



# Digital Video Standards

**The 1997 Digital Video Test Symposium**

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## **Digital Standards Bodies**

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The world of digital video standards is a complicated one, with many different standards groups actively producing sometimes overlapping specifications. Many aspects and applications of digital video are now being considered as eligible for standardization. Other aspects of the technology haven't been standardized, yet common industry practices are emerging. It will be many years still until the specifications for digital video fully stabilize.

With that said, however, there is still a wide range of applicable standards to help guide implementers and hopefully assist them in achieving equipment interoperability. We have tried in this paper to compile a list of relevant specifications, but caveat emptor applies, as some may have been overlooked. Also, some of the standards listed are in a state of flux and may have changed by the time you read this. To the best of our knowledge, this list is current as of March 14, 1997.

## **ATM-Forum**

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The ATM Forum started out as a small group five years ago with the goal of producing implementation agreements for the then-emerging ITU standards for ATM cell switching. The group has grown considerably, and as ATM technology has been applied in many new areas, the scope of this group's coverage has also grown considerably. Recently the Services and Applications Aspects sub-group has discussed MPEG carriage over ATM links. Some activity in the Residential Broadband group also pertains to digital video.

The most famous contribution of this group to digital video is the first specification listed below. It sparked a round of industry debate about implementation as the ATM Forum standardized on AAL-5 for carriage of MPEG while ETSI later chose AAL-1. Eventually both were recognized in the ITU.

## Approved Specifications

af-saa-0049.000—Audiovisual Multimedia Services:  
Video on Demand Specification 1.0

This implementation agreement addresses the carriage of MPEG-2 bit streams over ATM. The specification addresses specifically the requirements of video on demand using constant packet rate (CPR) MPEG-2 single program transport streams (ISO/ IEC 13818-1). It specifies the following:

- AAL requirements
- Encapsulation of MPEG-2 transport streams into AAL-5 PDUs
- ATM signaling and ATM connection control requirements
- Traffic characteristics
- Quality of service characteristics

The service profiles provide information on

- Reference models for the service
- Parameter values for the carriage mechanism that provides the service

## Under Discussion

Broadband Multimedia Services (BTD-SAA-AMS-BMS-02.00), Baseline Text, Jan 97

The broadband multimedia service baseline defines services based on exchanges of audio (voice), video, data, image, and graphics, and including telephony. These services are

- Multimedia desktop
- Interactive distance learning
- Video conferencing

These services assume the use of H.310-RAST 5 and H.321 over AAL-5 terminals. The choice of AAL-5 to support VBR-MPEG-2 among many has the following advantages:

- Ease of use
- Need for AAL-5 regardless of which AAL is used for MPEG-2
- Ready availability of AAL-5 chips
- Functions above AAL-5 CPCS that can be implemented in microcode
- Packet based, so MPEG-2 fits nicely with a packet-based AAL such as AAL-5

### **VBR MPEG-2 (BTD-SAA-AMS-VBR MPEG2-02.00) Baseline Text, Feb. 97**

This document specifies the transport of variable bit rate encoded MPEG-2 audio, video, and data over ATM. It addresses the transport of both MPEG-2 single program transport streams and MPEG-2 program streams. The transport mechanisms defined in this specification are suitable for both non-real time and real-time applications. It is therefore suitable for audiovisual conversational services.

This specification addresses the following:

- Description of a VBR service
- ATM transfer capabilities and characterisation of VBR video
- Impact of the network on the VBR ATM flow in terms of possible degradation as cell loss rate and jitter

## Advanced Television Systems Committee (ATSC)

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The ATSC was established by the U.S. FCC to investigate and thoroughly define an advanced (high-definition) television specification. It will eventually replace the existing NTSC system in the United States. The initial focus of the group was to create a digital HDTV system, but over the course of this effort, their specifications have grown to address normal or standard definition digital broadcasts as well. Most recently their system information and EPG formats have been adopted for cable by the SCTE and for MMDS. ATSC conducted a technical bake-off of industry submissions, trying to judge their applicability to terrestrial broadcasting. Each system was evaluated on the basis of a number of parameters such as robustness to multi-path interference. The competition was won by a consortium of companies known as the Grand Alliance. The specs were created roughly at the same time as the European DVB specs, but political bickering delayed their approval until this year. Unfortunately the ATSC and DVB specifications are divergent.

- **A/49**

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*ATSC Standard: Ghost Cancellation Signal for NTSC*

Describes a signal reference for detecting ghosting in NTSC signals.

- **A/53**

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*ATSC Digital Television Standard*

Describes the detailed system architecture, scan formats, compression standards, transport characteristics, and physical transmission for the ATSC system.

- **A/52**

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*Digital Audio Compression Standard (AC-3)*

ATSC's rendition of Dolby AC-3 digital audio compression.

- **21A/54**

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*Guide to the Use of the ATSC Digital Television Standard*

A tutorial guide to understanding the system characteristics of the ATSC system.

- **A/55**

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*Program Guide for Digital Television ATSC Standard*

Describes the ATSC program (present and future) guide information, carried over ISO/IEC 13818-1 private data sections. This specifications allows the transmission of standardized formats for Electronic Program Guide information.

- **A/56**

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*System Information for Digital Television ATSC Standard*

Adds ATSC proprietary program specific information (PSI) tables to those already defined by ISO/IEC 13818-1. This specification specifies standard formats for transmission of physical network descriptions of transmission channels (frequencies, channel allocations) so that receiver equipment can decode the incoming signals

- **A/57**

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*Program/Episode/Version Identification ATSC Standard*

Defines the ATSC program identifier, a means of uniquely defining a program/episode/version/source via table sections on a ISO/IEC 13818-1 PID stream. This system can be used to identify copyright and ownership of the program segments transmitted on an ATSC system.

- **A/58**

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*Harmonization with DVB SI in the use of the ATSC Digital Television Standard*

Gives a recommended practice guideline for ensuring interoperability between an ATSC and a DVB system, specifically with regard to the interchange of System Information (SI). It covers some procedures to be used to avoid conflicts between ATSC Program and System guide information. It is hoped that the use of procedures in this specification will lead to the creation of multi-mode transport streams capable of being decoded by both DVB and ATSC receivers.

