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Supplement 5

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SERIES J: TRANSMISSION OF TELEVISION, SOUND PROGRAMME AND OTHER MULTIMEDIA SIGNALS

Guidelines on the use of some ITU-T Recommendations in the J series

ITU-T J-series Recommendations – Supplement 5

(Previously CCITT Recommendations)

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TRANSMISSION OF TELEVISION, SOUND PROGRAMME AND OTHER MULTIMEDIA SIGNALS

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SUPPLEMENT 5 TO ITU-T J-SERIES RECOMMENDATIONS

GUIDELINES ON THE USE OF SOME ITU-T RECOMMENDATIONS IN THE J SERIES

Summary

This supplement gives guidance on the application of ITU-T Recommendations in the J series, in order that the reader may more readily identify those Recommendations that he should consult to obtain detailed information on the technical aspects of his specific interest.

Source

Supplement 5 to ITU-T J-series Recommendations was prepared by ITU-T Study Group 9 (1997-2000) and was approved under the WTSC Resolution No. 5 procedure on 17 September 1999.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this publication, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this publication, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this publication. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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Introduction

This Supplement is a companion to Recommendation J.2. It provides guidelines on the application of Recommendations in the J series, in order that the reader may more readily identify those Recommendations that may be of his specific interest. To do this, the Supplement is structured in several sections; each section lists and describes the Recommendations in the J series that apply to a specific technical topic.

The technical topics that this Supplement covers are the ones listed below. Additional sections of the Supplement, covering additional topics, are in preparation.

Section 1 – Point-to-point transmission of digital television for contribution and primary distribution.

Section 2 – Secondary distribution of digital television by cable television systems and similar methods.

Section 3 – Additional services supported by digital cable television systems.

Section 4 – Interactive television and sound broadcasting services.

Section 5 – Point-to-point digital transmission of sound-programme signals.

Section 6 – Measurement methods for digital cable television.

Section 7 – Conditional access and copy protection.

It should be noted that Recommendation J.1 – Terminology for new services in television and sound-programme transmission – points to a large number of terms, definitions and abbreviations in the areas covered by the various sections of this Supplement.

For an up-to-date text of the guidelines, the reader is referred to the ITU-T Website.

GUIDELINES ON THE USE OF SOME ITU-T RECOMMENDATIONS IN THE J SERIES

(Geneva, 1999)

SECTION 1

Point-to-point transmission of digital television for contribution and primary distribution

This section covers the transmission of digital television for purposes of programme contribution and primary distribution. The relevant Recommendations in the J series are listed in the table below, and a short description is given for each one of them in the subclauses that follow.

Number month/year	Title
Rec. J.80 (09/93)	Transmission of component-coded digital television signals for contribution-quality applications at bit rates near 140 Mbit/s
Rec. J.81 (09/93)	Transmission of component-coded digital television signals for contribution-quality applications at the third hierarchical level of ITU-T Recommendation G.702
Rec. J.81/Amd.1 (10/95)	Appendix II to Annex A to Recommendation J.81 – Guidelines for implementation of a complete television codec
Rec. J.81/Amd.2 (02/96)	Appendix IV to Annex A to Recommendation J.81 – Results of 34 Mbit/s codec interworking tests (February 1996)
Rec. J.81/Cor.1 (10/96)	Corrigendum 1 to Recommendation J.81
Rec. J.82 (07/96)	Transport of MPEG-2 constant bit rate television signals in B-ISDN
Rec. J.85 (06/90)	Digital television transmission over long distances – General principles
Rec. J.88 (09/99)	Transmission of enhanced definition television signals over digital links
Rec. J.89 (09/99)	Transmission mechanism for component-coded digital television signals for contribution and primary distribution applications using MPEG-2 4:2:2P@ML including all service elements for contribution and primary distribution
Rec. J.131 (03/98)	Transport of MPEG-2 signals in PDH networks
Rec. J.132 (03/98)	Transport of MPEG-2 signals in SDH networks

1.1 Recommendation J.80 – Transmission of component-coded digital television signals for contribution-quality applications at bit rates near 140 Mbit/s

Recommendation J.80 provides the specifications for a bit-rate-reduction codec. This codec is intended for use in the transmission of digital video signals for 625-line systems coded in components, according to Recommendation ITU-R BT.601. Recommendation J.80 applies to a transmission data rate close to 140 Mbit/s, a data rate that is normally only used for contribution purposes.

