] N [ ]
The Conference Roster	7.2	M	Y [ ] N [ ]
The Application Roster	7.3	M	Y [ ] N [ ]
Contents of the Application Roster	7.3.1	M	Y [ ] N [ ]
Description of the Application Roster Exchange Procedure	7.3.2	M	Y [ ] N [ ]
The Application Registry	7.4	M	Y [ ] N [ ]
Registry Keys	7.4.1	M	Y [ ] N [ ]
Ownership and Persistence	7.4.2	M	Y [ ] N [ ]
Dynamic Allocation	7.4.3	M	Y [ ] N [ ]
Conference Conductorship	7.5	O	Y [ ] N [ ]
Miscellaneous Functions	7.6	O	Y [ ] N [ ]
General Operation	8.1	M	Y [ ] N [ ]
Conference Establishment and Termination	8.2	M	Y [ ] N [ ]
Conference Creation	8.2.1	M	Y [ ] N [ ]
Querying Conferences	8.2.2	M	Y [ ] N [ ]
Joining a Conference	8.2.3	M	Y [ ] N [ ]
Inviting a Node to a Conference	8.2.4	O	Y [ ] N [ ]
Requesting to Add a Node to a Conference	8.2.5	O	Y [ ] N [ ]
Locking a Conference	8.2.6	O	Y [ ] N [ ]
Unlocking a Conference	8.2.7	O	Y [ ] N [ ]
Disconnecting from a Conference	8.2.8	O	Y [ ] N [ ]
Terminating a Conference	8.2.9	M	Y [ ] N [ ]
Ejecting a Node from a Conference	8.2.10	O	Y [ ] N [ ]
Transferring Nodes Between Conferences	8.2.11	O	Y [ ] N [ ]
The Conference and Application Rosters	8.3	M	Y [ ] N [ ]
Overview	8.3.1	M	Y [ ] N [ ]
Nodes Entering a Conference	8.3.2	M	Y [ ] N [ ]

A.17 T.124 PICS (Continued)

Enrolling Application Protocol Entities	8.3.3	M	Y [ ] N [ ]
Updating a Conference Roster Entry	8.3.4	M	Y [ ] N [ ]
Propagation of Roster Updates to the Top GCC Provider	8.3.5	M	Y [ ] N [ ]
Distribution of the Conference and Application Rosters	8.3.6	M	Y [ ] N [ ]
Nodes Leaving a Conference	8.3.7	M	Y [ ] N [ ]
Collapsing Application Capabilities Lists	8.3.8	M	Y [ ] N [ ]
Application and Conference Roster Inquiry	8.3.9	M	Y [ ] N [ ]
An Example of a Roster Update	8.3.10	O	Y [ ] N [ ]
Remotely Invoking an Application Protocol Entity	8.3.11	O	Y [ ] N [ ]
The Application Registry	8.4	M	Y [ ] N [ ]
Registering a Channel	8.4.1	M	Y [ ] N [ ]
Assigning a Token	8.4.2	M	Y [ ] N [ ]
Setting a Parameter	8.4.3	M	Y [ ] N [ ]
Retrieving an Entry	8.4.4	M	Y [ ] N [ ]
Deleting an Entry	8.4.5	M	Y [ ] N [ ]
Monitoring an Entry	8.4.6	M	Y [ ] N [ ]
Allocation of Unique Handles	8.4.7	M	Y [ ] N [ ]
Changes in Ownership and Registry Cleanup	8.4.8	M	Y [ ] N [ ]
Conference Conductorship	8.5	O	Y [ ] N [ ]
Grabbing Conductorship	8.5.1	O	Y [ ] N [ ]
Releasing Conductorship	8.5.2	O	Y [ ] N [ ]
Conductor Assignment and Release Indications	8.5.3	O	Y [ ] N [ ]
Asking to Be Given Conductorship	8.5.4	O	Y [ ] N [ ]
Giving Conductorship	8.5.5	O	Y [ ] N [ ]
Getting Conductorship Status	8.5.6	O	Y [ ] N [ ]
Conductorship Announcement When New Nodes Enter a Conference	8.5.7	O	Y [ ] N [ ]
Unexpected Disconnection of the Conductor	8.5.8	O	Y [ ] N [ ]
Asking to Be Given Conducted-Mode Permission	8.5.9	O	Y [ ] N [ ]
Granting Conducted-Mode Permission	8.5.10	O	Y [ ] N [ ]
Miscellaneous Functions	8.6	O	Y [ ] N [ ]
Timed Conferences	8.6.1	O	Y [ ] N [ ]
Requesting Conference Assistance	8.6.2	O	Y [ ] N [ ]
Broadcasting a Text Message	8.6.3	O	Y [ ] N [ ]
GCCPDU Definitions	8.7	M	Y [ ] N [ ]
Use of the Multipoint Communication Service	9	M	Y [ ] N [ ]
MCS Services	9.1	M	Y [ ] N [ ]
Channel Allocation	9.2	M	Y [ ] N [ ]
Token Allocation	9.3	M	Y [ ] N [ ]
Use of MCS Data Transmission Services	9.4	M	Y [ ] N [ ]
Encoding of PDUs in MCS Primitives	9.5	M	Y [ ] N [ ]
Format of User Data Parameter of MCS-Connect-Provider	9.6	M	Y [ ] N [ ]

A.17 T.124 PICS (Concluded)

Interpretation of the MCS Domain Selector	9.7	M	Y [ ] N [ ]
Static Channel ID Assignments	Annex A.1	M	Y [ ] N [ ]
Static Token ID Assignments	Annex A.2	M	Y [ ] N [ ]
Object Identifier Assignment	Annex B	M	Y [ ] N [ ]

A.18 T.125 PICS
Multipoint Communications Service Protocol Specification

Protocol Feature	**Std. Clause**	**Std. Status**	**Implemented?**
Overview of the MCS protocol	5	M	Y [ ] N [ ]
Model of the MCS layer	5.1	M	Y [ ] N [ ]
Services provided by the MCS layer	5.2	M	Y [ ] N [ ]
Services assumed from the transport layer	5.3	M	Y [ ] N [ ]
Functions of the MCS layer	5.4	M	Y [ ] N [ ]
Domain management	5.4.1	M	Y [ ] N [ ]
Channel management	5.4.2	M	Y [ ] N [ ]
Data transfer	5.4.3	M	Y [ ] N [ ]
Token management	5.4.4	M	Y [ ] N [ ]
Hierarchical processing	5.5	M	Y [ ] N [ ]
Domain parameters	5.6	M	Y [ ] N [ ]
Use of the transport service	6	M	Y [ ] N [ ]
Model of the transport service	6.1	M	Y [ ] N [ ]
Use of multiple connections	6.2	M	Y [ ] N [ ]
Transport connection release	6.3	M	Y [ ] N [ ]
Structure of MCSPDUs	7	M	Y [ ] N [ ]
Encoding of MCSPDUs	8	M	Y [ ] N [ ]
Routing of MCSPDUs	9	M	Y [ ] N [ ]
Connect MCSPDUs	9.1	M	Y [ ] N [ ]
Domain MCSPDUs	9.2	M	Y [ ] N [ ]
Meaning of MCSPDUs	10	M	Y [ ] N [ ]
MCS provider information base	11	M	Y [ ] N [ ]
Hierarchical replication	11.1	M	Y [ ] N [ ]
Channel information	11.2	M	Y [ ] N [ ]
Token information	11.3	M	Y [ ] N [ ]
Elements of procedure	12	M	Y [ ] N [ ]
MCSPDU sequencing	12.1	M	Y [ ] N [ ]
Input flow control	12.2	O	Y [ ] N [ ]
Throughput enforcement	12.3	O	Y [ ] N [ ]
Domain configuration	12.4	M	Y [ ] N [ ]
Domain merger	12.5	M	Y [ ] N [ ]
Domain disconnection	12.6	M	Y [ ] N [ ]
Channel id allocation	12.7	M	Y [ ] N [ ]
Token status	12.8	M	Y [ ] N [ ]
Reference implementation	13	O	Y [ ] N [ ]
Alternative encodings of an MCSPDU	Appendix I	O	Y [ ] N [ ]
SDL decomposition of an MCS provider	Appendix II	O	Y [ ] N [ ]
SDL specification of the Control process	Appendix III	O	Y [ ] N [ ]
SDL specification of the Domain process	Appendix IV	O	Y [ ] N [ ]
SDL specification of the Endpoint process	Appendix V	O	Y [ ] N [ ]

A.18 T.125 PICS (Concluded)

SDL specification of the Attachment process	Appendix VI	O	Y [ ] N [ ]
Characteristics of the reference implementation	Appendix VII	O	Y [ ] N [ ]

A.19 T.126 PICS
Multipoint Still Image and Annotation Conferencing Protocol Specification.

Protocol Feature	**Std. Clause**	**Std. Status**	**Implemented?**
SI Application Enrollment	5.1	M	Y [ ] N [ ]
Capabilities and Profiles	5.2	M	Y [ ] N [ ]
Workspaces	5.3	M	Y [ ] N [ ]
Hard Copy Devices	5.4	O	Y [ ] N [ ]
Bitmaps	5.5	M	Y [ ] N [ ]
Annotations	5.6	O	Y [ ] N [ ]
Drawing and Erasing Basic Shapes	5.6.1	O	Y [ ] N [ ]
Drawing and Erasing Custom Shapes	5.6.2	O	Y [ ] N [ ]
Text	5.6.3	O	Y [ ] N [ ]
Pointers	5.7	O	Y [ ] N [ ]
Remote Events	5.8	O	Y [ ] N [ ]
Archives	5.9	O	Y [ ] N [ ]
Conducted Mode Behavior	5.10	O	Y [ ] N [ ]
Use of MCS	6.	M	Y [ ] N [ ]
MCS Token and Channel Usage	6.1	M	Y [ ] N [ ]
Use of MCS Data Services	6.2	M	Y [ ] N [ ]
Use of GCC	7.	M	Y [ ] N [ ]
GCC Unique Handles	7.1	M	Y [ ] N [ ]
SI Protocol Parameters	8.1	M	Y [ ] N [ ]
SI Application Enrollment and Initialization	8.2	M	Y [ ] N [ ]
Static Mode	8.2.1	M	Y [ ] N [ ]
Multicast Mode	8.2.2	M	Y [ ] N [ ]
Private Mode	8.2.3	M	Y [ ] N [ ]
Forming Registry Keys	8.2.4	M	Y [ ] N [ ]
Establishing Dynamic Tokens	8.2.5	M	Y [ ] N [ ]
SI Capabilities	8.2.6	M	Y [ ] N [ ]
Workspaces	8.3	O	Y [ ] N [ ]
Workspace Structure	8.3.1	O	Y [ ] N [ ]
Plane Stacking	8.3.1.1	O	Y [ ] N [ ]
Plane Coordinate System	8.3.1.2	O	Y [ ] N [ ]
Workspace Views	8.3.1.3	O	Y [ ] N [ ]
Drawing Color Palette	8.3.1.4	O	Y [ ] N [ ]
Workspace Attributes	8.3.1.5	O	Y [ ] N [ ]
Workspace Synchronization	8.3.1.5.1	O	Y [ ] N [ ]
Acceptance of Keyboard and Pointing Device Events	8.3.1.5.2	O	Y [ ] N [ ]
Preference to Preserve the Workspace	8.3.1.5.3	O	Y [ ] N [ ]
Background Color	8.3.1.5.4	O	Y [ ] N [ ]
Workspace Plane Parameters	8.3.1.6	O	Y [ ] N [ ]
Plane Editability	8.3.1.6.1	O	Y [ ] N [ ]

A.19 T.126 PICS (Continued)

