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Technical Specification

Access and Terminals, Transmission and Multiplexing (ATTM); Third Generation Transmission Systems for Interactive Cable Television Services - IP Cable Modems; Part 3: Downstream Interface

[ITU-T Recommendation J.210 (11/2006), modified]

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM).

The present document is part 3 of a multi-part deliverable covering Third Generation Transmission Systems for Interactive Cable Television Services - IP Cable modems. Full details of the entire series can be found in part 1 [i.1].

Introduction

This European Standard (Cable DOCSIS 3.0 Network series) has been produced by ETSI Access, Terminals, Transmission and Multiplexing Technical Committee (ATTM), Cable Access Network sub-group.

1 Scope

The present document provides physical layer requirements for Cable Modem Termination System (CMTS) transmitters in the Data-Over-Cable Systems Interface Specifications (DOCSIS®) architecture. It defines the downstream interface specifications for:

- an edgeQAM (EQAM) device in a modular CMTS architecture; or
- an integrated CMTS

It was developed for the benefit of the cable industry, including contributions by operators and vendors from, Europe, North America and other regions.

The source material for this specification was provided by the ITU-T Recommendation J.210 [3] for which the most recent version can be found at <http://www.itu.int/ITU-T/>.

There are differences in the cable spectrum planning practices adopted for different networks in the world. Therefore two definitions for physical layer technology are included, which have equal priority and are not required to be interoperable. One technology definition is based on the downstream multi-programme television distribution that is deployed using 8 MHz channelling. The second technology definition is based on a multi-programme television distribution using 6 MHz channel spacing. Both options have equal status.

The choices of physical-layer technologies allow operators some flexibility within any frequency planning, EMC and safety requirements that are mandated for their area of operation.

EXAMPLE: The 6 MHz downstream-based option might be deployable within an 8 MHz channel plan. It is the network operator's choice of which technology definition to deploy.

NOTE: The present document references both physical layer technologies and where there are parameter differences both are specified for both options:

- (i) 8 MHz channel spacing; and
- (ii) 6 MHz channel spacing.

All optional physical-layer technologies are required to be backwards compatible with the earlier versions of those options defined in ES 201 488 [i.2] and ES 202 488 [i.3].

Requirements for EMC and safety are outside the scope of the present document. EMC and safety standards for European applications are published by CENELEC.

NOTE 1: Examples of such CENELEC product safety standards are EN 60950 [i.4] and EN 50083-1 [i.5].

NOTE 2: For CENELEC safety categories of interfaces, see EG 201 212 [i.6].

NOTE 3: Examples of such CENELEC product EMC standards are EN 50081-1 [i.7], EN 50082-1 [i.8] and EN 50083-2 [i.9].

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
 - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
 - for informative references.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] ITU-T Recommendation J.83 (Annex C): "Digital multi-programme systems for television, sound and data services for cable distribution, Annex C: Digital multi-programme System C".
- [2] ETSI ES 202 488-2: "Access and Terminals (AT); Second Generation Transmission Systems for Interactive Cable Television Services - IP Cable Modems; Part 2: Radio frequency interface specification".
- [3] ITU-T Recommendation J.210: "Downstream RF Interface for Cable Modem Termination Systems".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.2] ETSI ES 201 488: "Access and Terminals (AT); Data Over Cable Systems; Part 1: General".
- [i.3] ETSI ES 202 488: "Access and Terminals (AT); Second Generation Transmission Systems for Interactive Cable Television Services - IP Cable Modems".
- [i.4] EN 60950: "Information technology equipment - Safety".
- [i.5] CENELEC EN 50083-1:1993: "Cable networks for television signals, sound signals and interactive services - Part 1: Safety requirements".
- [i.6] ETSI EG 201 212: "Electrical safety; Classification of interfaces for equipment to be connected to telecommunication networks".
- [i.7] BS EN 61000-6-3:2001: "Electromagnetic compatibility (EMC). Generic standards. Emission standard for residential, commercial and light-industrial environments.".
- [i.8] BS EN 61000-6-4:2001: "Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments".

- [i.9] EN 50083-2:2001: "Cabled distribution systems for television and sound signals. Electromagnetic compatibility for equipment".
- [i.10] ETSI TS 102 639-1: Access and Terminals, Transmission and Multiplexing (ATTM); Third Generation Transmission Systems for Interactive Cable Television Services - IP Cable Modems; Part 1: General".
- [i.11] CEA-542-B: " Cable Television Channel Identification Plan".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

ceiling (ceil): ceiling function rounds a number up to the nearest integer or nearest multiple of significance

NOTE: Use: Ceiling (number, significance).

Cable Modem (CM): modulator-demodulator at subscriber locations intended for use in conveying data communications on a cable television system

Customer Premises Equipment (CPE): equipment at the end user's premises; may be provided by the service provider

Carrier-to-Noise Ratio (C/N or CNR): ratio of signal power to noise power in a defined measurement bandwidth. For digital modulation, $CNR = E_s/N_0$, the energy-per symbol to noise-density ratio; the signal power is measured in the occupied bandwidth, and the noise power is normalized to the modulation-rate bandwidth

NOTE: For analog NTSC video modulation, the noise measurement bandwidth is 4 MHz.