1.2 Recommendation J.81 – Transmission of component-coded digital television signals for contribution-quality applications at the third hierarchical level of ITU-T Recommendation G.702

Recommendation J.81 provides the specifications for a bit-rate reduction codec. This codec is intended for use in the transmission of digital television signals at bit rates of about 34 or 45 Mbit/s, coded in components according to Recommendation ITU-R BT.601.

Recommendation J.81 encompasses the coding algorithms needed for digital picture coding, and the interfaces with the transmission network. It applies to a transmission data rate of about 34 or 45 Mbit/s. These data rates are generally used for contribution and for primary distribution purposes.

The video coding algorithms are based on a hybrid predictive transform scheme incorporating arrangements for variable word-length coding, synchronization and video framing. Provision is made for the transmission of audio and of teletext services to accompany the video information, and for the application of scrambling for conditional access.

Network adaptation is specified to both plesiochronous and synchronous digital hierarchies.

Recommendation J.81 should be studied in conjunction with its Amendments 1 and 2 and its Corrigendum 1. Amendment 1 provides guidelines for the implementation of the complete codec; Amendment 2 describes the results of interworking tests performed on practical codecs; Corrigendum 1 rectifies a number of small errors that appeared in the original text of Recommendation J.81.

1.3 Recommendation J.82 – Transport of MPEG-2 constant bit rate television signals in B-ISDN

Recommendation J.82 covers the packetized transport of digital television signals in the broadband-ISDN. In the context of this Recommendation, television signals are digitally encoded and transmitted in compliance with MPEG-2 systems specified in ITU-T Rec. H.222.0 | ISO/IEC 13818-1, at a constant bit rate in the Asynchronous Transfer Mode (ATM), which is the mode used by the B-ISDN.

Other ITU-T Recommendations that apply in this area are those that concern ATM in the I-series Recommendations.

1.4 Recommendation J.85 – Digital television transmission over long distances – General principles

Recommendation J.85 provides some very general guidelines on the need to preferably use digital circuits when transmitting digital component video signals, and vice versa.

Those general guidelines are reflected in more recent and more focused Recommendations, and they are normally taken into account in current operation.

1.5 Recommendation J.88 – Transmission of enhanced definition television signals over digital links

Recommendation J.88 specifies a bit-reduction coding scheme for application to digital transmission of the EDTV-II composite signals defined for NTSC-compatible enhanced television.

ETDV-II signals have a complex structure; they consist of NTSC-compatible components transmitted in the centre part of the picture and of "helper" components located in the upper and lower parts of the picture.

The specified bit-reduction coding scheme is a composite coding scheme that does not require any decoding/re-encoding process for enhanced signals and colour component signals.

Consequently, the coding scheme is free from the picture quality losses brought about by composite-component conversion required in component-coding schemes.

The bit-rate required for contribution and distribution purposes is approximately 20 Mbit/s.

1.6 Recommendation J.89 – Transmission mechanism for component-coded digital television signals for contribution and primary distribution applications using MPEG-2 4:2:2P@ML including all service elements for contribution and primary distribution

Recommendation J.89 specifies the general transport mechanism for conveying all service elements used in MPEG-2 4:2:2 Profile at Main level compression, for contribution and primary distribution applications of digital television programmes.

The specification ensures compatibility at the level of the bit stream into the decoder. It is based on, and conforms with, the MPEG-2 standard (ISO/IEC 13818).

1.7 Recommendation J.131 – Transport of MPEG-2 signals in PDH networks

Recommendation J.131 provides specifications for the transmission of MPEG-2 transport streams within PDH networks working in conformity with Recommendation G.702 at the hierarchical bit rates of 1544, 2048, 6312, 8448, 34 368, 44 736 or 139 264 kbit/s.

The equipment considered in this Recommendation is the "Network Adapter" that performs the adaptation between MPEG-2 transport streams and the interfaces of PDH networks.

1.8 Recommendation J.132 – Transport of MPEG-2 signals in SDH networks

Recommendation J.132 provides specifications for the transmission of MPEG-2 transport streams within SDH networks working in conformity with Recommendation G.707 at the hierarchical bit rates of 155 520 or 51 840 kbit/s.