Plane Usage	8.3.1.6.2	O	Y [ ] N [ ]
Plane Protection	8.3.1.6.3	O	Y [ ] N [ ]
Workspace View Parameters	8.3.1.7	O	Y [ ] N [ ]
View Region	8.3.1.7.1	O	Y [ ] N [ ]
View State	8.3.1.7.2	O	Y [ ] N [ ]
Update Enable Flag	8.3.1.7.3	O	Y [ ] N [ ]
Source Display Indicator	8.3.1.7.4	O	Y [ ] N [ ]
Creating a Workspace	8.3.2	O	Y [ ] N [ ]
Deleting a Workspace	8.3.3	O	Y [ ] N [ ]
Editing Workspace, Plane, and View Attributes	8.3.4	O	Y [ ] N [ ]
Copying Workspace Contents	8.3.5	O	Y [ ] N [ ]
Workspace Refreshing for Late Arrivers	8.3.6	O	Y [ ] N [ ]
The Effect of Changes to the Application Roster	8.3.7	O	Y [ ] N [ ]
Workspace Caching	8.3.8	O	Y [ ] N [ ]
Bitmaps	8.4	M	Y [ ] N [ ]
Creating Bitmaps	8.4.1	M	Y [ ] N [ ]
Deleting Bitmaps	8.4.2	O	Y [ ] N [ ]
Editing Bitmaps	8.4.3	O	Y [ ] N [ ]
Bitmap Color Definition	8.4.4	O	Y [ ] N [ ]
Bitmap Color Component Sampling Ratios	8.4.5	O	Y [ ] N [ ]
Bitmap Formats	8.4.6	O	Y [ ] N [ ]
Uncompressed	8.4.6.1	M	Y [ ] N [ ]
ITU-T T.4 (G3)	8.4.6.2	CM	Y [ ] N [ ]
ITU-T T.6 (G4)	8.4.6.3	CM	Y [ ] N [ ]
ITU-T T.81 (JPEG)	8.4.6.4	O	Y [ ] N [ ]
ITU-T T.82 (JBIG)	8.4.6.5	O	Y [ ] N [ ]
Non-Standard Bitmap Format	8.4.6.6	O	Y [ ] N [ ]
Pointers	8.5	O	Y [ ] N [ ]
Drawing	8.6	O	Y [ ] N [ ]
Drawing Shapes	8.6.1	O	Y [ ] N [ ]
Point	8.6.1.1	O	Y [ ] N [ ]
Open Polyline	8.6.1.2	O	Y [ ] N [ ]
Closed Polyline	8.6.1.3	O	Y [ ] N [ ]
Rectangle	8.6.1.4	O	Y [ ] N [ ]
Ellipse	8.6.1.5	O	Y [ ] N [ ]
Non-Standard	8.6.1.6	O	Y [ ] N [ ]
Drawing Element Attributes and Parameters	8.6.2	O	Y [ ] N [ ]
Sample Rate	8.6.2.1	O	Y [ ] N [ ]
Rotation	8.6.2.2	O	Y [ ] N [ ]
Bounding Rectangle	8.6.2.3	O	Y [ ] N [ ]
Pen Color	8.6.2.4	O	Y [ ] N [ ]
Pen Thickness	8.6.2.5	O	Y [ ] N [ ]
Pen Nib	8.6.2.6	O	Y [ ] N [ ]
Line Style	8.6.2.7	O	Y [ ] N [ ]
Fill Color	8.6.2.8	O	Y [ ] N [ ]
Highlighting	8.6.2.9	O	Y [ ] N [ ]

A.19 T.126 PICS (Concluded)

View State	8.6.2.10	O	Y [ ] N [ ]
Depth Order	8.6.2.11	O	Y [ ] N [ ]
Creating Drawing Elements	8.6.3	O	Y [ ] N [ ]
Deleting Drawing Elements	8.6.4	O	Y [ ] N [ ]
Editing Drawing Elements	8.6.5	O	Y [ ] N [ ]
Remote Events	8.7	O	Y [ ] N [ ]
Remote Keyboard Events	8.7.1	O	Y [ ] N [ ]
Remote Pointing Device Events	8.7.2	O	Y [ ] N [ ]
Remote Printing Events	8.7.3	O	Y [ ] N [ ]
Archives	8.8	O	Y [ ] N [ ]
Conducted Mode Operation	8.9	O	Y [ ] N [ ]
SIPDU Definitions	9.	M	Y [ ] N [ ]
SI Profiles	Annex A	O	Y [ ] N [ ]
Static Channel and Token ID Assignments	Annex B	M	Y [ ] N [ ]
Static Channel ID Assignments	1.1	M	Y [ ] N [ ]
Static Token ID Assignments	1.2	M	Y [ ] N [ ]
Object Identifier Assignments	Annex C	M	Y [ ] N [ ]
Deriving Intermediate Palettes for Bitplane Progressive Transmission of Palettized Images	Appendix I	O	Y [ ] N [ ]

A.20 T.127 PICS
Multipoint Binary File Transfer Protocol

Protocol Feature	**Std. Clause**	**Std. Status**	**Implemented?**
Multipoint Transfer of Data - An Overview	6	M	Y [ ] N [ ]
T.127 System Model	6.1	M	Y [ ] N [ ]
Compression	6.2	O	Y [ ] N [ ]
Priority	6.3	O	Y [ ] N [ ]
File Preshipping	6.4	O	Y [ ] N [ ]
Baseline MBFT Application	7	M	Y [ ] N [ ]
Description of Operation	8	M	Y [ ] N [ ]
File Transfer User Application	8.1	O	Y [ ] N [ ]
File Transfer Application Resource Manager	8.2	M	Y [ ] N [ ]
File Transfer Application Service Element	8.3	M	Y [ ] N [ ]
MBFT Resources	8.4	M	Y [ ] N [ ]
MBFT Initialization	8.4.1	M	Y [ ] N [ ]
Static Mode	8.4.2	M	Y [ ] N [ ]
Multicast Mode	8.4.3	M	Y [ ] N [ ]
Private Mode	8.4.4	M	Y [ ] N [ ]
Forming Registry Keys	8.4.5	M	Y [ ] N [ ]
MBFT Capabilities	8.5	M	Y [ ] N [ ]
Support of Additional Concurrent File Transfers	8.6	O	Y [ ] N [ ]
Multicast Channels	8.6.1	O	Y [ ] N [ ]
Private Channels	8.6.2	O	Y [ ] N [ ]
Selective File Transfer	8.7	O	Y [ ] N [ ]
Leaving an MBFT Session	8.8	M	Y [ ] N [ ]

A.20 T.127 PICS (Concluded)

File Exchange	8.9	M	Y [ ] N [ ]
Transmitter Invoked Operation	8.9.1	M	Y [ ] N [ ]
Receiver Invoked Operation	8.9.2	O	Y [ ] N [ ]
Remote Directory Listing	8.10	O	Y [ ] N [ ]
Conducted Mode Behaviour	8.11	M	Y [ ] N [ ]
Peer File APE Present at Conducting Node	8.11.1	M	Y [ ] N [ ]
Peer File APE Absent at Conducting Node	8.11.2	M	Y [ ] N [ ]
Aborting a File Transfer	8.12	M	Y [ ] N [ ]
Diagnostics	8.13	O	Y [ ] N [ ]
NonStandard Operations	8.14	O	Y [ ] N [ ]
MBFT PDU Definitions	9	M	Y [ ] N [ ]
Use of the Multipoint Communication Service	10	M	Y [ ] N [ ]
Use of MCS Data Transmission Services	10.1	M	Y [ ] N [ ]
Channel Allocation	10.2	M	Y [ ] N [ ]
Token Allocation	10.3	M	Y [ ] N [ ]
MCS services	10.4	M	Y [ ] N [ ]
Use of Generic Conference Control	11	M	Y [ ] N [ ]
Resource IDs	11.1	M	Y [ ] N [ ]
Static Channel and Token Assignment	Annex A	M	Y [ ] N [ ]
Object Identifier Assignments	Annex B	M	Y [ ] N [ ]
File Transfer Examples	Appendix I	O	Y [ ] N [ ]
MBFT Attributes	Appendix II	O	Y [ ] N [ ]

A.21 Annex B PICS
(normative for Department of Defense)

Protocol Feature	**Std. Section**	**Std. Status**	**Implemented?**
FTR 1080A-1998	B.5.1.1	M	Y[ ] N[ ]
Transmission data rates: *p*=1, *p*=2	B.5.1.1	M	Y[ ] N[ ]
Proprietary codec	B.5.1.2	O	Y[ ] N[ ]
Motion rendition	B.5.1.3	M	Y[ ] N[ ]
VTU Network interface	B.5.1.4	O	Y[ ] N[ ]
Graphics-MIL-STD quantization tables	B.5.2	O	Y[ ] N[ ]
Graphics - Custom quantization tables	B.5.2	O	Y[ ] N[ ]
Security - interoperate with KG-194	B.5.4	CM	Y[ ] N[ ]
Security - KG-194 resync capability	B.5.4.3.2	CM	Y[ ] N[ ]
Security - interoperate with KIV-7	B.5.4.4	CM	Y[ ] N[ ]
Security - KIV-7 resync	B.5.4.4.2	O	Y[ ] N[ ]
ISDN BRI	B.6.1.1	O	Y[ ] N[ ]
Secure ISDN BRI	B.6.1.2	O	Y[ ] N[ ]

Annex B of Appendix A - Classified security and DoD specific requirements

B.1 Purpose

The purpose of this Annex is to provide the DoD and other federal agencies with interoperability and performance requirements and options that are not covered in the main body of the Profile. Annex B presents more detail than the Profile in several areas including the use of external encryption devices for classified conferences.

The technical parameters of this Annex may be exceeded to satisfy certain specific requirements, provided that the minimum mandatory requirements are met and that interoperability is maintained.

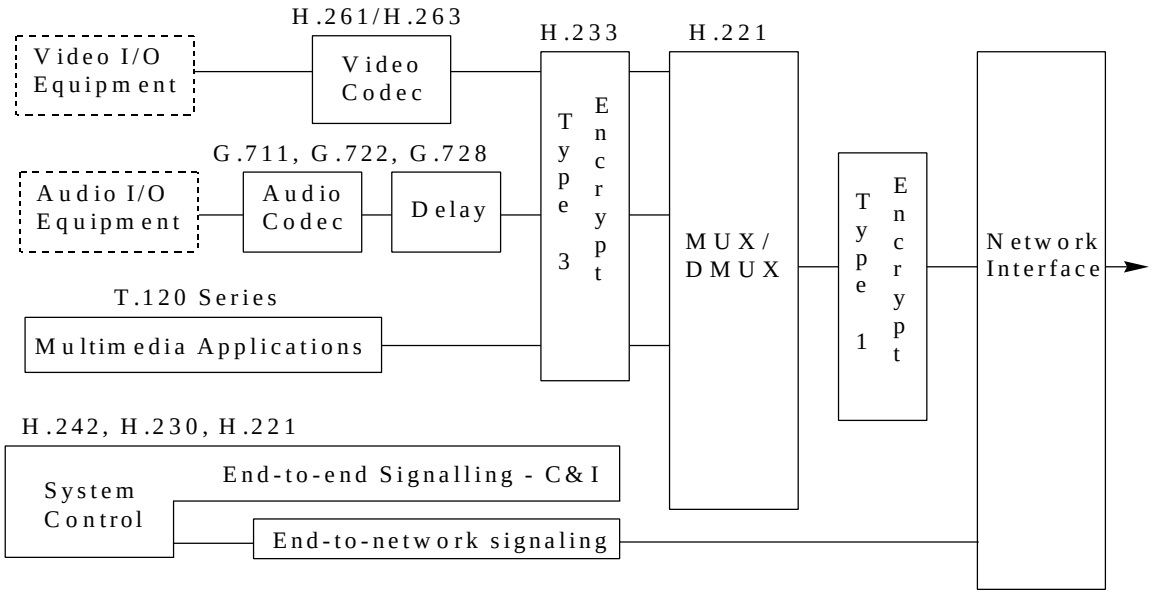


Figure B.1. Video teleconferencing equipment block diagram (dashed boxes are not included in the scope of the Profile)

B.2 Scope and Demarcation

The scope of this Annex is the same as the scope of the Profile except that it includes an optional encryption device for classified operation which is placed between the multiplexer/demultiplexer and the network interface. See Figure B.1.

