



**Integrated broadband cable  
telecommunication networks (CABLE);  
Cable Customer Premises Equipment (CPE) with  
Integrated Radio and Non-Radio Interfaces;  
Technical Specification covering the cable equipment  
technical requirements in support of  
Harmonised Standards for the essential requirements  
of article 3.1b of the Directive 2014/53/EU**

---

Reference

DTS/CABLE-00023

---

Keywords

CABLE

**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° 7803/88

---

**Important notice**

The present document can be downloaded from:  
<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at  
<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:  
<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

---

**Copyright Notification**

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.  
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2016.  
All rights reserved.

**DECT™**, **PLUGTESTS™**, **UMTS™** and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.  
**3GPP™** and **LTE™** are Trade Marks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.  
**GSM®** and the GSM logo are Trade Marks registered and owned by the GSM Association.

---

# Contents

Intellectual Property Rights .....	4
Foreword.....	4
Modal verbs terminology.....	4
Introduction .....	4
1 Scope .....	6
2 References .....	6
2.1 Normative references .....	6
2.2 Informative references.....	7
3 Definitions and abbreviations.....	8
3.1 Definitions.....	8
3.2 Abbreviations .....	8
4 Overview of Types of Cable Equipment.....	9
5 Relevant Receiver and Transmitter Parameters .....	10
5.1 Non-radio function .....	10
5.2 Radio Function .....	12
6 Primary and Secondary network interfaces.....	12
6.1 General .....	12
6.2 Functional representation of the cable equipment .....	13
7 Test and Measurements .....	14
7.1 Introduction .....	14
7.2 Test configuration.....	14
7.3 Measurements.....	15
7.3.1 General.....	15
7.3.2 Emission Measurements .....	15
7.3.3 Immunity Measurements .....	15
<b>Annex A (informative): Bibliography.....</b>	<b>16</b>
History .....	17

---

## Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

---

## Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Integrated broadband cable telecommunication networks (CABLE).

---

## Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

---

## Introduction

In 2014 the new Radio Equipment directive has been published by the EU commission (Radio Equipment Directive 2014/53/EU, OJ L153 22 May 2014 [i.1]). This directive will replace the existing Radio & Telecommunication Terminal Equipment Directive (RTTED) 1999/5/EC [i.2]. The new directive has to be implemented into national law before the 13<sup>th</sup> of June 2016. Before this date, Harmonised Standards need to be developed to be compliant with the new requirements included in the Directive 2014/53/EU [i.1] such that Cable Customer Premises Equipment (CPE) with integral non-radio and radio network interfaces compliance to article 3.1 of Directive 2014/53/EU [i.1] may be verified.

The present document applies to Cable CPE with integrated non-radio and radio interfaces.

The schedule for the Radio Equipment Directive 2014/53/EU [i.1] is:

- 12<sup>th</sup> June 2014, RED [i.1] comes into force;
- 12<sup>th</sup> June 2016 is the date by when Member States are required to implement RED [i.1] into their national laws;
- July 2017 is a transition period for RED [i.1] during which period the RTTED [i.2] may still be used i.e. one year transition period.

A new product entering the market after the 13<sup>th</sup> June 2016 is required to meet the requirements of RED [i.1].

The RED [i.1] is replacing the RTTED [i.2], however as the name implies, RTTE has become RE (no more 'TTE') therefore Telecom Terminal Equipment (TTE), has been removed from the Radio Equipment Directive:

- Cable modems and cable receiver equipment with a non-radio network interface i.e. fixed line cable RF network interface, will continue to have to comply with all other applicable Directives. In terms of the Directives EMC [i.3] and LVD [i.4].
- New LVD [i.4] and EMC Directives [i.3] apply from 20 April 2016.

NOTE: DOCSIS® is a registered Trade Mark of Cable Television Laboratories, Inc., and is used in the present document with permission.

---

# 1 Scope

The present document provides technical requirements for cable CPE with integrated radio and non-radio interfaces in support of Harmonised Standards for the essential requirements of article 3.1b of the Radio Equipment Directive 2014/53/EU [i.1].