The equipment considered in this Recommendation is the "Network Adapter" that performs the adaptation between MPEG-2 transport streams and the interfaces of SDH networks.

SECTION 2

Secondary distribution of digital television by cable television systems and similar methods

This section covers the secondary distribution of digital television programme signals by cable systems and by similar methods. The relevant Recommendations in the J series are listed in the table below, and a short description is given for each one of them in the subclauses that follow.

2.1 Recommendation J.83 – Digital multiprogramme systems for television, sound and data services for cable distribution

Recommendation J.83 provides worldwide specifications for the delivery of digital television services over a cable television network.

The Recommendation defines the framing structure, channel coding and modulation for digital multiprogramme television, sound and data signals distributed to the audience by cable television networks, possibly in frequency-division multiplex with existing analogue television signals.

The ITU-T has also issued an Information Note to Recommendation J.83, whose content should be taken into account when studying the Recommendation.

Number month/year	Title
Rec. J.83 (04/97)	Digital multiprogramme systems for television, sound and data services for cable distribution
Rec. J.83-Info (04/97)	Information Note: Corrigendum to Recommendation J.83
Rec. J.84 (04/97)	Distribution of digital multiprogramme signals for television, sound and data services through SMATV networks
Rec. J.87 (03/98)	Use of hybrid cable television links for the secondary distribution of television into the user's premises
Rec. J.117 (09/99)	Home digital network interface specification
Rec. J.150 (03/98)	Operational functionalities for the delivery of digital multiprogramme television, sound and data services through multichannel, multipoint distribution systems (MMDS)
Rec. J.150/Amd.1 (09/99)	Addendum 1 to Recommendation J.150 – Additions to Recommendation J.150 to also encompass local multipoint distribution systems (LMDS)

2.2 Recommendation J.84 – Distribution of digital multiprogramme signals for television, sound and data services through SMATV networks

Recommendation J.84 provides worldwide specifications for the delivery of digital television services over an SMATV television distribution network that uses a master antenna to receive programmes from a satellite.

The Recommendation defines the framing structure, channel coding and modulation for digital multiprogramme television, sound and data signals distributed to the audience by SMATV networks, possibly in frequency-division multiplex with existing analogue television signals.

The Recommendation follows the basic structure of Recommendation J.83.

2.3 Recommendation J.87 – Use of hybrid cable television links for the secondary distribution of television into the user's premises

Recommendation J.87 specifies operational rules, which should be followed in order to facilitate the carriage of both analogue and digital television signals of satisfactory quality on the same coaxial cable delivery system for the secondary distribution of television to the home.

2.4 Recommendation J.117 – Home digital network interface specification

The need to support cable services for High Definition TV (HDTV) sets, which are starting to emerge in the retail market, is converging with a general movement to interconnect multiple audio/visual (A/V) devices on a common bus or network. The IEEE Std 1394 interface has emerged as the preferred tool to accomplish this goal. Although the applications and their standards are still emerging, Recommendation J.117 defines requirements and options for a 1394 digital interface between a Home Digital Network Device (HDND), which is a type of set-top box (STB) and a Digital Television (DTV) receiver, with the Recommendation later extended to include a full set of networked devices in the home.

2.5 Recommendation J.150 – Operational functionalities for the delivery of digital multi-programme television, sound and data services through multichannel, multipoint distribution systems (MMDS)

Recommendation J.150 extends the principles of cable television network architectures to digital MMDS distribution systems, which use radio waves at microwave frequencies of the order of several GHz.

The Recommendation covers the specifications for the cabled part of such MMDS systems, when they are used as extensions or alternatives to cable television networks, possibly in frequency division multiplex with existing analogue signals. It follows the basic structure of Recommendation J.83.

Recommendation J.150/Amd.1 provides modifications to the Recommendation in order to include a varient of System A of Recommendation J.83 for operation at 10 GHz and above. It is derived from the satellite broadcast television specifications.

SECTION 3

Additional services supported by digital cable television systems

This section covers the additional services supported by digital cable television systems. The relevant Recommendations in the J series are listed in the table below, and a short description is given for each one of them in the subclauses that follow.