B.3 Application

This Annex applies to all acquisitions initiated for DoD VTC and videophone equipment operating between 56 and 1920 kbit/s after the effective date of the Profile. Examples include, but are not limited to, roll-about units as well as portable, modular, and desktop systems, studios, and cards integrated into personal computers. This Annex does not preclude the proprietary features as long as the corresponding standard features are also included. See the definitions of *mandatory* and *optional*

features for further explanation. This Annex is also recommended for federal agencies with classified security requirements, their contractors and anyone else who needs to communicate with DoD by way of VTC. This Profile, together with the Annex can be used in the design and installation of new VTC equipment and subsystems, and in authorized upgrading of existing VTC subsystems and equipment.

B.4 PICS

A Protocol Implementation Conformance Statement for the features of this Annex is included in Section A.21 of Annex A.

B.5 Subnetwork-type independent requirements

These requirements, in addition to those in main body of the Profile apply to all DoD VTC systems.

B.5.1 Video communications and control

B.5.1.1 General

Except as noted, the VTU shall conform to the requirements set forth in FTR 1080A-1998. FTR 1080A-1998 is based on the ITU-T H.320 family of standards.

B.5.1.2 Transfer rates

VTUs shall be able to operate at $p = 2$ with a single 128-kbit/s channel, and if a second network interface port is specified, with two 64-kbit/s channels. For other p values, operation only with a single channel is required.

Operation at $p > 2$ is optional. If a higher p value is required, then all p values in the set {1, 2, 6, 12, 23, 24} less than or equal to the requirement shall also be provided.

B.5.1.3 Video coding and decoding

The video CODEC subsystem can also provide other proprietary solutions in addition to ITU-T H.261. For every video coding rate the terminal is capable of, the terminal shall be capable of using the ITU-T H.261 coding algorithm. The purpose of this requirement is to prevent two terminals which are capable of communicating at a high transmission rate such as p = 24 having to communicate at a lower rate to be interoperable.

A terminal is not precluded from having proprietary picture formats other than QCIF or CIF, but if a terminal has a picture format with more pixels than QCIF (176x144 = 25344 pixels), it shall also have the CIF picture format implemented using ITU-T H.261. The purpose of this requirement is to prevent two terminals which are capable of CIF-like resolutions having to communicate at a QCIF resolution to be interoperable.

B.5.1.4 Motion rendition

The encoder shall be capable of encoding at least an average of 6 pictures per second, excluding pictures with scene changes. This is to help ensure a minimum level of motion rendition, however, depending on the user's needs, higher frame rates may be required. See paragraph B.7.1.8.1.

B.5.1.5 VTU network interface

For VTUs connected to dedicated Defense Networks such as DCTN, a minimum of one synchronous EIA-449 attachment port is strongly recommended as specified in B.5.4.3.1 and B.5.4.3.2. For other VTUs, a minimum of one EIA-449 attachment port as per 5.4.4.1 and 5.4.4.2 is strongly recommended. This will allow interface to KG-194 and KIV-7 cryptographic devices, should a classified conference be required. (There may be a need to do classified conferencing in an emergency even if the VTU is normally used for non-classified purposes.)

B.5.2 Still Images

ITU-T T.126 provides a mechanism for transmitting still images within a video teleconference, as per 5.1.10.3. The T.126 Soft-Copy-Image-0 Profile (option 2 in 5.1.10.3) is recommended as a minimum to send and receive still images. It provides a capability similar to the NITFS JPEG capability specified in MIL-STD-188-198A. The T.126 profile provides the capability to receive and transmit 384 pixels (wide) x 288 pixels (high) 8-bit grayscale and 24-bit YCbCr color images using sequential DCT with Huffman encoding. This includes the MIL-STD-188-198A Type 1 (8-bit gray scale) and Type 2 (24-bit color) compression modes.

For many applications, higher resolution is required, and in this case the T.126 Soft-Copy-Image-1 Profile (option 3 in 5.1.10.3) is recommended. This is the same as the Soft-Copy-Image-0 Profile except that the resolution capability is increased to 768 pixels(wide) x 576 pixels(high). This resolution is sufficient to handle full scale images digitized from NTSC broadcast quality video sources. For other resolutions, the options Soft-Copy-Image-Bitmap-Max-Width and Soft-Copy-Image-Bitmap-Max-Height can be used to specify any resolution up to 21,845.

The following options are not addressed by T.126. The capability to use the default quantization tables defined in MIL-STD-188-198A is optional. As per T.126, the tables are always transmitted along with the image data. They allow images to be coded at five different levels of quality, which results in different degrees of compression. Higher quality typically results in lower compression. The capability for the user to define custom T.81 quantization tables in order to maximize compression for special types of images is another option. See MIL-STD-188-198A and DISA/JIEO Circular 9008, NITFS Certification Test and Evaluation Program Plan, for more details.

Note that T.126 does not provide the same file formats, security labeling symbology, graphics meta language and text description that NITFS provides. However, the T.126 Image Annotation Profile (option 5 in 5.1.10.3) does provide an annotation capability which may be used to annotate images with security information, symbols, graphics, and text. Also note that the still image cameras and the display devices must be of the same or higher resolution in order to obtain the desired overall still image resolution. See B.7.1.8.2.

B.5.3 Data communications

The ITU standards provide mechanisms for data transfer as per 5.1.10.1.1, 5.1.10.4, 5.1.12 and 5.5.4.

B.5.4 Security

B.5.4.1 General

This paragraph specifies a standard means of securing the transmitted signals for classified information. The capability to interface and operate with cryptographic equipment for classified operation is optional. If the user requires the VTU for use in conducting classified conferences, the requirements of B.5.4.3 and its subparagraphs are mandatory.

The following area is briefly addressed in B.7.2, but only as a recommendation, not as a mandatory or optional feature: compromising emanations (TEMPEST). The following areas related to security are outside the scope of this Annex: physical security, including room security; user authorization; and key management and distribution

B.5.4.2 Levels of security

This Annex identifies three levels of security for the protection of the information transmitted between VTUs. The three security levels are described in B.5.4.2.1 through B.5.4.2.3.

B.5.4.2.1 Unencrypted

Information that is unclassified and not sensitive requires no protection by cryptographic equipment and can be transmitted in an unencrypted (plain-text) mode. All VTUs shall be able to transmit and receive unencrypted information.

B.5.4.2.2 Unclassified but sensitive (Type 3)

Information that is unclassified but sensitive and not exempted by the Warner Amendment (as defined in Title 10, United States Code, Section 2315) shall be protected by Type 3 cryptographic equipment that is certified by the National Institute of Standards and Technology (NIST). In this Profile, this information will be referred to as "Type 3." The method of encrypting this information is specified in 5.4 of the main body of the Profile.

B.5.4.2.3 Classified (Type 1)

Information that is classified and information that is unclassified but sensitive Warner Amendment information shall be protected by Type 1 cryptographic equipment certified by the National Security Agency (NSA). In this Profile, this information will be referred to as "Type 1." As an option, it is strongly recommended that VTUs be able to interface with and operate with Type 1 cryptographic equipment. For the purposes of this Profile, Type 2 Warner-exempt information shall be protected by Type 1 cryptographic equipment.

The protection of classified VTC information shall be accomplished by encrypting the signal output from the VTU before it enters the network interface equipment to go out to the network, and by decrypting the signal coming from the network through the network interface equipment before it goes into the VTU. To minimize the number of encryption devices and simplify the key management required in a conference above 56/64 kbit/s, the VTUs shall operate in a single-channel mode (using a single EIA-449 network interface). A cryptographic device is placed between the network interface equipment and the VTU. See Figure B.2 for a simplified diagram of the connections between the network, network interface equipment, cryptographic device, and VTU. To operate over a network that contains a restricted channel at one end of the link and an unrestricted channel at another end of the link, special provisions must be made. See B.7.4 for more details.

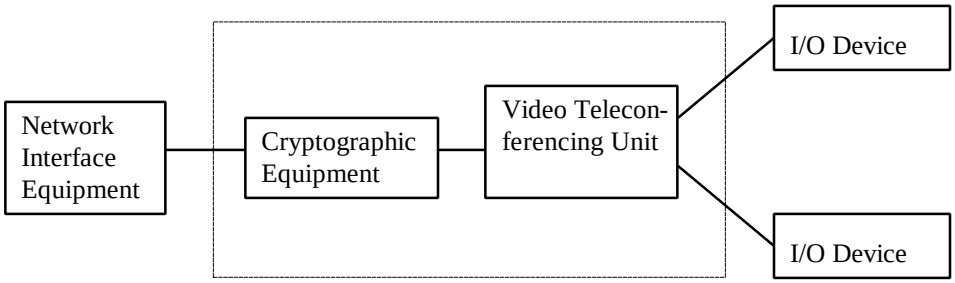


Figure B.2. Line of demarcation with external cryptographic device

ITU-T H.233 recommends that the VTU service channel (which contains the FAS, BAS, and ECS signals) remain unencrypted; however, the encryption scheme just described is a trunk encryption applied between VTUs that encrypts the entire signal, including the VTU service channel. The encrypted signal is decrypted prior to reaching the destination VTU.

If a requirement exists for classified conferencing, each transmission channel used by the VTU shall be protected by Type 1 cryptographic equipment. This will require one cryptographic unit at each VTU. If more than one transmission channel is used, as in the case of operation at $p = 2$ using ISDN or switched 56 circuits, then an aggregator (IMUX) shall be used to multiplex and demultiplex the two transmission channels to the single cryptographic unit.

Two families of cryptographic equipment are permitted for securing VTC: KG-194 and KIV-7. KG-194 (and compatible) devices have traditionally been used for VTC and will continue to be used for dedicated networks. The newer, smaller, KIV-7 (or compatible) devices may now be used for dial-up and other non-dedicated circuits. The KIV-7 uses a KG-84 type encryption algorithm. Its small size makes it particularly well suited for desktop and portable applications. Interoperability between the two families will be achieved through classified MCUs which will have both encryption devices on their ports. It is anticipated that most new classified VTC applications will use the KIV-7 or compatible, and that eventually DoD will migrate to entirely using KIVs or compatible.

B.5.4.3 Type 1 cryptographic equipment for dedicated networks

For existing dedicated networks such as DCTN, the KG-194/194A or compatible equipment shall be used to protect Type 1 information passing through the VTU. If KG-194-compatible equipment is used, it must be compatible in terms of both encryption and key-management schemes, except that existing KG-81 equipment may continue to be used until KG-194 or compatible equipment is available.

B.5.4.3.1 Electrical and mechanical interfaces

The KG-194 cryptographic equipment is compatible with EIA-422-B. The cryptographic equipment will appear to the VTU as a DCE (data circuit-terminating equipment). The cryptographic equipment will appear to the network interface equipment as a data terminal equipment (DTE). See Figure B.3.

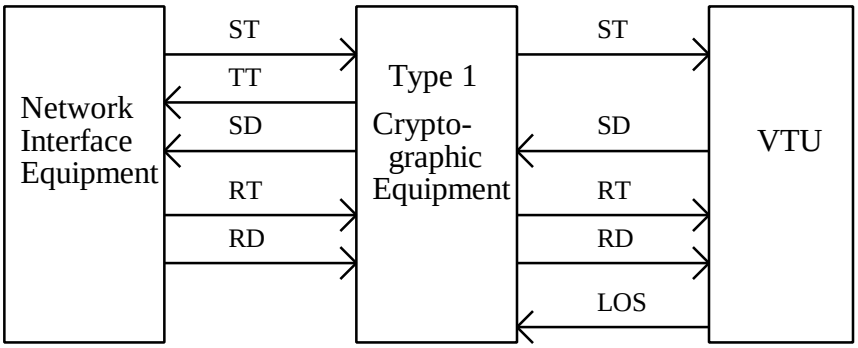


Figure B.3. EIA-449/EIA-422-B Electrical interface for VTU, KG-194 and compatible cryptographic device, and network interface device.

All of the signal lines connecting the cryptographic equipment to the VTU and the network interface equipment shall have differential balanced connections.