## **DAVIC**

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DAVIC stands for Digital Audio-Visual Council. The purpose of DAVIC is to favour the success of emerging digital audio-visual applications and services, by the timely availability of internationally accepted specifications of open interfaces and protocols that maximise interoperability across countries and across applications and services. DAVIC initially formed to adopt specifications for emerging interactive and video on demand systems at a time when no such body existed. The subsequent “de-trandification” and lack of media popularity for VoD, combined with a vacuum for some aspects of physical broadcasting specs, shifted some of the focus of DAVIC over time. Most recently DAVIC has tackled data broadcasting applications.

DAVIC is one of the few groups that has attempted to standardize access network physical interfaces and extensions to ISO’s DSM-CC in areas such as video server control and set-top data representation.

Status of published specifications:

- DAVIC 1.0 Published and approved (Dec/95)
- DAVIC 1.1 Published and approved (Sept/96)
- DAVIC 1.2 Approved (to be published Mar/97)
- DAVIC 1.3 In progress

### **DAVIC 1.0**

Contains specifications on the following:

- Physical layers: HFC, FTTC, satellite, ATM
- Information representation: MPEG-2 video, MPEG-1 compressed audio, AIFF-C linear audio, DVB-SI, graphics, MHEG-5
- Mid-layers: MPEG-2 TS, AAL-5, DSM-CC U-U, OMG IDL/UNO
- Signalling: Q.2931, DSM-CC U-N
- Management: SNMP

## DAVIC 1.1

The main DAVIC 1.1 sub work-items are the following:

- Additions to part 1 ( new functions)
- A10 API (content-related data, navigation tools, etc. )  
Resource descriptors used in dynamic flows
- Reference decoder model
- Multipoint access in DAVIC networks
- Switched video broadcasting
- Server MIB
- Physical interface for A0 and STU data port MMDS
- LMDS
- Cable modem
- ADSL
- PSTN/ISDN enhanced broadcast
- Metadata/A10
- Virtual machine (Java)
- Additional information representation
- Distributed server
- Internet access
- S3 channel initialisation
- Part 11—usage data
- Profiles update
- Software download protocols (DSM-CC download)



## DAVIC 1.2

The main DAVIC 1.2 sub work-items are as follows:

- Communications API for Internet access
- Management access protocols for server, DS, and STU  
ADSL ATM mapping
- Part 10—basic security for DAVIC 1.0 systems,  
copyright protection, watermarking
- Synthetic audio
- Higher quality audio and video
- Audio-only profile
- Guidelines for Internet access
- Scaleable audio and video
- 3D-graphics and virtual reality information coding
- Multiple STUs “in the home”
- Interface and protocols for DAVIC client peripherals
- Part 13—conformance and interoperability

## DAVIC 1.3

The main DAVIC 1.3 sub work-items are the following:

- Communicative services (telephony, conferencing and  
multi-player games)
- Home network
- DAVIC system management
- Network related control
- Multiple server and services
- Mobility
- Multicast technologies
- Internetworking unit
- Downloadable client functionalities
- Extended Java functionality
- Still Picture display control API for STU
- Rainy day scenario considerations for DAVIC 1.0  
systems
- Incomplete items from previous calls

## Digital Video Broadcasting (DVB)

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The DVB Project is a group of mainly European organizations working to establish the technical framework for digital broadcasting systems in Europe. The product of the work in DVB has and will come in the form of standards, recommendations, and implementation guidelines, endorsed and released by ETSI and EBU.

The DVB is a consortium of commercial companies that agree on implementations that enhance existing standards work. The DVB committee was initially restricted to European companies, but subsequently has relaxed its restrictions as DVB standards have been implemented globally.

DVB had added the missing functions in the ISO MPEG-2 specifications to allow implementation of digital video systems that mimic the capabilities of today's conventional analog TV broadcasting for terrestrial, satellite, cable, MMDS, and SMATV applications. DVB is currently working on specifications for interactive applications.

The following relevant specifications from the DVB sub-groups have been or are in the process of being submitted to formal standards bodies for ratification:

- **A017**

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*Common Interface Specification for Conditional Access and other Digital Video Broadcasting Decoder Applications*

Specifies a general parallel data port (variation of the PC card) for the real-time processing of channel data through removable processing cards. Typical use will be conditional access (CA) decoding via *SmartCards*.

- **ETS 300 421**

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*Digital broadcasting systems for television, sound and data services: framing structure, channel coding and modulation for 11/12 GHz satellite services*

Standardizes the use of quaternary phase shift keying (QPSK) channel coding and a protection strategy based on convolutional coding and a shortened Reed-Solomon (RS) code. Used for satellite transmission of ISO/IEC 13818-1 streams at various transponder frequencies.

- **ETS 300 429**

*Digital broadcasting systems for television, sound and data services; Framing structure, channel coding and modulation for cable systems*

Standardizes the use of 16-/32-/64-quadrature amplitude modulation (QAM) channel coding and a protection strategy based on convolutional coding and a shortened Reed-Solomon (RS) code. Used for cable distribution of ISO/IEC 13818-1 streams.

- **ETS 300 473**

*Digital broadcasting systems for television, sound and data services: specification for conveying ITU-R System B teletext in digital video broadcasting (DVB) bitstreams*

Specifies the method by which ITU-R/EBU teletext is transported over DVB systems.

- **ETS 300 473**

*Digital broadcasting systems for television, sound and data services: satellite master antenna television (SMATV) distribution systems*

Describes the transmission protocol for digital broadcasting over SMATV systems. This standard is complementary to ETS 300 429.

- **ETS 300 468**

*Digital broadcasting systems for television, sound and data services: specifications for system information (SI) in digital video broadcasting (DVB) systems*

Adds DVB proprietary program specific information (PSI) tables to those already defined by ISO/IEC 13818-1. This information describes the physical network and EPG information allowing standardized implementations of receivers.