Number month/year	Title
Rec. J.90 (04/97)	Electronic programme guides for delivery by cable television and similar methods
Rec. J.94 (11/98)	Service information for digital broadcasting in cable television systems

3.1 Recommendation J.90 – Electronic programme guides for delivery by cable television and similar methods

Recommendation J.90 specifies requirements to be met when electronic programme guides are delivered to the home by digital cable television and similar distribution methods.

It identifies the various items of information that a properly structured electronic programme guide should provide, and the users' requirement to be met in order to allow the user to easily navigate through the information provided.

3.2 Recommendation J.94 – Service information for digital broadcasting in cable television systems

Recommendation J.94 specifies the content of Service Information. Service Information is used to convey the description of the services contained in a multiplex of audio, video, and data that is distributed by cable networks (e.g. CATV systems), in conformity with the specifications contained in Recommendation J.83 for the transmission characteristics for digital multiprogramme signals distributed through cable networks.

The service information should be carried within the MPEG-2 transport layer as Program Specific Information (PSI). This mechanism provides some ancillary data capacity in the forward channel, which can be used to accommodate the needs of other services such as electronic programme guides.

Being highly flexible, the MPEG-2 transport layer can be configured to deliver any desired mix of television, sound and data signals, with sound either related or unrelated to the video signal content, and at various possible levels of quality.

The Recommendation is intended to ensure that designers and operators of cable distribution (e.g. CATV) networks carrying multiprogramme signals will have the information they need to be able to establish and maintain fully satisfactory networks. It also provides the information needed by designers and manufacturers of equipment (including receivers) for digital multiprogramme signals distributed by cable networks.

SECTION 4

Interactive television and sound broadcasting services

This section covers systems designed to provide interactivity for television and sound broadcasting services, using cable television or telecommunication transmission. The relevant Recommendations in the J series are listed in the table below, and a short description is given for each one of them in the subclauses that follow.

Number month/year	Title
Rec. J.110 (03/98)	Basic principles for a worldwide common family of systems for the provision of interactive television services
Rec. J.111 (03/98)	Network independent protocols for interactive systems
J Serie/Sup.3 (11/98)	Guidelines for the implementation of Recommendation J.111 "Network independent protocols" – Example of digital video broadcasting (DVB) systems for interactive services
Rec. J.112 (03/98)	Transmission systems for interactive cable television services
J Serie/Sup.2 (11/98)	Guidelines for use implementation of Annex A of Recommendation J.112 "Transmission systems for interactive cable television services" – Example of Digital Video Broadcasting (DVB) interaction channel for cable television distribution
J Serie/Sup.1 (11/98)	Example of linking options between Annexes of ITU-T Recommendation J.112 and Annexes of ITU-T Recommendation J.83
Rec. J.113 (03/98)	Digital video broadcasting interaction channel through the PSTN/ISDN
Rec. J.114 (09/99)	Interaction channel using digital enhanced cordless telecommunications
Rec. J.115 (09/99)	Interaction channel using the global system for mobile communications

4.1 Recommendation J.110 – Basic principles for a worldwide common family of systems for the provision of interactive television services

Reliance upon digital technology provides opportunities for the introduction of interactive services, which may be required at a number of levels, each having a variety of requirements for the interaction channel, in terms of Quality of Service.

Recommendation J.110 gives general guidance for the harmonious development of interactive television services. It covers the subject areas of interaction channels, interactive services and transport mechanisms.

Recommendation J.110 is properly aligned with the corresponding Recommendation issued by the ITU-R.

4.2 Recommendation J.111 – Network independent protocols for interactive systems

Recommendation J.111 describes protocols which are independent of the underlying physical and transport protocol and are used for the support of interaction services, based on digital TV broadcast systems.

The model of the system is based on a "broadcast channel" and on an "interaction channel".

The broadcast channel carries content from the broadcast service provider and, in some instances, from the interactive service provider to the user. It may also carry embedded Application Control Data or Application Communication Data (ACD/ACD) and/or Date Download Control (DDC) from the interactive service provider to the user, possibly for controlling an application for which the interactive service provider supplies data associated to the programme.

The interaction channel carries content from the interactive service provider to the user, and may also carry user contribution content back to the interactive service provider. It also carries ACD/ACD to and from the user, and may also carry DDC to the user.

A bidirectional application control and communication channel is also foreseen between the broadcast service provider and the interactive service provider for synchronization purposes.