The interface between the network interface equipment and the cable to the cryptographic equipment shall include the following signals: Send Timing (ST), Terminal Timing (TT), Send Data (SD), Receive Timing (RT), and Receive Data (RD). See Table B.1. This interface shall conform to the specifications of EIA-449 (mechanical) and EIA-422-B (electrical). The cryptographic equipment does not generate a clock signal to the network interface equipment. Rather, the TT signal is derived by the cryptographic equipment from the ST signal provided by the network interface equipment. A minimum of one synchronous EIA-449 attachment port shall be provided on the VTU to provide capability to connect to a cryptographic device. The electrical characteristics shall be as specified in EIA-422-B for balanced voltage digital-interface circuits.

The interface between the VTU and the cable to the cryptographic equipment shall include, in accordance with EIA-449 and EIA-422-B, the signals ST, SD, RT, and RD. The interface shall also use a nonstandard loss of synchronization (LOS) signal. It is recommended that this LOS signal be balanced, in accordance with EIA-422-B, with pin 3 designated as the "A" lead and pin 21 as the "B" lead.

Signal	EIA-449 Pins		Description
	A Lead	B Lead	
LOS	3	21	Loss of Synchronization
RD	6	24	Receive Data
RT	8	26	Receive Timing
SD	4	22	Send Data
ST	5	23	Send Timing
TT	17	35	Terminal Timing

Table B.1. KG-194 and compatible cryptographic equipment interface signals

B.5.4.3.2 Resynchronization

The VTU shall be able to provide a resynchronization signal to Type 1 cryptographic equipment. Detection of loss-of-sync and initiation of an automatic resynchronization by the VTU is required to support real-time VTC.

During normal operation, the VTU shall express a logic "1," in accordance with EIA-422-B, paragraph 4.1, on the LOS line to the cryptographic equipment. If the VTU loses frame alignment, as defined in ITU-T Recommendation H.221, paragraph 2.3, *Loss and Recovery of Frame Alignment*, the VTU shall express a logic "0" pulse with a duration not less than 2^{18} bits plus 3.0 milliseconds and less than 2^{19} bits plus 3.0 milliseconds on the LOS line.

The logic "0" pulse shall also be in accordance with EIA-422-B, paragraph 4.1. Type 1 cryptographic equipment will continue to provide the clock signal and hold the Receive Data (RD) signal line at a logic "0" while it resynchronizes. The VTU shall restart the Type 1 resynchronization process, as defined in this paragraph, within 30 seconds after both of the following conditions have been met:

a. the LOS line has returned to logic "1"; and
b. the VTU is unable to find the frame alignment, as defined in ITU-T Recommendation H.221.

This process shall continue until frame alignment is achieved.

B.5.4.4 Type 1 cryptographic equipment for non-dedicated networks

For dialup and other non-dedicated networks, and for new dedicated networks, KIV-7, KIV-7-HS or compatible equipment shall be used. Existing KG-194s or compatibles may continue to be used in non dedicated networks until KIV-7s become available.

B.5.4.4.1 Electrical and mechanical interfaces

This paragraph will be addressed in a future revision of the Profile. Further details are available in the booklet “Embeddable KG-84 COMSEC Module (KIV-7) User’s Manual”.

(The suggested interface between the KIV-7 cryptographic device and the VTU is under study and will be provided in future revisions to the Profile.)

Figure B.4. Suggested interface for network interface device, KIV-7 cryptographic device, and VTU.

B.5.4.4.2 Resynchronization

Resynchronization can be done either manually or automatically, depending on the application. If done manually, no resynchronization signal is required from the VTU. The operator simply pushes the "initiate" button on the KIV-7 to resynchronize it. If done automatically, the VTU must detect loss of synchronization and must supply a resynchronization signal to the KIV-7.

The choice of manual or automatic resynchronization depends on several factors. For VTU applications where the KIV is difficult to access or there are banks of KIVs colocated, or where "bit slips" on the network transmission timing is frequent, automatic resynchronization of the KIV-7 by the VTU is recommended. Resynchronization is mandatory for MCU's. Bit slips occur when there are small differences in the network timing between the near and far end. For applications where network timing "bit slips" are infrequent, and where the operator can easily reach the KIV-7 front panel (particular desktop configurations), resynchronization may be done manually and no resynchronization pulse is required from the VTU. Further details are available in the booklet "Embeddable KG-84 COMSEC Module (KIV-7) User's Manual".

B.5.4.4.3 Key management

The KIV allows for local and over-the-air (OTAR) rekeying. For details, see the booklet "Embeddable KG-84 COMSEC Module (KIV-7) User's Manual".

B.5.4.4.4 Common KG-194 and KIV-7 interface

This paragraph will be addressed in a future revision of the Profile.

B.5.4.5 MCU Security

Two types of MCUs are specified by this Profile. Unclassified MCUs shall only be used for unclassified or unclassified sensitive conferences (See 5.6.5). Classified MCUs shall be used for classified conferences (See B.5.4.4.1). Classified MCUs may also be used for unclassified conferences (See B.5.4.4.2).

The dial-out capability of some MCUs provides an additional level of assurance that only those participants that should be in the conference are in it. This is applicable to both unclassified and classified conferences.

Requirement	M/CM/O*	Transmit	Receive	Notes
Unclassified operation	M	X	X	
Unclassified Sensitive Operation	O	X	X	
Classified Operation	O	X	X	
Type I Encryption KG-194 KG-194 I/F KG-194 Resync	 CM CM CM	X	X	Mandatory if connected to existing dedicated network which provides for Classified Operation
Type 1 Encryption KIV-7 KIV-7 I/F KIV-7 Resync	 CM CM CM	X	X	Mandatory for Classified Operation (except for existing dedicated networks)
Switching from unclassified to classified	CM	X	X	Mandatory for Classified operation
Multi-level Security	O			
Dial-out Capability	O	X		
Cascading	O	X	X	
Segmentable Operation	O	X	X	

(* - M: Mandatory; CM: Conditional Mandatory; O: Optional)

Table B.2. MCU Security

B.5.4.5.1 Classified MCU in Classified Operation

B.5.4.5.1.1 MCU Port Encryption

A Classified MCU shall meet all of the requirements for a VTU described in B.5.4. Each transmission channel between the MCU and a VTU or another MCU shall be protected by Type 1 cryptographic devices as described in B.5.4.3 or B.5.4.4.

All classified MCUs shall have the capability to operate with KIV-7s (or compatible devices). All classified MCUs which connect to existing classified networks shall, in addition to KIV-7 capability, also have the capability to operate with KG-194s (or compatible devices). The MCUs connected to existing dedicated networks shall provide the interoperability between the dedicated networks using KG-194s and other networks using KIV-7 and/or KG-194 devices.

This will require a cryptographic device for each port in use on the MCU and one for each VTU in the conference. For example, a three party conference will require six cryptographic devices: three cryptographic devices at the MCU and one cryptographic device at each of three VTUs. See B.6.1.2, B.7.5.1.3, and B.7.5.2.2 for interface configurations.

B.5.4.5.1.2 Trusted Facilities

It is necessary that the Classified MCU be located in a trusted facility such as a SCIF or other protected enclosure, since classified, unprotected data is present internal to the MCU. See B.7.2.

B.5.4.5.1.3 Simultaneous Conference Operation

A Classified MCU may provide simultaneous conference operation as described in 5.5.7 provided that all simultaneous conferences being handled by the MCU are at the same security classification level. If compartmented information is present, all conferences shall have cleared access to the same compartments. For the case of simultaneous classified conferencing at a single classification level, or where all conferences are cleared to the same compartments, there is no specific NSA requirement for conference-to-conference isolation that applies to all cases. There is typically a need for conference-to-conference isolation, because the participants in one conference usually do not have a need to know what is going on in the other conferences. However, the degree of isolation required between these conferences may vary depending on the specific applications and must be determined on a case-by-case basis for each installation. In most cases, 60 dB of isolation will be adequate. Adequate safeguards must be in place to assure that all the VTUs and MCUs participating in the multipoint conference are at the same level.

B.5.4.5.1.4 Multi-level Security

A Classified MCU may provide simultaneous conference operation as described in 5.5.7 for simultaneous conferences at different security classification levels, including unclassified, provided that the MCU has been certified by NSA to the proper level of assurance for the specified security classification levels. In accordance with NSTISSAM TEMPEST/2-95, section 4.3b, a Classified MCU providing simultaneous conference operation at different security levels, including unclassified, shall provide the following levels of isolation between conferences at different classification levels:

Type of Signal	dB of Isolation	Frequency Range Required
digital (audio,video or data)	60 dB	The entire range 1R through 10R, where R is the composite data ate of the signal
analog audio	100 dB	From 0.3 - 15 Khz
analog baseband video	80 dB	From 0 to 5 Mhz

(MCU's typically process only digital data. One possible exception is analog audio addons.)

(As of this date, we are not aware of any MCUs that have been certified by NSA to meet these requirements, so multi-level security may not yet be available.)

B.5.4.5.1.5 Cascading

A Classified MCU may provide cascading capability as described in 5.5.6 for connecting multiple MCUs in a single conference provided that all MCUs are operating at the same security classification level, and that if compartmented information is present that all MCUs have cleared access to the same compartments. Adequate safeguards must be in place to assure that all the VTUs participating in the multipoint conference are at the same level.

A Classified MCU may provide combinations of cascading and simultaneous conference operation provided that the above individual requirements are met.

B.5.4.5.2 Classified MCU in Unclassified Operation

B.5.4.5.2.1 Security Level Reconfiguration

Reconfiguration of a classified MCU to unclassified operation is possible. If reconfiguration between classified and unclassified operation is required, the operational doctrine for the site must assure that no inadvertent connection of an unencrypted channel be made to a classified conference. It is possible for cryptographic devices to be installed on several ports of the MCU, but be inadvertently left off of one or moreports. The decrypted data within the MCU could then be transmitted out of one of the unprotected ports. There is no automatic safeguard to prevent this.

A Classified MCU, which has not been certified for multi-level security operation as described in B.5.4.5.1.4, may be configured with several classified ports and several unclassified ports. In this configuration, the MCU cannot support simultaneous classified and unclassified conferences. The classified ports may be used for classified conferences and the unclassified ports shall be isolated from the unclassified network by at least 100 dB of isolation.. Alternatively, the unclassified ports may be used for unclassified conferences and the classified ports shall not be used.

B.5.4.5.2.2 Switching to Classified during a Conference

A Classified MCU shall allow an Unclassified conference to be initiated and then be switched to a classified conference, provided that all operational security measures have been met. This will cause the MCUs and VTUs to loose sync. The MCUs and VTUs must be able to resynchronize to the framing information without having to disconnect and

reconnect the call. This also requires that the cryptographic device be switched between bypass and operate modes, or be re-strapped to achieve the same result.

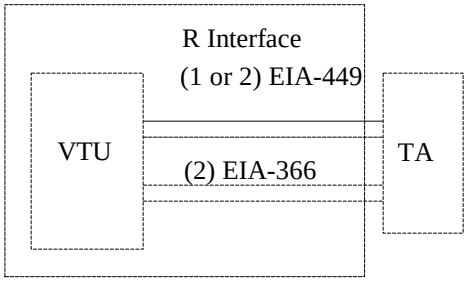
B.6 Subnetwork-type dependent requirements

B.6.1 ISDN Basic Rate Interface (BRI)

ISDN interfaces are optional. Two optional interfaces are specified in 6.3.1.1 and 6.3.1.2 of the Profile. Further details regarding option 2 are specified in B.6.1.1 below. A third option for classified operation is also included in B.6.1.2.

B.6.1.1 Option 2, External terminal adapter with dialing interface

This addresses additional requirements to 6.3.1.2 of this Profile.



(Interior of dashed-line polygon indicates scope of profile)

Figure B-5. Option 2, External TA with dialing interface.

The EIA-366-A dialing interface is not permitted to be physically or electrically connected during classified operation. (See Figure B.8 in B.7.5.1.2 for a typical configuration.) Note that if the VTU user specifies the one EIA-449 port version, and two B channels are used, the necessary IMUX function to go from a single channel to two B channels must be performed by the TA. See Figure B-5. In the dual-port version, the IMUX function is performed within the VTU.