- **prETS 300 744**

*Digital broadcasting systems for television, sound and data services: framing structure, channel coding and modulation for digital terrestrial television*

Describes a baseline system for digital terrestrial television broadcasting of LDTV/SDTV/EDTV/HDTV services. Standardizes the use of 16-/32-/64-quadrature amplitude modulation (QAM) channel coding and a protection strategy based on convolutional coding and a shortened Reed-Solomon (RS) code. Used for cable distribution.

- **prETS 300 800**

*Digital Video Broadcasting (DVB); DVB interaction channels for cable TV distribution systems (CATV)*

Describes a baseline method for interaction (i.e., return) channels over CATV. This is but one option in an upcoming assortment of alternatives for implementing interactive services within a DVB system.

- **ETR 162**

*Digital broadcasting systems for television, sound and data services: allocation of service information (SI) codes for digital video broadcasting (DVB) systems*

Describes the allotment of DVB SI table identifiers (as described in ETS 300 468) for various vendors and organizations.

- **ETR 211**

*Digital video broadcasting (DVB): guidelines on implementation and usage of DVB service information*

Highly recommended rules for the encoding and decoding of DVB SI, as defined in ETS 300 468. Explains the usage rules for DVB-SI implementations.

- **ETR 289**

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*Digital video broadcasting (DVB): common scrambling (CS) system (TM1244) description*

Specifies the minimum set of common conditional access (CA) elements necessary to achieve interoperability between DVB implementations.

- **ETR 290**

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*Digital video broadcasting (DVB): measurement guidelines (DVB-MG 66)*

Provides guidelines and techniques for the objective measurement of the quality level of signals distributed over DVB satellite, cable, and terrestrial systems. The various guidelines suggest tests from basic physical and signal specifications, up to the ISO/IEC 13818-1 transport stream protocol.

- **prEN 50083-9**

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*Interfaces for CATV/SMATV headends and similar professional (TM1449) equipment*

Describes physical interfaces for the transport of MPEG-2 data between professional signal processing devices, such as those found in headends and uplink stations. The DVB-SPI, SSI, and ASI interfaces are defined in this document.

- **TM1664**

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*DVB interfaces to PDH networks*

Specifies the transmission of MPEG-2 data streams between two DVB interfaces (prEN 50083-9 compliant) within PDH networks working at the ITU-T G.702 hierarchical bit rates (1544 to 139624 kb/s).

## IEEE

The Institute of Electrical and Electronics Engineers produces standards in many areas of electrical applications. Recently several working groups have started specifications that have relevance to digital video transmission.

### IEEE1394-1995, High-Speed Serial Bus

IEEE1394 is an isochronous serial bus that has S100, S200, and S400 derivatives which are 100Mb/s, 200Mb/s, and 400Mb/s respectively. The bus is intended to connect consumer multimedia equipment (set-tops, VCRs, camcorders, etc.) over short distances. It typically uses a 6-pin connector (3 twisted pairs: data, strobe and power) and is "hot-pluggable." It includes daisy chaining and branching capabilities and supports up to 63 devices. Another name for the bus is "FireWire," which it was called by Apple when Apple founded the technology in 1986. It was developed by the 1394 Trade Association and adopted as an IEEE standard in 1995.

### P1394 Working Group

In progress in the P1394 working group:

- Gigabit speeds for cables
- Longer distances using copper wire and plastic fibre (POF) A/V command and control protocols
- 1394 to 1394 bus bridges
- 1394 gateways to communication interfaces such as ATM

### IEEE 802.14 Working Group

The IEEE 802.14 Working Group is chartered to create standards for data transport over traditional cable TV networks (cable modems). The reference architecture specifies a hybrid fiber/coax plant with an 80 kilometer radius from the head end. The primary thrust of the network protocol in design is to transport IEEE 802.2 LLC traffic types (exemplified by Ethernet). There is, however, a strong feeling within the group that the network should also support ATM networking to carry various types of multimedia traffic.

The 802.14 has standardized on 64QAM downstream, QPSK/16QAM upstream, ATM cells as one of the transport units, DAVIC/DVB FEC for downstream, mandatory ATM cell transport in cable modems and headend, and variable length packet support optional in cable modem and headend.

## **MPEG ISO/IEC JTC1/SC29/WG11**

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The Moving Picture Experts Group (MPEG) is a working group of ISO/IEC in charge of the development of international standards for compression, decompression, processing, and coded representation of moving pictures, audio, and their combination. So far MPEG has produced the following:

- MPEG-1, a standard for storage and retrieval of moving pictures and audio on storage media such as CD-ROM
- MPEG-2, a standard for digital television backwards compatible with MPEG-1 that extends this compression system for use in HDTV, digital broadcasting, and DVD-ROM.

Two more standards are currently under development:

- MPEG-4, a standard for multimedia applications
- MPEG-7, a content representation standard for information search.

### **MPEG-1 Standards Published**

MPEG-1 is a standard in 5 parts:

- **ISO/IEC 11172-1: 1993 Information technology**  
Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mb/s,  
Part 1: Systems
- **ISO/IEC 11172-2: 1993 Information technology**  
Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mb/s,  
Part 2: Video
- **ISO/IEC 11172-3: 1993 Information technology**  
Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mb/s,  
Part 3: Audio
- **ISO/IEC 11172-4: 1995 Information technology**  
Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mb/s, Part 4:  
Conformance testing
- **ISO/IEC DTR 11172-5: Information technology**  
Coding of moving pictures and associated audio for digital storage media up to about 1.5 Mb/s, Part 5:  
Software simulation

## MPEG-2 Standards Published

MPEG-2 is a standard currently in 9 parts:

- **ISO/IEC 13818-1: 1995 Information technology**

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Generic coding of moving pictures and associated audio information: Systems

- **ISO/IEC 13818-2: 1995 Information technology**

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Generic coding of moving pictures and associated audio information: Video

- **ISO/IEC 13818-3: 1995 Information technology**

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Generic coding of moving pictures and associated audio information, Part 3: Audio

- **ISO/IEC 13818-4: 1996 Information technology**

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Generic coding of moving pictures and associated audio information, Part 4: Compliance testing