Recommendation J.111 should be studied together with Supplement 3 to the J-series Recommendations. Supplement 3 explains the ways in which the network independent protocols specified in Recommendation J.111 can be used in conjunction with an interaction network to implement the full range of interactive services. Such services complement broadcast television services according to their commercial requirements. These may require a one-way (reverse direction) narrow-band path or a two-way interaction channel (one in the reverse direction and the other in the forward direction); in the latter case the reverse-direction path may be narrow-band or it may need to be wide-band.

4.3 Recommendation J.112 – Transmission systems for interactive cable television services

Digital television services have been established in many countries and the benefits of extending these to provide interactive services are widely recognized. Cable television distribution systems are particularly suited for the implementation of bidirectional data services, which may include fast Internet access and/or interactive cable television. For the introduction of fast Internet access and/or interactive cable television services, standardized systems should be used to achieve the benefits of economies of scale and facilitate interoperability.

Recommendation J.112 extends the scope of Recommendation J.83 to make provision for bidirectional data transmission over coaxial and hybrid fibre-coax cables for interactive services.

Like Recommendation J.83, Recommendation J.112 contains several annexes in recognition of different existing media environments. The annexes in Recommendation J.112 should be read in conjunction with the corresponding annexes in Recommendation J.83.

It should be noted that the annexes to Recommendation J.112 describe different variations of the same protocol layers, for use in different ITU regions. However, telecommunications and computer standards that are well established and widely used in the public domain can support connectivity between these variations.

Recommendation J.112 should be studied in conjunction with Supplements 1 and 2 to the J-series Recommendations.

Supplement 1 gives an example of how the interactivity features described in a particular Annex to Recommendation J.112 for use with the transmission system specified in the Annex of Recommendation J.83 that has the same designation, can also be used in conjunction with the transmission system that is specified in a different Annex to Recommendation J.83. E.g. it describes how Annex A to Recommendation J.112, which is intended for use together with the transmission system specified in Annex A to Recommendation J.83, can also be used together with the transmission system specified in another Annex to Recommendation J.83.

Supplement 2 provides guidelines for the implementation of the interaction channel provided by cable television networks.

4.4 Recommendation J.113 – Digital video broadcasting interaction channel through the PSTN/ISDN

Recommendation J.113 describes the provision of return channel interaction protocols over PSTN and ISDN to, and independently of, digital television distribution systems such as cable television systems. It describes network dependent protocols within the transport and physical layers for the PSTN/ISDN (network independent protocols are described in Recommendation J.111).

4.5 Recommendation J.114 – Interaction channel using digital enhanced cordless telecommunications

Recommendation J.114 is the baseline specification for the provision of an interaction channel using the Digital Enhanced Cordless Telecommunications (DECT) Standard in conjunction with a digital broadcasting delivery medium.

The Recommendation is not transmission-medium specific. It can be used with any of the broadcast transmission media currently standardized by the ITU, such as cable, satellite, terrestrial, etc., thus ensuring the maximum degree of interoperability and economies of scale.

The Recommendation is also consistent with the generic reference model described in Recommendation J.110, and with the network independent protocols in Recommendation J.111.

4.6 Recommendation J.115 – Interaction channel using the global system for mobile communications

Recommendation J.115 is the baseline specification for the provision of an interaction channel using the Global System for Mobile Communications (GSM) in conjunction with a digital broadcasting delivery medium.

The Recommendation is not transmission-medium specific. It can be used with any of the broadcast transmission media currently standardized by the ITU, such as cable, satellite, terrestrial, etc., thus ensuring the maximum degree of interoperability and economies of scale.

The Recommendation is also consistent with the generic reference model described in Recommendation J.110, and with the network independent protocols in Recommendation J.111.

SECTION 5

Point-to-point digital transmission of sound programme signals

This section covers the point-to-point digital transmission of sound-programme signals for contribution or primary distribution purposes. The relevant Recommendations in the J series are listed in the table below, and a short description is given for each one of them in the subclauses that follow.