B.6.1.2 Option 3, Classified operation

Option 3 is for Type 1 classified operation, in accordance with B.5.4.3. The VTU shall use only one EIA-449 port, as described in B.5.4.3.1, B.5.4.3.2, B.5.4.4.1 and B.5.4.4.2. See Figures B-6 and B-7.

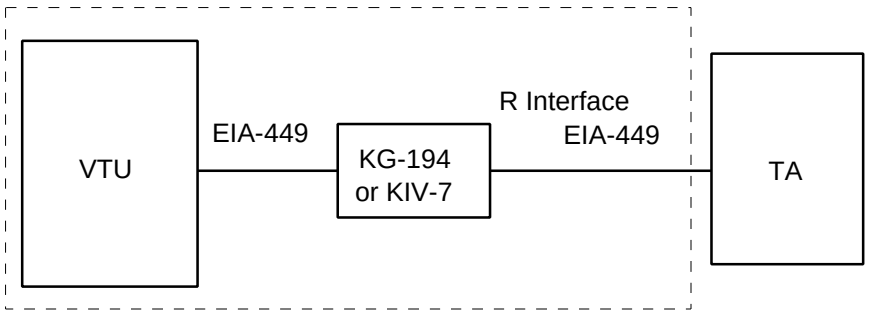


Figure B-6. Option 3, Classified operation with single channel.

Dialing must be performed on the network side of the cryptographic device. In this option, dialing is typically done through the TA. (See Figure B-10 in B.7.5.1.3 for a more detailed configuration.) No other physical or electrical connection between the VTU and the network or network interface is permitted other than through the cryptographic device, unless written permission for a specific configuration has been obtained from NSA. Note that if two B channels are used, the necessary IMUX function to go from a single channel to two B channels must be performed by the IMUX/TA, as shown in Figure B-7.

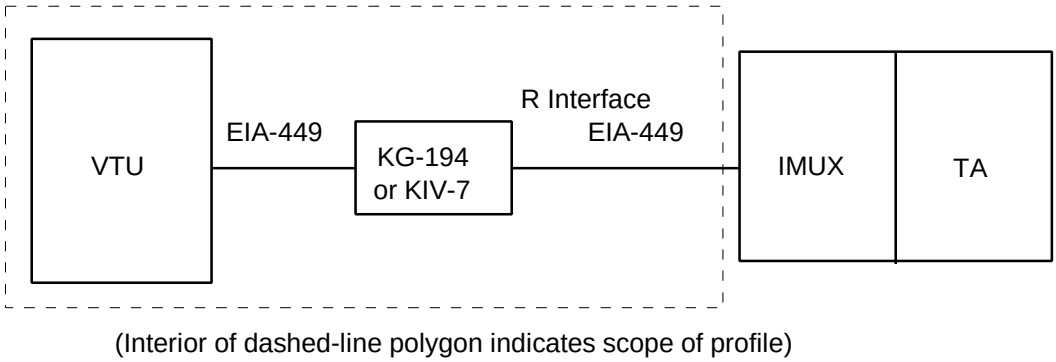


Figure B-7. Option 3, Classified operation with multiple channels.

B.6.1.3 Classified MCU Network Interface

One synchronous EIA-449 interface for each attachment port shall be provided on the MCU to provide the capability to connect to a cryptographic device. The electrical characteristics shall be as specified in EIA-422-B for balanced voltage digital-interface circuits. The requirements of B.5.4.3 shall apply to the EIA-449 network interface ports that are required for the MCU to interface with KG-194-compatible cryptographic equipment. The requirements of B.5.4.4 shall apply to the EIA-449 network interface ports that are required to interface with KIV-7 compatible equipment. The user will need to specify how many ports are to be used with KG-194s and how many with KIV-7s.

If an external inverse multiplexer is needed for networks with more than 1 channel, such as ISDN and dual-switched 56-kbit/s networks, see B.7.5.2.

B.7 Notes

(This section contains information of a general or explanatory nature that may be helpful; however, the section is not mandatory.)

B.7.1 Acquisition guidance

B.7.1.1 Nondevelopmental items

The selected minimum essential (mandatory) requirements identified in this Profile should allow maximum flexibility by permitting nondevelopmental item (NDI) or commercial off-the-shelf (COTS) acquisition.

B.7.1.2 Tailoring

For new DoD acquisitions, the mandatory portions of this Profile must be included, but it is up to the individual to decide which options should be acquired.

B.7.1.3 Mandatory optional

The term *mandatory optional* for a given feature is not used in this Profile but is sometimes used in acquisition documents. Care must be taken to distinguish between the language of the Profile and the language of the acquisition documents, since they serve different purposes. A feature that is optional in the Profile could be mandatory, mandatory optional, optional, or omitted entirely from the acquisition documents, depending on the user's needs.

B.7.1.4 Software upgrades

It is recommended that procurement officials add language to their contracts to mandate that upgrades or enhancements to the VTU or MCU be implemented in software as much as possible. Having upgrades in software instead of hardware will usually allow for more cost-effective changes.

B.7.1.5 Overseas conferences

The A-law audio coding option, as specified in 5.3.2.1, is recommended if it is anticipated that overseas conferences with non-DoD sites will be held.

B.7.1.6 Electrical and mechanical interfaces

For classified operation with KG-194 cryptographic devices, it is recommended that the electrical and mechanical interfaces of the cables connecting the KG-194 be specified at both the network interface and the VTU or MCU. For ISDN TAs an EIA-449 to EIA-530 cable may be required since TAs typically do not have EIA-449 interfaces.

B.7.1.7 Audio

B.7.1.7.1 Audio subsystem

It is the responsibility of the room audio subsystem to provide the specified electrical input level to the VTU or MCU, and to amplify the specified output electrical level from the VTU or MCU to the proper acoustic level. In addition, it may cancel or suppress echoes, mix various microphones, and distribute signals to loudspeakers.

B.7.1.7.2 Narrowband speech mode

The 0F (framed) modes are for audio data rates of 56 kbit/s (unrestricted network) and 48 kbit/s (restricted network).

B.7.1.7.3 Audio at $p = 1$

For operation at $p = 1$ use of G.711 or G.722 will result in an audio-only connection. To obtain audio and video at $p = 1$, use G.728 audio.

B.7.1.8 Video

B.7.1.8.1 Video picture-quality definition

Four ANSI standards relate to the measurement of video picture quality for VTC. Since methods presented by these standards are new, commercial test equipment for conducting these measurements is not known to be available as of the date of the Profile.

1. The first is ANSI T1.801.01-1995 "Digital Transport of Video Teleconferencing/Video Telephony Signals - Video Test Scenes for Subjective and Objective Performance Assessment". This standard specifies a collection of video test scenes that have been approved for use in subjective and objective performance assessment. Scenes are divided by content categories that are chosen to be representative of typical VTC applications. The measured video performance of a VTC system may be strongly dependent on the type of input video transmitted by the VTC system. Scenes with more motion and/or more spatial detail may produce lower subjective quality ratings than scenes with less motion and/or less spatial detail. Therefore, the user should take special care to select a subset of test scenes from ANSI T1.801.01-1995 that adequately characterize the intended application. Note: the accompanying video test tape to this ANSI standard is available from the Alliance for Telecommunications Industry Solutions, 1200 G Street, NW, Suite 500, Washington, DC 20005)

2. The second is ANSI T1.801.02-1996 "Digital Transport of Video Teleconferencing/Video Telephony Signals - Performance Terms, Definitions, and Examples". This standard provides a dictionary of digital video performance terms and impairments and includes a video tape that illustrates common digital video impairments such as tiling, smearing, edge busyness, error blocks, and jerkiness. Thus, this standard

gives end-users and service providers a common language for discussing digital video impairments.

3. The third is ANSI T1.801.03-1996 "Digital Transport of One-Way Video Signals - Parameters for Objective Performance Assessment". This standard specifies methods of measurement for objective video performance parameters (the standard does not cover audio) for end-to-end transmission quality between the video input interface of one VTU and the video output interface of another VTU. The performance metrics in ANSI T1.801.03 have been approved for in-service or out-of-service use for detecting the continued operational readiness of one-way, 525-line video systems utilizing digital transport facilities (e.g., maintenance, fault detection, and quality monitoring).

4. The fourth is ANSI T1.801.04-1997 "Multimedia Communications Delay, Synchronization, and Frame Rate Measurement". This standard specifies ANSI approved methods of measurement for end-to-end audio and video delay, and audio-visual synchronization. Transmission frame rate can be measured using this standard or ANSI T1.801.03.

Acquisition authorities should take measures to ensure levels of video quality necessary for their applications, especially when acquiring a variety of products from different sources. Video quality should be tested while interoperating not only with the same manufacturer's equipment, but also with different manufacturer's equipment, because this can drastically affect the video quality. At present, the most accurate method of assessing video quality is subjective testing (the test scenes in ANSI T1.801.01 have been approved for subjective testing of VTC systems).

Although incomplete, the objective testing methods presented by the above ANSI standards can provide useful indicators of quality. The ultimate goal is to refine and extend the objective measurement technology to produce objective methods that can replace subjective experiments for a wide range of applications. This work is continuing on a national as well as an international level so that the user of this document is encouraged to determine the status of these investigations.

B.7.1.8.2 Freeze-frame picture quality

The limiting factors in freeze-frame video quality are often the cameras and monitors. Typically, the resolution of the cameras and monitors is designed for the motion video resolution and may not provide the desired freeze-frame picture quality. For example, the freeze-frame resolution of 4 x FCIF (704 x 576 pels) exceeds the specifications of NTSC cameras and monitors (maximum 480 horizontal lines). To make full use of the 4 x FCIF resolution, special cameras and monitors have to be procured.

B.7.1.8.3 Picture format (resolution)

If the user requires the VTU or MCU to operate at a rate equal to or greater than $p = 6$, then it is recommended that the VTU or MCU also have the capability for FCIF resolution at rates equal to and above $p = 2$.

B.7.1.9 Multipoint Control Unit (MCU)

In addition to the operations described in Section 5.5, there are several other options which are not ITU Recommendations issues, but still should be identified in an acquisition document. These options include:

Network interface.
The network interface selected is heavily dependent on the type of network to which the MCU will be connected. This decision requires close coordination with the network provider. If the network is a digital public switched network, such as narrow-band ISDN, a single PRI is recommended for unclassified MCUs. This interface will allow multiple VTUs to be connected through a single network interface. For classified MCUs, a separate EIA-449/EIA-422-B interface is required for each VTU or MCU connection.

Number of VTUs in a conference.
This can typically range from 4 to 24. It should be possible to increase the number of VTUs supported by the MCU by adding cards and/or software without returning the equipment to the factory.

Number of simultaneous conferences (Segmentable operation).
The number of simultaneous conferences is usually related to the number of VTUs that can be supported. For example, if the MCU can support 16 VTUs (i.e., 5 MCUs supporting 3 VTUs each, or 4 MCUs supporting 4 VTUs each, or 3 MCUs supporting 5 VTUs each, or 2 MCUs supporting 8 VTUs each, or 1 MCU supporting 16 VTUs) then it can usually support up to 8 simultaneous conferences. (8 conferences of 2 VTUs each.)

Cascading.
Does the MCU support cascading to other MCUs in a standards compliant manner? This will allow increasing the number of VTUs in a conference beyond the number supported by a single MCU. It will also allow more efficient communications. For example, if an East Coast MCU connects to 4 East Coast VTUs and a West Coast MCU connects to 4 West Coast VTUs, only a single coast-to-coast connection is required between the two MCUs. Otherwise the four VTUs on one coast will require individual coast-to-coast connections to the MCU on the other coast.

Audio.

Does the MCU support G.722 and G.728? Support of these algorithms will allow conferences to operate at a higher level of capability. Support of G.722 will provide better quality audio. Support of G.728 will provide better quality video because it makes more bandwidth available for video. If audio switching is desired, the method of control should be understood since it is not within the ITU Recommendations.