- **ISO/IEC 13818-5: 1996 Information technology**

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Generic coding of moving pictures and associated audio, Part 5: Software simulation (Future TR)

- **ISO/IEC 13818-6: 1996 Information technology**

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Generic coding of moving pictures and associated audio information, Part 6: Extensions for DSM-CC as a full software implementation

- **ISO/IEC DIS 13818-7: Information technology**

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Generic coding of moving pictures and associated audio information, Part 7: Advanced audio coding

- **ISO/IEC 13818-9: 1996 Information technology**

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Generic coding of moving pictures and associated audio information, Part 9: Extension for real time interface for systems decoders



## MPEG-4 Standards Published

The focus of this standard is to establish a compression system that works for low-quality, extremely low bit rate transmission for applications such as wireless videophones. Recently a framework has been completed, but detailed design and specifications of the codec principles are still being debated as emerging experimental compression techniques are being finished and evaluated.

- ISO/IEC WD 14496-1 Systems
- ISO/IEC WD 14496-2 Video
- ISO/IEC WD 14496-3 Audio
- ISO/IEC WD 14496-6 DSM-CC multimedia integration framework (DMIF)

## DMIF

Building on the success of the recently completed DSM-CC specification, ISO/IEC JTC1/SC29/WG11 has identified the next phase of DSM-CC known as DSM-CC multimedia integration framework (DMIF). DMIF merges interactive, broadcast and conversational multimedia in one specification applicable to set-tops, desktops and mobile stations. The scope of DMIF encompasses the following:

- End-to-end sessions across multiple network provider implementations
- Integration with network technologies such as ATM and Internet
- Integration with specific object domains such as CORBA and JAVA
- Multiple peer session operation
- Fully symmetric consumer and producer operation in one device
- Scheduling and real-time switching/multiplexing of bit streams

## **MPEG-7**

MPEG-7 is a data representation standards allowing navigable and searchable storage of moving and still visual information. The intent is to reduce the complexity of identifying source material in large volumes of information.

The current workplan foresees the International Standard completed in 2000.

## **ITU**

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The ITU is the king of the standards bodies. Its recommendations have the weight of law in some countries. ITU-T and ITU-R were until recently known as the CCITT and CCIR.

### **ITU-T Approved**

- H.200 (03/93) Framework for recommendations for audiovisual services
- H.221 (07/95) Frame structure for a 64 to 1920 kb/s channel in audiovisual teleservices
- H.222.0 (07/95) Information technology—Generic coding of moving pictures and associated audio information: Systems
- H.222.1 (03/96) Multimedia multiplex and synchronization for audiovisual communication in ATM environments
- H.223 (03/96) Multiplexing protocol for low bit rate multimedia communication
- H.224 (11/94) A real time control protocol for simplex application using the H.221 LSD/HSD/MLP channels
- H.230 (07/95) Frame-synchronous control and indication signals for audiovisual systems
- H.231 (03/96) Multipoint control units for audiovisual systems using digital channels up to 1920 kb/s
- H.233 (07/95) Confidentiality system for audiovisual services
- H.234 (11/94) Encryption key management and authentication system for audiovisual services
- H.242 (03/96) System for establishing communication between audiovisual terminals using digital channels up to 2 Mb/s

- H.243 (03/96) Procedures for establishing communication between three or more audiovisual terminals using digital
- H.244 (07/95) Synchronized aggregation of multiple 64 or 56 kb/s channels
- H.261 (03/93) Video codec for audiovisual services at p x 64 kb/s
- H.262 (07/95) Information technology – Generic coding of moving pictures and associated audio information: Video
- H.263 (03/96) Video coding for low bit rate communication
- H.281 (11/94)–A far end camera control protocol for videoconferences using H.224
- H.320 (03/96) Narrowband visual telephone systems and terminal equipment
- H.321 (03/96) Adaptation of H.320 visual telephone terminals to B-ISDN environments
- H.322 (03/96) Visual telephone systems and terminal equipment for local area networks that provide a guaranteed quality of service
- H.324 (03/96) Terminal for low bit rate Multimedia Communication
- H.331 (03/93) Broadcasting type audiovisual multipoint systems and terminal equipment
- J.82 (07/96) Transport of MPEG-2 constant bit rate television signals in B-ISDN
- J.83 (10/95) Digital multi-programme systems for television sound and data services for cable distribution
- J.83 Corr.1 Corrigendum 1 to Recommendation J.83 (10/95)—Digital multi-programme systems for television sound and data services for cable distribution
- J.84 (10/95) Distribution of digital multi-programme signals for television, sound and data services through SMATV networks
- J.85 (06/90) Digital television transmission over long distances – general principles
- J.86 (06/90) Mixed analogue-and-digital transmission of analogue composite television signals over long distances

- P.910 (08/96) Subjective video quality assessment methods for multimedia applications
- P.930 (08/96) Principles of a reference impairment system for video

## Under Discussion

Refer to section 8.3 ???

## ITU-R

ITU-R J Series Recommendations

ITU-R J.83 “Framework for transmission of digital signals in cable systems” standardises the modulation, FEC, filtering, adaptive equalization and physical parameters of MPEG transport on 6 and 8 MHz cable channels.

