

**Access, Terminals, Transmission and Multiplexing (ATTM);
Third Generation Transmission Systems for
Interactive Cable Television Services - IP Cable Modems;
Part 3: Downstream Radio Frequency Interface;
DOCSIS 3.0**

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Foreword

This draft European Standard (EN) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

The present document is part 3 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.7].

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

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1 Scope and purpose

1.1 Scope

The present document defines the RF characteristics required in the downstream transmitter(s) of DOCSIS 3.0 CMTSs and EQAMs, sufficiently enough to permit vendors to build devices that meet the needs of cable operators around the world.

In addition to defining these requirements for a DOCSIS 3.0 device, the present document could also be applicable to other devices such as:

- an Edge QAM (EQAM) not being used for DOCSIS 3.0 services; or
- an integrated Cable Modem Termination System [CMTS] with multiple downstream channels per RF port previous to DOCSIS 3.0.

There are differences in the cable spectrum planning practices adopted for different networks in the world. Therefore two options for physical layer technology are included, which have equal priority and are not required to be interoperable. One technology option is based on the downstream multi-program television distribution that is deployed in North America using 6 MHz channelling. The other technology option is based on the corresponding European multi-program television distribution. Both options have the same status, notwithstanding that the document structure does not reflect this equal priority. The first of these options is defined in clauses 5, 6 and 7, whereas the second is defined by replacing the content of those clauses with the content of annex A. Correspondingly, [4] and [2] apply only to the first option, and EN 300 429 [8] only to the second. Compliance with the present document requires compliance with the one or the other of these implementations, not with both. It is not required that equipment built to one option shall interoperate with equipment built to the other.

A DRFI-compliant device may be a single-channel only device, or it may be a multiple-channel device capable of generating one or multiple downstream RF carriers simultaneously on one RF output port. An EQAM may be a module of a modular cable modem termination system (M-CMTS) and be used for delivering a high-speed data service or it may serve as a component of a digital video or Video-on-Demand (VoD) system, delivering high quality digital video to subscribers. These specifications are crafted to enable an EQAM to be used without restriction in either or both service delivery scenarios simultaneously. "Simultaneous" in the early deployments means that if a RF output port has multiple QAM channels, some channel(s) may be delivering high-speed data while some other channel(s) may be delivering digital video. The present document enables future uses, wherein a single QAM channel may share bandwidth between high-speed data and digital video in the same MPEG transport stream.

Conceptually, an EQAM will accept input via an Ethernet link, integrate the incoming data into an MPEG transport stream, modulate one of a plurality of RF carriers, per these specifications, and deliver the carrier to a single RF output connector shared in common with all modulators. Conceivably, a single EQAM RF channel could be used for data and video simultaneously. The reason that an EQAM RF channel can be used for either is that both digital video and DOCSIS data downstream channels are based on ITU-T Recommendation J.83 [4], annex B for cable networks in North America and EN 300 429 [8] for cable networks deployed in Europe. On downstream channels complying to ITU-T Recommendation J.83 [4], annex B, typically, the only difference between an EQAM RF channel operating in a video mode and an EQAM RF channel operating in DOCSIS data mode is the interleaver depth (see clauses 6.3.1 and 6.3.3). DOCSIS data runs in a low latency mode using a shallow interleaver depth at the cost of some burst protection. DOCSIS data can do this because if a transmission error occurs, the higher layer protocols will request re-transmission of the missing data. For video, the sequence of frames in the program is both time sensitive and order sensitive and cannot be re-transmitted. For this reason, video uses a deeper interleaver depth to provide more extensive burst protection and deliver more of the program content without loss. The penalty video pays is in latency. The entire program content is delayed by a few milliseconds, typically, and is invisible to the viewers of the program. The conflicting demands for interleaver depth are what prevent a single EQAM RF channel from being used optimally for video and DOCSIS data simultaneously. A traditional integrated CMTS, however, is used solely for DOCSIS data.

1.2 Purpose of Document

The purpose of the present document is to define the RF characteristics required in the downstream transmitter(s) of CMTSs and EQAMs, sufficiently enough to permit vendors to build devices that meet the needs of cable operators around the world.

1.3 Use of References in the present document

The present document will not attempt to wholly replicate the normative references provided in the document. However, it will use extracted portions of said documents where it adds clarity to the present document. For fuller understanding of the present document, the most recent versions of [4] annex B or EN 300 429 [8], respectively, as well as ES 202 488-2 [1] should be available for reference.

1.4 Requirements

Throughout the present document, the words that are used to define the significance of particular requirements are capitalized. These words are:

"MUST"	This word means that the item is an absolute requirement of this specification.
"MUST NOT"	This phrase means that the item is an absolute prohibition of this specification.
"SHOULD"	This word means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighed before choosing a different course.
"SHOULD NOT"	This phrase means that there may exist valid reasons in particular circumstances when the listed behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.
"MAY"	This word means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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 necessary for the application of the present document.

- [1] 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".
- [2] CEA-542-B (July 2003): "Cable Television Channel Identification Plan".
- [3] ANSI/SCTE 02 (2006): "Specification for "F" Port, Female Indoor".
- [4] ITU-T Recommendation J.83 (April 1997 - Annex B): "Digital multi-programme systems for television, sound and data services for cable distribution".
- [5] ISO/IEC 13818-1 (2000): "Information Technology - Generic Coding Of Moving Pictures and Associated Audio Systems Recommendation H.222.0".
- [6] Cable Television Laboratories, Inc. CM-SP-RFIV2.0-C02-090422 (April 2009): "Data-Over-Cable Service Interface Specifications - DOCSIS 2.0 - Radio Frequency Interface Specification".