Number month/year	Title
Rec. J.41 (1988)	Characteristics of equipment for the coding of analogue high quality sound-programme signals for transmission on 384 kbit/s channels
Rec. J.42 (1988)	Characteristics of equipment for the coding of analogue medium quality sound-programme signals for transmission on 384-kbit/s channels
Rec. J.51 (08/94)	General principles and user requirements for the digital transmission of high quality-sound programmes
Rec. J.52 (07/96)	Digital transmission of high-quality sound-programme signals using one, two or three 64 kbit/s channels per mono signal (and up to six per stereo signal)
Rec. J.55 (06/90)	Digital transmission of high-quality sound-programme signals on distribution circuits using 480 kbit/s (496 kbit/s) per audio channel
Rec. J.57 (06/90)	Transmission of digital studio quality sound signals over H1 channels

5.1 Recommendation J.41 – Characteristics of equipment for the coding of analogue high quality sound-programme signals for transmission on 384 kbit/s channels

Recommendation J.41 specifies the characteristics of equipment for the coding of 15 kHz monophonic analogue sound-programme signals into a digital signal of 384 kbit/s.

For stereophonic operation, two monophonic digital codecs can be utilized.

Equipment for coding of analogue sound-programme signals, as specified in the Recommendation, can be a stand-alone encoder/decoder with a digital interface at 384 kbit/s or a combined encoder-multiplexer respectively decoder-demultiplexer with a digital interface at 1544 or 2048 kbit/s.

The recommended encoding laws are based on a uniformly quantized 14-bit/sample PCM technique with companding. They employ either eleven-segment 14- to 11-bit instantaneous A-law companding, or five-range 14- to 10-bit near-instantaneous companding.

5.2 Recommendation J.42 – Characteristics of equipment for the coding of analogue medium quality sound-programme signals for transmission on 384-kbit/s channels

Recommendation J.42 specifies the characteristics of equipment for the coding of 7 kHz monophonic analogue sound-programme signals into a digital signal. Two monophonic digital signals can be combined to form a 384-kbit/s signal as specified in Recommendation J.41.

Equipment for coding of analogue sound-programme signals, as specified in the Recommendation, can be a stand-alone encoder/decoder with a digital interface at 384 kbit/s, or a combined encoder-multiplexer respectively decoder-demultiplexer with a digital interface at 1544 or 2048 kbit/s.

The recommended encoding laws are based on a uniformly quantized, 14-bit/sample PCM technique with companding and employ either eleven-segment 14- to 11-bit instantaneous A-law companding, or five-range 14- to 10-bit near-instantaneous companding.

5.3 Recommendation J.51 – General principles and user requirements for the digital transmission of high quality-sound programmes

Recommendation J.51 indicates some principles and recommended practices to be used for the digital transmission of broadcast-quality sound programmes.

In particular, the Recommendation recalls that a minimum digital encoding resolution of 16 bits/sample should be used for broadcast-quality sound programmes, and a sampling frequency of 48 kHz, or of 32 kHz if no further signal processing is foreseen. It also recalls that sound programmes originated in digital form should be kept in such form through transmission.

5.4 Recommendation J.52 – Digital transmission of high-quality sound-programme signals using one, two or three 64 kbit/s channels per mono signal (and up to six per stereo signal)

Recommendation J.52 describes a system for the transmission of sound signals on 1 to 6 standardized 64 kbit/s channels (B-channels) of the N-ISDN.

It also applies to transmission on permanent connections with a 2048 kbit/s or a 1544 kbit/s frame.

Different bit-rate reduction encoding methods may be used, depending on the application (transmission for contribution, distribution, emission, and commentary). The Recommendation specifies the method to be used, among those that allow the transmission of high-quality digital monophonic sound-programme signals with bit rates in the range of 64 to 192 kbit/s (stereo signals are encoded in a single bit stream). The recommended methods are among those recommended by the ITU-R and standardized by ISO/IEC 11172-3.

The bit stream to be transmitted can optionally be protected by means of error-correction measures.

It is desirable to use standardized 64 kbit/s channels or multiples thereof, for the transmission of high-quality sound programmes and of the associated data.

The Recommendation defines the formatter and reformatter for the transport of the bit-rate reduced audio signals and of the associated data on one or several such standardized channels, while maintaining N-ISDN bit-sequence integrity.

The Recommendation also contains clarifications that reflect experience gained in its implementation and a chapter on the transmission of programme-associated data in the ancillary data field of the ISO frame.