It contains four annexes that enumerate the allowable transmission systems for cable:

- Annex A: Specifies a DVB-C based QAM modulated system for 8 MHz PAL channels (Annex B: GI Digicypher (which formed the basis for and is equivalent to the SCTE/ATSC cable system) based transmission QAM modulated system for 6 MHz NTSC
- Annex C: DVB-C based QAM modulated system for 6 MHz NTSC channels (used primarily in Japan)
- Annex D: VSB modulated system derived from the ATSC terrestrial broadcasting system for 6 MHz NTSC channels (proposed primarily by Zenith, and mostly not adopted)

## ITU-R BT Series Recommendations— Broadcasting Service (Television)

- BT.500 Methodology for the subjective assessment of the quality of television pictures
- BT.814 Specifications and alignment procedures of setting of brightness and contrast of displays (used in BT.500 evaluation).
- BT.815 Reference signal for measuring contrast ration (used for BT.500 evaluation)
- BT.1200 (NEW) Target standard for digital video systems for the studio and for international programs
- BT.1204 (NEW) Measuring methods for digital video equipment with analogue input/output
- BT.1208 (NEW) Video coding for digital terrestrial television broadcasting

- BT.472-3 Video-frequency characteristics of a television system to be used for the international
- BT.656-3 (REVISED) Interfaces for digital component video signals in 525-line and 625-line television
- BT.799-2 (REVISED) Interfaces for digital component video signals in 525-line and 625-line television
- BT.809 - Programme delivery control (PDC) system for video recording
- BT.11-2/AE Draft interfaces for digital component video signals
- BT.11-2/AF Draft iInterfaces for digital component video signals

### **Other ITU-R Work in Progress**

- 10-11S/117 Information relating to technological advances in digital video compression
- 11-1/6 Target standard for digital video systems for the studio and for international programme
- 11-3/45-1 Part 1  
DTTB specification for service information in digital video broadcasting system
- 11-3/45-2 Part 2  
DTTB specification for service information in digital video broadcasting system
- 11-3/45-3 Part 3  
DTTB specification for service information in digital video broadcasting system
- 11-3/45-4 Part 4  
DTTB specification for service information in digital video broadcasting system
- 11-3/45-5 Part 5  
DTTB specification for service information in digital video broadcasting system
- 11-3/46 DTTB  
Allocation of service information codes for digital video broadcasting systems
- 11-3/46 DTTB  
Allocation of service information codes for digital video broadcasting systems
- 11-3/47 Digital video broadcasting  
Implementation guidelines for the use of MPEG-2 systems
- guidelines for the use of MPEG-2 systems
- 11-3/68 Common interface specification for conditional access and other digital video broadcasting
- 11A/41 Digital video broadcasting  
Support for use of scrambling and conditional access within digital systems
- 11B/11 Digital video bit-rate reduction codec assessment methods and results

## Drafts in Committee

| SOUND AND TELEVISION (TV) TRANSMISSION             |                |  |        |      |
|--|----------------|--|--------|------|
| Quest  | Recommendation | Subject  | Timing | Prio |
| Terminology  |                |  |        |      |
| 8/2  | E.LAYER        | Telecommunication network definitions  | 98-01  | M    |
| 11/2   | E.800          | Quality of service and dependability vocabulary  | 97-05  | M    |
| AD/9   | J.1            | Terminology for television and sound programme transmission  | 96-03  |      |
| AD/9   | J.1            | Terminology for television and sound programme transmission  | 97-04  |      |
| Network Capabilities                               |                |  |        |      |
| X/9  | J.110 (=J.int) | Requirements and possibilities for interactivity in the secondary distribution of television   | 97-04  | H    |
| Network Performance (NP). Quality of service (QoS) |                |  |        |      |
| 8/2  | E.LAYER        | Telecommunication network definitions  | 98-01  | M    |
| 11/2   | E.800          | Quality of service and dependability vocabulary  | 97-05  | M    |
| C/9  | J.sas          | Subjective assessment of sound quality in digital audio transmission systems   | 98-02  |      |
| Traffic Engineering                                |                |  |        |      |
| 8/2  | E.LAYER        | Telecommunication network definitions  | 98-01  | M    |
| Signals processing                                 |                |  |        |      |
| 0/9  | J.nhn          | Use of non-homogeneous networks comprising digital and analogue links for the secondary distribution of television                           | 98-02  | M    |
| Bearer services                                    |                |  |        |      |
| X/9  | J.110 (=J.int) | Requirements and possibilities for interactivity in the secondary distribution of television   | 97-04  | H    |
| Teleservices                                       |                |  |        |      |
| X/9  | J.110 (=J.int) | Requirements and possibilities for interactivity in the secondary distribution of television   | 97-04  | H    |
| Supplementary services                             |                |  |        |      |
| X/9  | J.110 (=J.int) | Requirements and possibilities for interactivity in the secondary distribution of television   | 97-04  | H    |
| Audiovisual/Multimedia                             |                |  |        |      |
| 37/9   | J.82           | Transport of MPEG-2 constant bit rate TV signals in B-ISDN   | 96-03  | H    |
| 40/9   | J.52           | Digital transmission of sound programme signals  | 96-03  | M    |
| AA/9   | J.epg          | Electronic programme guides for delivery by cable TV   | 97-02  | H    |
| AD/9   | J.1            | Terminology for television and sound programme transmission  | 96-03  |      |
| AD/9   | J.1            | Terminology for television and sound programme transmission  | 97-04  |      |
| N/9  | J.ppl          | Distribution of PALplus signals  | 98-02  |      |
| 0/9  | J.nhn          | Use of non-homogeneous networks comprising digital and analogue links for the secondary distribution of television                           | 98-02  | M    |
| P/9  | J.81           | Transmission of component-coded digital television for contribution-quality applications at the third hierarchical level of ITU-T Rec. G.702 | 96-10  | M    |
| P/9  | J.83 Annex B   | Digital multi-programme systems for television, sound and data for cable distribution  | 96-10  | H    |
| P/9  | J.84 Annex C   | Distribution of digital multi-programme signals for television sound and data services through SMATV networks                                | 96-10  | H    |
| X/9  | J.110 (=J.int) | Requirements and possibilities for interactivity in the secondary distribution of television   | 97-04  | H    |