Video.
Some MCUs provide video mixing capability where more than one VTU's video can be seen simultaneously. A typical implementation divides the video screen into four rectangles, with each rectangle showing a different VTU site.

Secondary VTUs.
It is recommended that the MCU support secondary VTUs. This will allow less capable VTUs or audio only terminals to still participate in the conference at least in an audio only mode.

Terminal numbering.
It is recommended that the MCU support terminal numbering.

Value added services.
Other capabilities such as password access to the conference, access to an operator during a conference, dial out capability, and other features are available in some MCUs. In selecting these features, care should be taken in assuring that they are compatible with common VTUs and do not require proprietary VTU functionality. If proprietary VTU functionality is required, these features can only be accessed by that manufacturers VTUs and may not be usable in most conferences.

B.7.2 TEMPEST recommendations

B.7.2.1 General

The following are recommendations only (not mandatory). TEMPEST requirements for secure VTC systems should be applied case by case, in accordance with MILDEP or DoD TEMPEST requirements. TEMPEST protection must be considered if the VTU is being used for the processing of classified information.

Any equipment certified under NACSIM 5100A is still acceptable for use under NSTISSAM TEMPEST/1-92 (see B.7.2.3). There are both facility and equipment TEMPEST zones. A facility TEMPEST zone is a defined area within a facility where equipment with appropriate TEMPEST characteristics (TEMPEST zone assignment) may be operated without emanating electromagnetic radiation beyond the controlled space boundary of the facility. NOTE: Facility TEMPEST zones are determined by measuring electromagnetic attenuation provided by a building's properties and the free space loss to the controlled space boundary. Equipment TEMPEST zone assignments are based on the level of compromising emanations produced by the equipment.

B.7.2.2 TEMPEST requirements

TEMPEST requirements should be referred to the individual MILDEPs as follows:

- Air Force - Information Warfare Center
- Army - Intelligence Security Command
- Navy and Marine Corps - Naval Electronic Systems Security Command
- NSA - NSA TEMPEST Advisory Group

Below are the addresses of the commands:

Air Force: Commander
Air Force Information Warfare Center/EAC
San Antonio, TX 78243-5000

Army: Commander
TEMPEST Det
902 MI GP
ATTN: IAGPA-A-VH
Vint Hill Farms Station
Warrenton, VA 22186-5126

Navy/
Marine Corps: Naval Electronic Systems Security Engineering Center
ATTN: INFOSEC Department
3801 Nebraska Avenue, NW
Washington, DC 20393-5270

NSA: Department of Defense
National Security Agency
TEMPEST Advisory Group
ATTN: C9
Fort George G. Meade, MD 20755-6000

For DoD agencies not listed above, contact the NSA office for information.

B.7.2.3 TEMPEST documents

TEMPEST requirements are stated in the following documents or their latest revision:

NACSIM 5100A *Compromising Emanations Laboratory Test Requirements, Electromagnetics. National Security Telecommunications and Information System Security (NSTISS)*

NTISSI 7000	*National Telecommunications and Information Systems Security Instruction, TEMPEST Countermeasures for Facilities, 7 October 1988*
NTISSP 300	*National Telecommunications and Information Systems Security Policy, National Policy on the Control of Compromising Emanations, 3 October 1988*
NSTISSAM TEMPEST/1-92	*Compromising Emanations Laboratory Test Requirements, Electromagnetics. National Security Telecommunications and Information System Security (NSTISS)*
	Commercial COMSEC Endorsement Program Procedures, 31 August 1987, National Security Agency
	INFOSEC System Security Products & Services Catalog, October 1990, National Security Agency

The above documents can be obtained from:

National Telecommunications & Information
Systems Security Committee
Director, NSA
Fort George G. Meade, MD 20755-6000

OPNAVINST C5510.93E	*Navy Implementation of National Policy on Control of Compromising Emanations, 22 February 1988, with OPNAVNOTE C 5510 of 13 October 1990*
AR 380-19-1	*Control of Compromising Emanations, September 1990 (Army)*

B.7.3 Type 3 Cryptographic equipment - export restrictions

Type 3 is for transmission of unclassified sensitive information. Use of the DES algorithm outside the DoD community is beyond the scope of this Annex. DES is an export-controlled algorithm. Export of the DES algorithm is handled case by case. FIPS PUB 140-1 contain information concerning the export of DES.

B.7.4 Classified operation over restricted networks

Type 1 data encryption from a VTU or MCU operating on an unrestricted network, in restricted mode, will result in encryption of the bit 8 sub-channel. A gateway between the unrestricted network and a restricted network will remove the bit 8 sub-channel. This

results in corruption of the encrypted data, such that the far-end cryptographic equipment is not able to properly decrypt the data back into the original bit pattern.

For operation of VTU or MCUs using Type 1 security over an unrestricted network connected to a restricted network, the following procedure should be used: Each VTU or MCU is connected through a cryptographic device to a network interface device (that is, an inverse multiplexer (IMUX), or a terminal adapter). The network interface device at the unrestricted network must interface to the cryptographic device at multiples of 56 kbit/s and perform the bit 8 sub-channel stuffing/stripping for the unrestricted network. The cryptographic device and the VTU or MCU at both ends of the network receive network timing at 56 kbit/s. This approach puts the encrypted data in bits 1 to 7 only. These bits will not be affected by the gateway, and the encrypted data will not be corrupted.

B.7.5 Network access alternatives

Network interfaces, except for those specified in 6.3.1, 6.4, and B.6.1 are outside the scope of this Profile. The following is for information only.

B.7.5.1 ISDN access alternatives

Paragraphs 6.3.1, 6.4, and B.6.1 of the Profile specify several options for connecting to ISDN, but do not preclude the use of other alternatives. This paragraph and its subparagraphs describe various methods of basic rate interface (BRI) ISDN connectivity. VTU or MCU manufacturers may have some of this equipment integrated into their Profile-compliant designs. Paragraph B.7.5.1.3 addresses Type 1 classified operation. Paragraphs B.7.5.1.1, B.7.5.1.2, B.7.5.1.4, and B.7.5.1.5 address unclassified and unclassified sensitive operation. For unclassified sensitive operation, the VTU or MCU and the Type 3 cryptographic equipment are typically integrated into a single physical unit.

Three physical interfaces are associated with ISDN: the R interface, the S/T interface, and the U interface. It is recommended that if the S/T interface is provided, it be in accordance with ANSI T1.605, *ISDN Basic Access Interface for S and T Reference Points* (Layer 1 Specification). It is recommended that if the U interface is provided, it be in accordance with ANSI T1.601, *ISDN Basic Access Interface for Use on Metallic Loops for Application on the Network Side of the NT* (Layer 1 Specification).

B.7.5.1.1 External terminal adapter

Figure B-8 shows a typical configuration, including the interface between the VTU or MCU and the separate terminal adapter, which is the R interface.

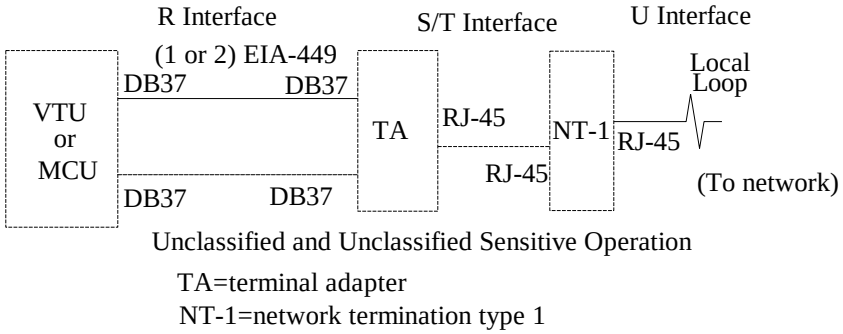


Figure B-8. Network configuration for external terminal adapter.

The R interface of the VTU or MCU consists of two 56/64 kbit/s EIA-449 ports, or one 112/128 kbit/s EIA-449 port. Paragraph 6.3.1.1 also makes use of this configuration. If the VTU or MCU has one port, the external terminal adapter will have to include an inverse multiplexing function to create the two B channels from the one VTU or MCU port and vice versa. This version is for unclassified or Type 3 unclassified, sensitive operation.

B.7.5.1.2 External terminal adapter with dialing interface

Figure B-9 shows a typical configuration, including the interface between the VTU or MCU and the separate terminal adapter, which is the R interface.

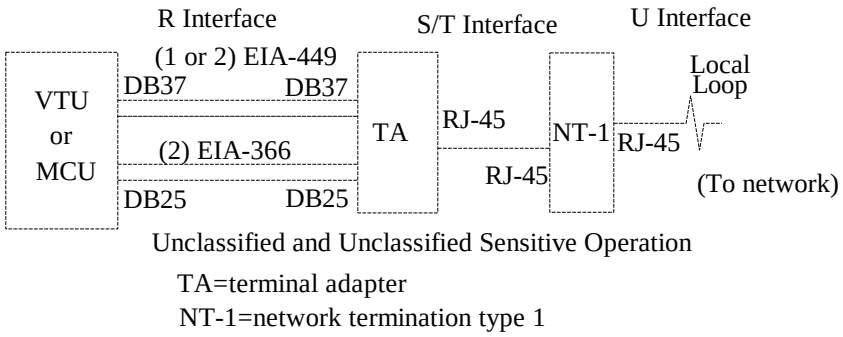


Figure B-9. Network configuration for external terminal adapter with EIA-366 dialing interface.

The R interface of the VTU or MCU consists of two 56/64 kbit/s EIA-449 ports, or one 112/128 kbit/s EIA-449 port. The R interface also includes two EIA-366-A dialing interfaces: one for each B channel. Paragraphs 6.3.1.2 and B.6.1.1 also make use of this configuration. If the VTU or MCU has one port, the external terminal adapter will have to include an inverse multiplexing function to create the two B channels from the one VTU or MCU port and vice versa. This configuration is for unclassified or Type 3 unclassified, sensitive operation. Type 1 classified operation is not permitted.

B.7.5.1.3 Classified operation

For Type 1 classified operation, the cryptographic equipment is added at the R interface, as shown in Figure B-10.

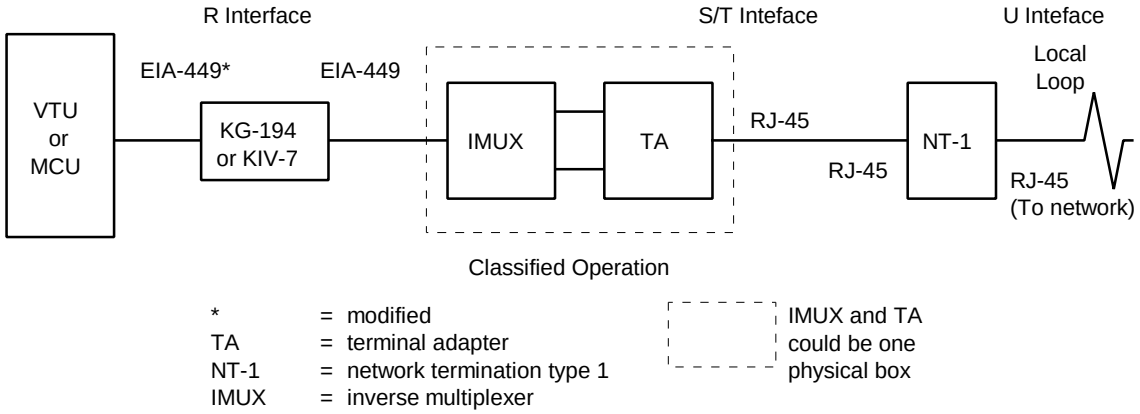


Figure B-10. Network configuration for classified operation.

If the VTU or MCU has the EIA-366 port, there can be nothing physically connected to it during a classified conference.

B.7.5.1.4 Integrated terminal adapter

Figure B-11 shows a diagram of this configuration.