5.5 Recommendation J.55 – Digital transmission of high-quality sound-programme signals on distribution circuits using 480 kbit/s (496 kbit/s) per audio channel

Recommendation J.55 specifies the use of the so-called 16/14-bit companding method for the transmission of high-quality sound-programme signals at 480 kbit/s.

The use of this method is recommended for those distribution applications where a sampling frequency of 32 kHz is used and where a dynamic range corresponding to more than 14 bits is required, and the BER is better than 10^{-5}.

The Recommendation also specifies the format to be used to multiplex two stereophonic programmes or four monophonic programmes for transmission at the H12 hierarchical level.

The Recommendation further specifies the coding method and multiplexing format to be used for those cases where a higher ancillary data capacity is required and dedicated 2048 kbit/s links are available.

5.6 Recommendation J.57 – Transmission of digital studio quality sound signals over H1 channels

Recommendation J.57 specifies the provisions for the transmission of digital sound-programme signals on H1 channels in the digital hierarchy when the signal is of studio quality. This quality is higher that the one used for distribution and it requires more than 16 bits/sample.

The Recommendation stipulates that near-instantaneous companding from 20 to 15 bits/sample be used, with an appropriate encoding law.

Furthermore, the audio signal companding should be such that the samples are compressed for transmission in the H11 channel. This is recommended in order to simplify interworking between the H12 hierarchical level, which provides a total of 20 bits per sample, and the H11 hierarchical level, which provides a total of 16 bits/sample. In this way, the essential data occupies the entire available capacity of the H11 channel and the first 24 available octets of each frame of the H12 channel. The residual bits in the H12 channel may be used to convey additional data, to improve resolution of the audio coding and/or to provide a user data channel.

SECTION 6

Measurement methods for digital cable television

This section covers measurement methods for digital cable television. The relevant Recommendation in the J series is listed in the table below, and a short description is given in the subclause that follows.

Number month/year	Title
Rec. J.141 (09/99)	Performance indicators for data services delivered over cable television systems

6.1 Recommendation J.141 – Performance indicators for data services delivered over cable television systems

Recommendation J.141 recommends some performance indicators that can be used (among others) to evaluate the performance of digital modems in a hybrid fibre/coax (HFC) cable television network in the presence of continuous or impulsive noise.

The Recommendation is based on some characteristics of the modems that are intended for use in the delivery of data services over digital television cable.

SECTION 7

Conditional access and copy protection

This section covers conditional access and copy protection for long-distance transmission and for cable television distribution of television and sound-programme signals. The relevant Recommendations in the J series are listed in the table below, and a short description is given for each one of them in the subclause that follow.

Number month/year	Title
Rec. J.91 (08/94)	Technical methods for ensuring privacy in long-distance international television transmission
Rec. J.93 (03/98)	Requirements for conditional access in the secondary distribution of digital television on cable television systems
Rec. J.95 (09/99)	Copy protection of intellectual property for content delivered on cable television systems

7.1 Recommendation J.91 – Technical methods for ensuring privacy in long-distance international television transmission

Recommendation J.91 provides common specifications for a conditional access system for long-distance international transmission of digital television signals in conformity with Recommendation J.81.

The Recommendation defines the interfaces and equipment needed to operate the conditional access system and it specifies a transport protocol to carry conditional access messages in a dedicated data channel that is specified in Recommendation J.81.

Practical implementations are described in the annexes to the Recommendation.

7.2 Recommendation J.93 – Requirements for conditional access in the secondary distribution of digital television on cable television systems

Recommendation J.93 covers the requirements, hardware and command interfaces, policies and procedures appertaining to conditional access for the secondary distribution of digital television and data over cable television systems.

The intent is that the actual conditional access features selected for implementation in a specific cable television system should be based on the system requirements specified in the Recommendation.

7.3 Recommendation J.95 – Copy protection of intellectual property for content delivered on cable television systems

Recommendation J.95 describes the necessary requirements for a system to protect the intellectual property rights (IPR) of television programming entities against the illegal copying, duplication, and distribution of their creative property.

The system described has aspects that prohibit unauthorized individuals from accessing encrypted MPEG data streams.

Also, techniques for "watermarking" television signals for identification and copying allowances are presented.

The Recommendation contains both general descriptions, and discussions of specific technical approaches to copy protection.

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