## SOUND AND TELEVISION (TV) TRANSMISSION

| Quest                         | Recommendation | Subject  | Timing | Prio |
|-------------------------------|----------------|--|--------|------|
| Testing                       |                |  |        |      |
| C/9                           | i.sas          | Subjective assessment of sound quality in digital audio transmission systems   | 98-02  |      |
| Architecture                  |                |  |        |      |
| AA/9                          | J.epg          | Electronic programme guides for delivery by cable  | 97-02  | H    |
| Transmission System/Equipment |                |  |        |      |
| 37/9                          | J.82           | Transport of MPEG-2 constant bit rate TV signals in B-ISDN   | 96-03  | H    |
| 40/9                          | J.52           | Digital transmission of sound programme signals  | 96-03  | M    |
| AD/9                          | J.1            | Terminology for television and sound programme transmission  | 96-03  |      |
| AD/9                          | J.1            | Terminology for television and sound programme transmission  | 97-04  |      |
| N/9                           | J.ppl          | Distribution of PALplus signals  | 98-02  |      |
| O/9                           | J.nhn          | Use of non-homogeneous networks comprising digital and analogue links for the secondary distribution of television                           | 98-02  | M    |
| P/9                           | J.82           | Transmission of component-coded digital television for contribution-quality applications at the third hierarchical level of ITU-T Rec. G.702 | 96-10  | M    |
| P/9                           | J.83 Annex B   | Digital multi-programme systems for television, sound and data for cable distribution  | 96-10  | H    |
| P/9                           | J.84 Annex C   | Distribution of digital multi-programme signals for television, sound and data services through SMATV networks                               | 96-10  | H    |
| X/9                           | J.110 (=J.int) | Requirements and possibilities for interactivity in the secondary distribution of television   | 97-04  | H    |

## AUDIOVISUAL MULTIMEDIA SYSTEMS (AVMMS)

| Quest                  | Recommendation     | Subject  | Timing | Prio |
|------------------------|--------------------|--|--------|------|
| Signals processing     |                    |  |        |      |
| 12/15                  | G.729 Annex A      | Reduced complexity 8 kbit/s CS-ACELP speech coder  | 96-06  | H    |
| 13/15                  | G.763              | 32 kbit/s based DCME   | 97-04  | H    |
| 13/15                  | G.766              | Facsimile demodulation   | 96-06  | H    |
| 13/15                  | G.16dcme           | 16 kbit/s based-DCME   | 99     | H    |
| 16/15                  | I.ATM-V            | Speech Transmission over ATM   | 97-04  | H    |
| Service definition     |                    |  |        |      |
| 20/1                   | F.700 (= F.AVMM)   | AV/MM services   | 96-03  | H    |
| 20/1                   | F.702              | Multimedia conference services   | 96-03  | H    |
| 20/1                   | F.720 (Supplement) | Videotelephony mobile (Resolution No. 5 approved)  |        | L    |
| 20/1                   | F.723              | PSTN videotelephone  | 96-03  | M    |
| 20/1                   | F.mcs.1            |  | 97-02  | H    |
| Bearer services        |                    |  |        |      |
| X/9                    | J.110 (=J.int)     | Requirements and possibilities for interactivity in the secondary distribution of television | 97-04  | H    |
| Teleservices           |                    |  |        |      |
| X/9                    | J.110 (=J.int)     | Requirements and possibilities for interactivity in the secondary distribution of television | 97-04  | H    |
| Supplementary services |                    |  |        |      |
| X/9                    | J.110 (=J.int)     | Requirements and possibilities for interactivity in the secondary distribution of television | 97-4   | H    |

| Audiovisual/Multimedia |                         |   |              |     |
|------------------------|-------------------------|---|--------------|-----|
| A/8                    | T.101 (Annexes)         | Maintenance   | 99-          | L   |
| A/8                    | T. 107                  | VEMMI (Versatile MultiMedia Interface)  | 98/99        | M   |
| A/8                    | T.170                   | Framework and functional reference model for broadband MIRS   | 97/98        | M   |
| A/8                    | T. 171                  | MHEG-1 Coded representation of Multimedia and Hypermedia Objects (ASN. 1 Notation)  | 96-10        | M   |
| A/8                    | T. 172                  | MHEG-5 Coded representation of Multimedia and Hypermedia Objects; Profile for base-level implementation (ASN. 1 Notation) | 97/98        | H   |
| A/8                    | T. 173                  | MHEG-3 Script Interchange Representation (SIR)  | 97-02        | M   |
| A/8                    | T. 174                  | API for MHEG- 1   | 96-10        | L   |
| A/8                    | T.175                   | API for MBEG-5  | 97/98        | H   |
| A/8                    | T. 176                  | End to end protocol for MIRS  | 98-          | H   |
| A/8                    |                         | Interworking between different MIRS (e.g. Videotex, Internet, MHEG, DAVIC)  | 97/98/9<br>9 | H/M |
| 37/9                   | J.82                    | Transport of MPEG-2 constant bit rate TV signals in B-ISDN  | 96-03        | H   |
| 40/9                   | J.52                    | Digital transmission of sound programme signals   | 96-03        | M   |
| AA/9                   | J.epg                   | Electronic programme guides for delivery by cable TV  | 97-02        | H   |
| AD/9                   | J.1                     | Terminology for television and sound programme transmission   | 97-04        |     |
| AD/9                   | J.1                     | Terminology for television and sound programme transmission   | 96-03        |     |
| N/9                    | J.ppl                   | Distribution of PALplus signals   | 98-02        |     |
| O/9                    | J.nhn                   | Use of non-homogeneous networks comprising digital and analogue links for the secondary distribution of television        | 98-02        | M   |
| P/9                    | J.83 Annex B            | Digital multi-programme systems for television, sound and data for cable distribution                                     | 96-10        | H   |
| P/9                    | J.84 Annex C            | Distribution of digital multi-programme signals for television, sound and data services through SMATV networks            | 96-10        | H   |
| X/9                    | J. 1 1 0 (=J.int)       | Requirements and possibilities for interactivity in the secondary distribution of television                              | 97-04        | H   |
| 2/15                   | G.723.1 (Annexes AIBIC) | Speech coding for mobile/PSTN   | 96-06        | H   |
| 2/15, 3/15             | H.222.OIMPEG-2          | Registration of copyright identifier. Registration of format identifier. Amendments 1 and 2                               | 96-06        | H   |
| 2/15                   | H.223/m                 | Mux. protocol for low bit-rate MM comm. for mobile  | 97-04        | H   |
| 2/15                   | H.225.0                 | Multiplex for non-guaranteed QoS LANs   | 96-0         |     |
| 2/15                   | H.246/m                 | Comm. between MM terminals at low bit-rate for mobile   | 96-06        | H   |
| 2/15                   | H.261                   | Video codec for audiovisual services at p x 64 kbit/s   |              | H   |
| 2/15                   | H.262IMPEG-2Video.      | Registration of copyright identifier. 4:2:2 profile Amendments 1 and 2  | 96-06        | H   |
| 2/15                   | H.263/L                 | Advanced video coding for narrow telecom. channels  |              | L   |
| 2/15                   | H.263/m                 | Video coding for mobile channels  | 97-04        | H   |
| 2/15                   | H.310                   | Broadband visual systems and equipment  | 96-06        | H   |
| 2/15                   | H.323                   | H.320 to LANs with non-guaranteed QoS   | 96-06        | H   |
| 2/15                   | H.32X                   | Broadband visual systems and equipment  | 96           | H   |
| 3/15                   | H.200                   | Framework for audiovisual Recommendations   | 96-06        | L   |
| 3/15                   | H.221                   | Frame struct. for 64 - 1 920 kbit/s AV teleservices   |              | H   |
| 3/15                   | H.224                   | Real time cont. protocol for simplex appl. using LSD/HSD/MLP channels   |              | H   |
| 3/15                   | H.233                   | Confidentiality system  |              |     |
| 3/15                   | H.234                   | Key management systems for AV services  |              | H   |
| 3/15                   | H.244                   | Channel aggregation   |              | H   |
| 3/15                   | H.245/m                 | Comm. between NM terminals at low bit rate for mobile   | 97-04        | H   |