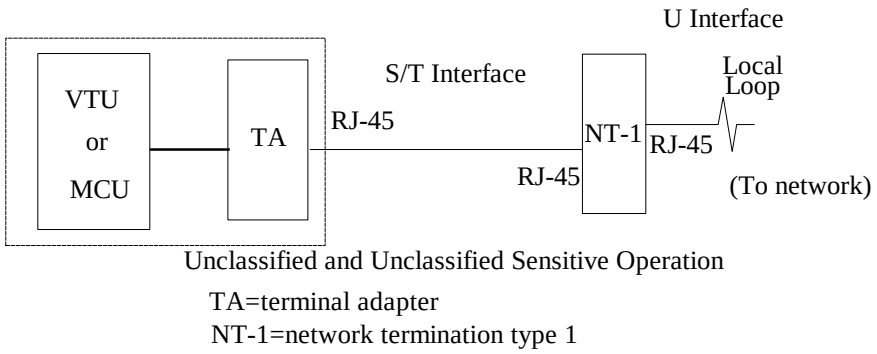


Figure B-11. Network configuration for integrated Terminal Adapter.

The terminal adapter is integrated with the VTU or MCU into a single physical unit. The NT-1 is physically separate. This is only for unclassified and unclassified, sensitive operation. In this case, the integrated unit will provide the S/T interface to the Type 1 network termination. The connector at the S/T interface is an RJ-45. Type 1 classified conferencing is not permitted with this configuration.

B.7.5.1.5 Integrated terminal adapter and network termination

Figure B-12 shows a diagram of this configuration.

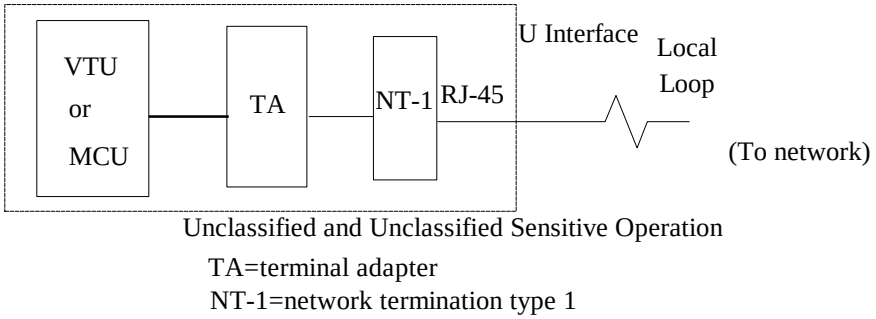


Figure B-12. Network configuration for integrated TA and NT1.

This is only for unclassified and unclassified, sensitive operation. The VTU or MCU, TA and NT-1 are integrated into a single physical unit. The integrated unit will now provide the U interface for the network. Type 1 classified conferencing is not permitted with this configuration.

B.7.5.2 Aggregation using inverse multiplexers

To provide interoperability between inverse multiplexers, the following is recommended.

B.7.5.2.1 Unclassified operation

An aggregator or inverse multiplexer (IMUX) is used to connect a single-channel VTU or MCU to another single-channel VTU or MCU through a multiple-channel network. The VTU or MCU is connected to an IMUX. The IMUX-Network-IMUX connection provides a clear data channel at a specified data rate, e.g., 384 kbit/s. At the other end, the IMUX is connected to the other VTU or MCU. (See Figure B-13.)

The IMUX operates in Mode B1, as defined in H.244. In this mode, the IMUX-Network-IMUX interface initially operates in a framed mode to achieve channel synchronization. When synchronization is achieved, the framing is dropped and the entire channel capacity is used for transmitting the data stream.

The IMUX-VTU or MCU interface is at the same data rate, e.g., 384 kbit/s, as the total data rate (3 x BRI) of the IMUX-Network interface. This is because the IMUX-Network data streams do not contain framing information.

Setup and control of the IMUX can be done manually or automatically. Loss of synchronization between the network channels must be detected and reset manually by initializing the IMUX to a framed mode, as described above. Note that the IMUX may be integrated or external to the VTU or MCU.

B.7.5.2.2 Classified operation

A VTU or MCU used for classified operation and connected to a multiple -channel network shall use an aggregator or inverse multiplexer (IMUX). The VTU or MCU shall

be a single-channel VTU or MCU having the interface described in B.5.4.3.1. The VTU or MCU is connected to a cryptographic device (KIV-7 or KG-194). The cryptographic device is then connected to an IMUX or a dedicated network. The IMUX-Network-IMUX connection provides a clear data channel at a specified data rate, e.g., 384 kbit/s. At the other end, the IMUX is connected to a cryptographic device (KIV-7 or KG-194). The cryptographic device is connected to the far-end VTU or MCU. (See Figure B-14.)

Interoperability between the KG-194 and the KIV-7 is achieved through the MCU. For example, KG-194 encrypted information is decrypted by the KG-194 cryptographic devices located at the MCU, and then may be reencrypted by a KIV-7 to communicate with a KIV-7 encrypted VTU.

The IMUX operates in Mode 1, as defined in ANSI T1A-EIA-619. In this mode, the IMUX-Network-IMUX interface initially operates in a framed mode to achieve channel synchronization. When synchronization is achieved, the framing is dropped and the entire channel capacity is used for transmitting the encrypted data stream. Since the framing information is encrypted, no capabilities can be communicated between the terminal and the IMUX.

The IMUX-Cryptographic interface is at the same data rate, e.g., 384 kbit/s, as the total data rate (3 x BRI) of the IMUX-Network interface. This is because the IMUX-Network data streams do not contain framing information.

Setup and control of the IMUX must be done manually, or with proper isolation, to ensure RED-BLACK separation. No VTU or MCU-to-IMUX communication or electrical connection is allowed. Loss of synchronization between the network channels must be detected and reset manually by initializing the IMUX to a framed mode, as described above.

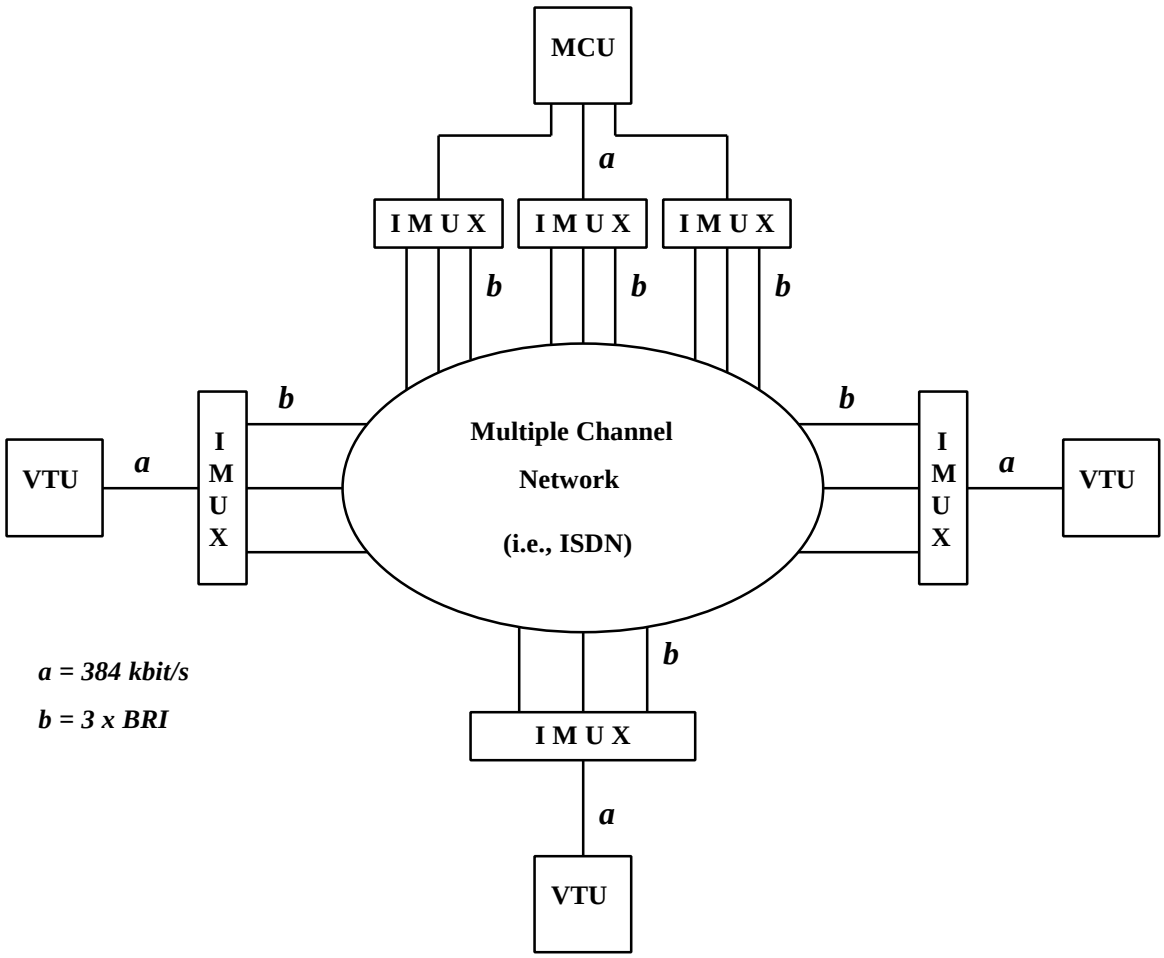


Figure B-13. Example of MCU/IMUX Operation with single-channel VTUs.

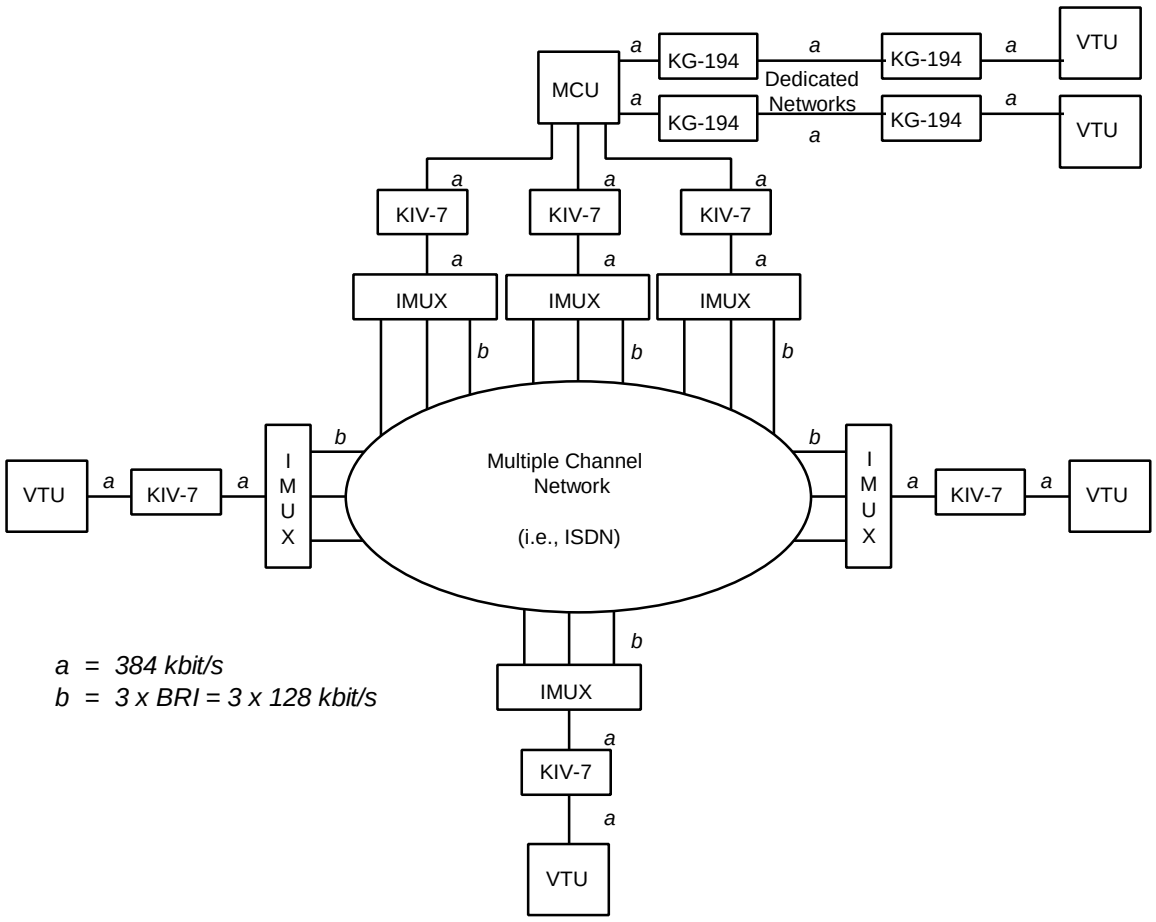


Figure B-14. Example of MCU/IMUX Operation - Classified conference

B.7.5.3 Other network interfaces

The VTU may support additional interfaces to the TA, which are outside the scope of this Profile. Below are some examples of such interfaces:

- V.35
- Dual V.35
- V.35 with EIA-366-A
- Dual V.35 with dual EIA-366-A
- X.21
- Dual X.21

The VTU may also support direct network interfaces, which are outside the scope of this Profile. Below are some examples of direct network interfaces:

- Primary rate ISDN interface
- North America T1 interface

- 2-wire switched 56-kbit/s interface
- 4-wire switched 56-kbit/s interface.