Decibels (dB): ratio of two power levels expressed mathematically as $dB = 10 \log_{10}(P_{OUT}/P_{IN})$

Decibel-Millivolt (dBmV): unit of RF power expressed in decibels relative to 1 millivolt over 75 Ω , where $dBmV = 20 \log_{10}(\text{value in mV}/1 \text{ mV})$

Decibel-Microvolt (dB μ V): unit of RF power expressed in decibels relative to 1 microvolt over 75 Ω , where $dB\mu V = 20 \log_{10}(\text{value in } \mu V/1 \mu V)$

Electronic Industries Alliance (EIA): voluntary body of manufacturers which, among other activities, prepares and publishes standards.

EdgeQAM modulator (EQAM): head end or hub device that receives packets of digital video or data

NOTE: It re-packetizes the video or data into an MPEG transport stream and digitally modulates the digital transport stream onto a downstream RF carrier using quadrature amplitude modulation (QAM).

Forward Error Correction (FEC): class of methods for controlling errors in a communication system. FEC sends parity information with the data which can be used by the receiver to check and correct the data.

Gigahertz (GHz): unit of frequency; 1 000 000 000 or 10⁹ Hz

Hertz (Hz): unit of frequency; formerly cycles per second

Harmonic Related Carriers (HRC): method of spacing channels on a cable television system with all carriers related to a common reference

Hybrid Fiber/Coax System (HFC): broadband bidirectional shared-media transmission system using optical fiber trunks between the head-end and the fiber nodes, and coaxial cable distribution from the fiber nodes to the customer locations

Incremental Related Carriers (IRC): method of spacing NTSC television channels on a cable television system in which all channels are offset up 12,5 kHz with respect to the CEA-542-B [i.12] standard channel plan except for channels 5 and 6

kilohertz (kHz): unit of frequency; 1 000 or 103 Hz; formerly kilocycles per second

Media Access Control (MAC): used to refer to the layer 2 element of the system which would include DOCSIS framing and signaling

Megahertz (MHz): unit of frequency; 1 000 000 or 106 Hz; formerly megacycles per second

Modulation Error Ratio (MER): ratio of the average symbol power to average error power

M/N: relationship of integer numbers M,N that represents the ratio of the downstream symbol clock rate to the DOCSIS master clock rate

Multiple System Operator (MSO): corporate entity that owns and/or operates more than one cable system.

National Television Systems Committee (NTSC): committee which defined the analog, colour television, broadcast standards in North America

NOTE: The standards television 525-line video format for North American television transmission is named after this committee.

NGNA LLC: company formed by cable operators to define a next-generation network architecture for future cable industry market and business requirements

Physical Media Dependent Sublayer (PMD): sublayer of the Physical layer which is concerned with transmitting bits or groups of bits over particular types of transmission link between open systems and which entails electrical, mechanical and handshaking procedures

QAM channel (QAM ch): analog RF channel that uses quadrature amplitude modulation (QAM) to convey information

Quadrature Amplitude Modulation (QAM): modulation technique in which an analog signal's amplitude and phase vary to convey information, such as digital data

Radio Frequency (RF): portion of the electromagnetic spectrum from a few kilohertz to just below the frequency of infrared light

Radio Frequency Interface (RFI): term encompassing the downstream and the upstream radio frequency interfaces

Root Mean Square (RMS): square root of the mean value squared a function

Self-Aggregation: method used to compute the headend noise floor by summing measured noise from a single device over a specified output frequency range

Standard Channel Plan (STD): method of spacing NTSC television channels on a cable television system defined in [CEA-542-B]

Upstream Channel Descriptor (UCD): MAC Management Message used to communicate the characteristics of the upstream physical layer to the cable modems

Video on Demand (VoD): system that enables individuals to select and watch video content over a network through an interactive television system

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CMCI	Cable Modem CPE Interface
CMTS	Cable Modem Termination System
DOCSIS	Data-Over-Cable Service Interface Specifications
ERMI	Edge Resource Manager Interface
ISO	International Standards Organization
ITU	International Telecommunications Union
ITU-T	Telecommunication Standardization Sector of the ITU
MPEG	Moving Picture Experts Group
NGNA	Next Generation Network Architecture, see NGNA LLC

OSSI Operations System Support Interface
PHY Physical Layer

Endorsement notice

Modifications to ITU-T Recommendation J.210

The elements of ITU-T Recommendation J.210 [4] (11/2006) apply, with the following modifications:

NOTE: Underlining and/or strike-out are used to highlight detailed modifications where necessary.

Replace references given in J.210 as shown in table 1.

Table 1

	Reference(s) in J.210 [5]	Replaced reference(s)
1	ITU-T Recommendation J.122	ETSI ES 202 488-2

Delete annex B as it is not applicable.

Delete reference ITU-T Recommendation J.83-C as it is not applicable.

Delete reference to Article 23/26 as it is not applicable.

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