|  |                  |  |       |   |
|--|------------------|--|-------|---|
| Audiovisual/Multimedia   |                  |  |       |   |
| 3/15   | H.281            | Far end camera control using H.224   |       | H |
| 3/15   | H.32i            | Interworking between H series terminals                                      | 97-04 | H |
| 8/15   | G.Multimedia mux | Multimedia Multiplexer Interfacing over the PSTN                             | 96-06 | H |
| 14/15  | G. 167           | Acoustic Echo Control  | 96-   | H |
| 15/15  | G.IEC            | Advanced Echo Cancellers   | 97-04 | H |
| 15/15  | G.IEC            | Appendix on Use of Echo Control  | 97-04 | H |
| Fault, Configuration, Accounting, Performance and Security Management (FCAPSM) |                  |  |       |   |
| 9/15   | G.765            | Appendix I on PCME Operations Guide  |       |   |
| 9/15   | G.cimf           | Configuration Map Interface Format   | 97-04 |   |
| Testing  |                  |  |       |   |
| C/9  | J.sas            | Subjective assessment of sound quality in digital audio transmission systems | 98-02 |   |
| Architecture   |                  |  |       |   |
| A/8  | T. 170           | Framework and functional reference model for broadband MIRS                  | 97/98 | M |
| AA/9   | J.epg            | Electronic programme guides for delivery by cable TV                         | 97-02 | H |
| Security   |                  |  |       |   |
| 3/15   | H.233            | Confidentiality system   |       |   |
| 3/15   | H.234            | Key management systems for AV services                                       |       | H |
| Transmission System/Equipment  |                  |  |       |   |
| 37/9   | J.82             | Transport of MPEG-2 constant bit rate TV signals in B-ISDN                   | 96-03 | H |

## AUDIOVISUAL MULTIMEDIA SYSTEMS (AVMMS)

| Quest                         | Recommendation   | Subject  | Timing | Prio |
|-------------------------------|------------------|--|--------|------|
| Transmission System/Equipment |                  |  |        |      |
| 40/9                          | J.52             | Digital transmission of sound programme signals  | 96-03  | M    |
| AD/9                          | J.1              | Terminology for television and sound programme transmission  | 97-04  |      |
| AD/9                          | J.1              | Terminology for television and sound programme transmission  | 96-03  |      |
| N/9                           | J.ppl            | Distribution of PALplus signals  | 98-02  |      |
| 0/9                           | J.nhn            | Use of non-homogeneous networks comprising digital and analogue links for the secondary distribution of television | 98-02  | M    |
| P/9                           | J.83 Annex B     | Digital multi-programme systems for television, sound and data for cable distribution                              | 96-10  | H    |
| P/9                           | J.84 Annex C     | Distribution of digital multi-programme signals for television, sound and data services through SMATV networks     | 96-10  | H    |
| X/9                           | J. I IO (=J.int) | Requirements and possibilities for interactivity in the secondary distribution of television                       | 97-04  | H    |
| 21/12                         | G. 131           | Stability and echo   | 96-05  | M    |
| 2/15                          | H.222.2          | Real time interface  | 96-06  | H    |
| 2/15                          | H.222            | Multiplex for non-guaranteed QoS LANs  | 96-06  | H    |
| 2/15                          | H.324/m          | MM terminal for low bit-rate mobile visual telephone   | 97-04  | H    |
| 2/15                          | H.322.2          | H.320 tn TANs with non-guaranteed QoS  | 96-06  | H    |
| 9/15                          | G.764            | Appendix I on Packetization Guide  |        | H    |
| 13/15                         | G. 16dcme        | 16 kbi based-DCUE  | 99     | H    |
| 16/15                         | I.ATM-V          | Speech Transmission over ATM   | 97-04  | H    |