B.7.6 Objective standards for various networks.

It is DOD's objective to include the following standards as mandatory components in future versions of the Profile, subject to DOD and Federal approval, and subject to continued industry availability of interoperable products implementing these standards. Each of these standards is also designed to work in conjunction with the T.120 family of standards. Interoperability between various types of networks usually requires gateways, which will be addressed in future versions of the profile.

B.7.6.1 Local Area Networks (LANs).

The objective mandate standard for LANs is H.323. Entitled "Packet based multimedia communications systems", this umbrella standard describes terminals equipment and services for packet switched networks such as Ethernet, Token ring and ATM. Operation of H.323 terminal over multiple LAN segments, including the Internet and the NIPRNET may result in unacceptable performance because of the delays introduced.

B.7.6.2 Asynchronous Transfer Mode (ATM).

There are three ITU umbrella standards that could be used for operation over ATM: H.310, H.321, and H.323. H.323 is the objective mandate for VTC over ATM. H.310 is meant for high quality VTC typically using greater than 2 Mbits/s bandwidth, but is relatively expensive to implement, and does not at this writing have a great deal of industry support. H.321 is basically H.320 over ATM. It is relatively straightforward to implement, but also lacks widespread industry support at this time. H.323 provides for two modes of operation over ATM: 1) Internet Protocol (IP) over ATM media stream transport and 2) Real Time Protocol (RTP) over ATM media stream transport (Annex C of H.323). The first of these modes is widely supported by industry, and there is considerable industry effort to develop products to meet the second mode. If the second of these two modes is implemented, then the first must also be implemented as the common interoperable mode. Table B.3 shows the functional standards which are called out by the H.323 umbrella standard.

It is not completely clear which of the three standards (H.310, H.321, and H.323) will become the dominant standard for ATM in the future, but since H.323 currently has the most support from industry, this standard has been chosen as the objective mandate for ATM. H.310 may be added at a later time when there is more industry support, since it provides a high level of quality unavailable from any of the other VTC standards.

Table B.3. Relationships Between the Umbrella Standards and the Functional Standards.

Umbrella Standard	**H.323**	**H.324**
Network Type	Packet-based networks (LANs, ATM)	PSTN or POTS (the analog phone system)
Video	H.261 H.263	H.261 H.263
Audio	G.711 G.722 G.728 G.723.1 G.729	G.723.1
Multiplexing	H.225.0	H.223
Control	H.245	H.245
Multipoint	H.323	None
Data	T.120	T.120
Network Protocols	TCP/IP IEEE 802.X ATM I.361 I.400 V.34	V.34 Modem Cellular Radio

B.7.6.3 Public Switched Telephone Network (PSTN).

H.324, which describes terminals for low bit rate multimedia communication, is the objective mandate standard. This umbrella standard operates at low bit-rates of between 9.6 and 28.8 kbps over ordinary telephone lines (POTS). The low bit rate also makes it valuable for tactical applications. It may carry real time voice, data, or video, or any combination of these. Table B.3 shows the functional standards which are called out by the H.324 umbrella standard.

By virtue of its inclusion in the Joint Technical Architecture, this standard is currently mandatory for DOD for VTC operation at data rates between 9.6 and 28.8kbps. This will be reflected in future versions of the Profile.

B.8 DoD VTC Policy

This industry profile for VTC is the official VTC standards document to be used by DoD per ASD direction. The ASD policy memo requiring conformance to this Appendix is in Appendix B.

B.9 JTA Memorandum

The Profile is also cited as mandatory in the Joint Technical Architecture (JTA). The OSD memo which requires compliance with the JTA follows the ASD policy memo in Appendix B.

APPENDIX B

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
6000 DEFENSE PENTAGON
WASHINGTON, DC 20301-6000

March 30, 1998

COMMAND, CONTROL,
COMMUNICATIONS, AND
INTELLIGENCE

MEMORANDUM FOR DIRECTORS OF THE DEFENSE AGENCIES
DIRECTOR, INFORMATION SYSTEMS FOR COMMAND, CONTROL, COMMUNICATIONS AND COMPUTERS, U.S. ARMY
DIRECTOR, SPACE INFORMATION WARFARE, COMMAND AND CONTROL, U.S. NAVY
ASSISTANT CHIEF OF STAFF, SYSTEMS FOR COMMAND, CONTROL, COMMUNICATIONS AND COMPUTERS, U.S. AIR FORCE
DIRECTOR, COMMAND, CONTROL, COMMUNICATIONS, COMPUTERS AND INTELLIGENCE, U.S. MARINE CORPS
DIRECTOR, COMMAND, CONTROL, COMMUNICATIONS, AND COMPUTER SYSTEMS, JOINT STAFF
DIRECTOR, JOINT STAFF
DIRECTOR, DEFENSE TELECOMMUNICATIONS SERVICE—WASHINGTON

SUBJECT: Video Teleconferencing (VTC) Standards Guidance

To improve interoperability and standardization of Video Teleconferencing (VTC) in the Department of Defense (DoD), the Office of the Assistant Secretary of Defense, Command, Control, Communications, and Intelligence (C3I), issued specific policy guidance on October 31, 1994, to use the Corporation for Open Systems (COS) Video Teleconferencing Profile (also known as the Industry Profile for VTC) for acquisition of VTC equipment. Corporation for Open Systems has ceased its business operations, thus requiring DoD to seek a new sponsor for the VTC standard.

Department of Defense successfully solicited the Federal Telecommunications Standards Committee (FTSC) to accept the Profile as a document applicable to the entire Federal Government. An accord was reached and the new Federal standard, Federal Telecommunications Recommendation (FTR) 1080-1997, was approved October 30, 1997. It contains the original COS VTC Profile as an Appendix. The Appendix will be mandatory for DoD and optional for the rest of the Federal community. The Profile is fully compatible with, and interoperable with, the main body of FTR 1080A-1998. However, it contains much more detail, including additional requirements like security, that are not in the main body and are, therefore, optional for the rest of the Federal community.

Effective immediately, all new procurements for VTC that operate between transmission data rates of 56 to 1,920 kb/s shall conform to the requirements of FTR 1080A-1998, including

the requirements of the latest approved version of Appendix A. This

supersedes the October 31, 1994, mandate to conform to the COS VTC Profile.

The Joint Technical Architecture is also being updated to reflect this guidance. It applies to all C3I systems and all systems that interface with C3I systems.

The DISA Center for Standards point of contact for VTC standards is Mr. Klaus Rittenbach, JIEO/JEBBA, DSN 987-6864, Commercial (732)427-6864, E-mail: RITTENBK@FTM.DISA.MIL. Paper and electronic copies of FTR 1080A-1998 and of Appendix A are available from Mr. Rittenbach. Before using the FTR, contact JIEO/JEBBA to determine the latest version of Appendix A.

Request Director, Joint Staff, provide this guidance to the Commanders-in-Chief. My point of contact for this action is Mr. Richard Colver, who is assigned to my Communications Directorate, DSN 225-3137, Commercial (703) 695-3137, E-mail: COLVERR@OSD.PENTAGON.MIL.

/S/
Stanley E. Gontarek
Deputy Assistant Secretary of Defense
(Command, Control and Communications)
(Acting)

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, DC 20301

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS
UNDER SECRETARIES OF DEFENSE
ASSISTANT SECRETARIES OF DEFENSE
GENERAL COUNSEL OF THE DEPARTMENT OF DEFENSE
INSPECTOR GENERAL OF THE DEPARTMENT OF DEFENSE
DIRECTOR, OPERATIONAL TEST AND EVALUATION
ASSISTANTS TO THE SECRETARIES OF DEFENSE
DIRECTORS OF THE DEFENSE AGENCIES
DIRECTOR, JOINT STAFF

SUBJECT: Implementation of the DoD Joint Technical Architecture

Effective military operations require the ability to respond with a mix of forces, anywhere in the world, on a moment's notice. Interoperability is essential for these joint operations. Information must flow seamlessly and quickly among DoD's sensors, processing and command centers, and shooters, to enable dominant battlefield awareness and operations inside the enemy's decision loop.

The DoD Joint Technical Architecture (JTA) is a key piece of DoD's overall strategy to achieve this capability. Its open, standards-based approach also offers significant opportunities for reducing cost and cutting development and fielding time through enhancing software portability, use of COTS, ease of systems upgrade and hardware independence. The JTA is the result of collaboration among the Services, Joint Staff, USD (A&T), ASD (C3I), DISA, DIA, and other elements of the Intelligence Community.

The JTA specifies a set of performance-based, primarily commercial, information processing, transfer, content, format and security standards. These standards specify the logical interfaces in command, control and intelligence systems and the communications and computers (C4I) that directly support them. The JTA is a practical document, identifying standards where products available today. It is entirely consistent with and supportive of DoD's Specification and Standards Reform.

Effective immediately, the JTA (Version 1.0) is mandatory for all emerging systems and systems upgrades. The JTA applies to all C4I systems and the interfaces of other key assets (e.g., weapons systems, sensors, office automations systems, etc.) with C4I systems. The JTA also applies to C4I Advanced Concept Technology

Demonstrations and other activities that lead directly to the fielding of operational C4I capabilities.

The Services, Agencies and other Components are responsible for the implementation of the JTA (including enforcement, budgeting and determining the pace of systems upgrades). All emerging C4I systems and C4I systems upgrades are to comply with the JTA. Existing C4I systems are to migrate to the applicable JTA standards, while considering cost, schedule and performance impacts. Waivers may be granted only by Service, Agency and other Component Acquisition Executives, with the concurrence of the ASD (C3I) and the USD (A&T). In this context, non-response after two weeks from the date of receipt by OSD constitutes concurrence. Each Service, DoD Agency, and applicable other Component is requested to provide a plan outlining its approach to implementing the JTA to ASD (C3I) and USD (A&T) within 90 days.

The JTA is a living document that will evolve as technology and the marketplace change. Within 90 days, the USD (A&T) and ASD (C3I), with the support of the Services and Agencies, will develop a proposal for updating, maintaining, and configuration managing the JTA. It is our intention to expand the scope of the JTA to encompass all systems with which the C4I systems will directly interact. Implementation experiences will be fed back into the JTA to ensure that it is the best technical guidance for our developers. The goal of the JTA is interoperability and effectiveness in a joint and ultimately a coalition environment; tests and exercises will be used to evaluate progress.

For applicable systems, the JTA replaces the standards guidance in the Technical Architecture Framework for Information Management (TAFIM) currently cited in DoD Regulation 5000.2-R.

Request Director, Joint Staff forward this, memorandum to the Unified Combatant Commands.

AUG 22 1996

/S/
Paul G. Kaminski
Under Secretary of Defense
(Acquisition and technology)

/S/
Emmett Paige, Jr.
Assistant Secretary of Defense
(Command, Control,
Communications and Intelligence)