| AUDIOVISUAL MULTIMEDIA SYSTEMS (AVMMS)             |  |  |          |      |
|--|--|--|----------|------|
| Quest  | Recommendation                             | Subject  | Timing   | Prio |
| Interworking                                       |  |  |          |      |
| A/8  | T.101 (Annexes)                            | Maintenance  | 99-      | L    |
| A/8  |  | Interworking between different MIRS (e.g. Videotex, Internet, MHEG, DAVIC)   | 97/98/99 | H/M  |
| 2/15, 3/15   | H.222.OIMPEG-2 Systems. Amendments 1 and 2 | Registration of copyright identifier. Registration of format identifier.   | 96-06    | H    |
| 2/15   | H.223/m                                    | Mux. protocol for low bit-rate MM comm. for mobile   | 97-04    | H    |
| 2/15   | H.225.0                                    | Multiplex for non-guaranteed QoS LANs  | 96-06    |      |
| 2/15   | H.246/m                                    | Comm. between MM terminals at low bit-rate for mobile  | 96-06    | H    |
| 3/15   | H.221                                      | Frame struct. for 64 - 1 920 kbit/s AV teleservices  |          | H    |
| 3/15   | H.224                                      | Real time cont. protocol for simplex appl. using LSD/HSD/MLP channels  |          | H    |
| 3/15   | H.244                                      | Channel aggregation  |          | H    |
| 3/15   | H.245/m                                    | Comm. between MM terminals at low bit rate for mobile  | 97-04    | H    |
| 3/15   | H.281                                      | Far end camera control using H.224   |          | H    |
| Network capabilities                               |  |  |          |      |
| X/9  | J. 1 10 (=J.int)                           | Requirements and possibilities for interactivity in the secondary distribution of television                       |          |      |
| Tariff/charging/accounting                         |  |  |          |      |
| 16/3   | 1 D.188                                    | Videoconference  |          | H    |
| Network Performance (NP). Quality of service (QoS) |  |  |          |      |
| 8/2  | E.LAYER                                    | Telecommunication network definitions  | 98-01    | M    |
| 11/2   | E.800                                      | Quality of service and dependability vocabulary  | 97-05    | M    |
| C/9  | J.sas                                      | Subjective assessment of sound quality in digital audio transmission systems                                       | 98-02    |      |
| 21/12  | G.131                                      | Stability and echo   | 96-05    | M    |
| 14/15  | G. 167                                     | Acoustic Echo Control  | 96-      | H    |
| 15115  | G.IEC                                      | Advanced Echo Cancellers   | 97-04    | H    |
| 15115  | G.IEC                                      | Appendix on Use of Echo Control  | 97-04    | H    |
| Traffic engineering                                |  |  |          |      |
| 8/2  | E.LAYER                                    | Telecommunication network definitions  | 98-01    | M    |
| Signals processing                                 |  |  |          |      |
| 0/9  | J.nhn                                      | Use of non-homogeneous networks comprising digital and analogue links for the secondary distribution of television | 98-02    | M    |
| 2/15   | G.723.1 (Annexes A, B, C)                  | Speech coding for mobile/PSTN  | 96-06    | H    |
| 2/15   | H.261                                      | Video codec for audiovisual services at p x 64 kbit/s  |          | H    |
| 2/15   | H.262                                      | MPEG-2 Video. Registration of copyright identifier. 4:2:2 profile Amendments 1 and 2                               | 96-06    | H    |
| 2/15   | H.263/L                                    | Advanced video coding for narrow telecom. channels   |          | L    |
| 2/15   | H.263/m                                    | Video coding for mobile channels   | 97-04    | H    |
| 6/15   | G.ACB                                      | Audio coding at less than 64 kbit/s  | 98-      | L    |
| 6/15   | G.WSC/A                                    | Wideband speech coding at 16/24 kbit/s: Mode A Low-Delay   | 98-      | M    |
| 6/15   | G.WSC/B                                    | Mode B Low-Complexity: Audio coding at 16/24/32 kbit/s   | 97-04    | H    |
| 7/15   | G.4kbps                                    | Speech coding at 4 kbit/s  | 98-      | H    |
| 9/15   | G.764                                      | Appendix I on Packetization Guide  |          | H    |
| 9/15   | G.765                                      | Appendix I on PCME Operations Guide  |          | H    |
| 9/15   | G.cimf                                     | Configuration Map Interface Format   | 97-04    | H    |

## Society of Motion Picture and Television Engineers (SMPTE)

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SMPTE defines various standards, recommended practices, and engineering guidelines for the television and film industry. They have produced many important transmission standards in the area of uncompressed digital video transmission, but have until recently been quiet about compressed systems. Recently SMPTE was identified as the registry for ATSC content identifiers used for copyright identification in the ATSC and SCTE systems.

Many SMPTE standards define the popular formats for uncompressed digital and analog video, before and after compression. Here are a few of the more relevant standards:

- **SMPTE 125M-1992**

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*SMPTE Standard for Television—Component Video Signal 4:2:2—Bit Parallel Digital Interface*

- Specifies a short distance (< 300 m) link for carrying TU-R BT.601 (formerly CCIR-601) signals over a twisted-pair ECL link.

- **SMPTE 170M-1994**

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*SMPTE Standard for Television—Composite Analog Video Signal—NTSC for Studio Applications*

Specifies an analog format for carrying video signals. This is SMPTE's rendition of the NTSC standard.

- **SMPTE 259M-1993**

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*SMPTE Standard for Television—10-bit 4:2:2—Component and 4fsc NTSC Composite Digital Signals Serial Digital Interface*

Specifies a long distance link for carrying digital video signals over a coaxial (BNC) link. This interface is commonly used by higher-performance compression systems.

- **SMPTE 292M**

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*Proposed SMPTE Standard for Television—Bit-Serial Interface for High-Definition Television Systems*

Specifies a long distance link for carrying high-definition digital video over coaxial (BNC) and fibre links (FC).

## **European Broadcasting Union**

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This group, like SMPTE has produced many important specifications related to analog, and uncompressed digital video and audio. This group has close ties with the DVB Project, but at this time has not published any specifications known to the authors relating to compressed digital video.

## **Society of Cable Television Engineers (SCTE)**

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The SCTE emerged from a professional association and guild. It had previously focused on procedural guidelines for the (largely US) cable television industry. SCTE has close ties with a cable-industry funded research laboratory called CableLabs. Recently CableLabs created a spec based on leading US cable manufacturer General Instruments' DigiCypher system, with input from Scientific Atlanta. This specification has been ratified by the ITU under J.83 Annex B and is published in that document:

- **SCTE-DVS-031**

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*Digital Video Transmission Standard for Cable Television* expands on the ISO and ATSC specifications with a specification of the physical QAM modulation and FEC coding for 6 MHz NTSC cable channels.





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