Cable equipment comprises integrated non-radio and radio network interfaces. These functions are integrated either on the same integrated electronic components on the same printed circuit board or by separate integrated components on the same printed circuit boards but housed in the same equipment enclosure. The non-radio function is the Cable RF as specified by ETSI EN 302 878-2 [1] for data communication services and by ETSI EN 300 429 [2] for video communication services. The radio function is a wireless local area network operating in the 2,4 GHz and 5 GHz frequency bands according to IEEE 802.11 [3].

NOTE: Cable equipment does not comprise separate radio and non-radio products that are combined in one enclosure. Where cable equipment of this type exist then the essential requirements of article 3.1b of Directive 2014/53/EU [i.1] apply to the equipment and the equipment requirements are as specified by ETSI draft harmonised standard ETSI EN 303 446-1 [i.5], at the time of writing it is under development ETSI TC ERM WGEMC.

---

## 2 References

### 2.1 Normative 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 referenced 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.

The following referenced documents are necessary for the application of the present document.

- [1] ETSI EN 302 878-2: "Access, Terminals, Transmission and Multiplexing (ATTM); Third Generation Transmission Systems for Interactive Cable Television Services - IP Cable Modems; Part 2: Physical Layer; DOCSIS 3.0".
- [2] ETSI EN 300 429: "Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for cable systems".
- [3] IEEE 802.11™-2012: "IEEE Standard for Information Technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".
- [4] ETSI EN 302 878-3: "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".
- [5] CENELEC EN 60728-1: "Cable networks for television signals, sound signals and interactive services - Part 1: System performance of forward paths".
- [6] ETSI EN 301 489-1: "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Harmonised Standard covering the essential requirements of article 3.1(b) of the Directive 2014/53/EU and the essential requirements of article 6 of the Directive 2014/30/EU; Part 1: Common technical requirements".

- [7] ETSI EN 301 489-17: "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard covering the essential requirements of article 3.1(b) of the Directive 2014/53/EU".

## 2.2 Informative 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 referenced document (including any amendments) applies.

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

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.
- [i.2] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.
- [i.3] Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast).
- [i.4] Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits (recast).
- [i.5] ETSI EN 303 446-1: "ElectroMagnetic Compatibility (EMC) Standard for radio equipment and services; Part 60: Specific conditions for combined radio and non-radio equipment in the domestic environment. Harmonised Standard covering the essential requirements of article 3.1(b) of the Directive 2014/53/EU".
- [i.6] IEEE 802.11b™: "IEEE Standard for Information Technology - Telecommunications and information exchange between systems - Local and Metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: Higher Speed Physical Layer (PHY) Extension in the 2.4 GHz band".
- [i.7] IEEE 802.11g™: "IEEE Standard for Information Technology - Telecommunications and information exchange between systems - Local and Metropolitan Area Networks - Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Further Higher Data Rate Extension in the 2.4 GHz Band".
- [i.8] IEEE 802.11n™: "IEEE Standard for Information technology -- Local and metropolitan area networks -- Specific requirements -- Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 5: Enhancements for Higher Throughput".
- [i.9] IEEE 802.11a™: "IEEE Standard for Information Technology - Telecommunications and information exchange between systems - Local and Metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: High Speed Physical Layer in the 5 GHz band".
- [i.10] CM-SP-CMCIv3.0-I02-140729: "Cable Modem to Customer Premise Equipment Interface Specification".
- [i.11] ETSI TS 103 161-14: "Access, Terminals, Transmission and Multiplexing (ATTM); Integrated Broadband Cable and Television Networks; IPCablecom 1.5; Part 14: Embedded MTA Analog Interface and Powering Specification".

- [i.12] IEEE 802.11ac™: "IEEE Standard for Information technology -- Telecommunications and information exchange between systems - Local and metropolitan area networks -- Specific requirements -- Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications -- Amendment 4: Enhancements for Very High Throughput for Operation in Bands below 6 GHz".

## 3 Definitions and abbreviations

### 3.1 Definitions

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

**Bluetooth™ system:** equipment in compliance with Bluetooth™ specification

NOTE: Bluetooth™ is an example of a suitable product available commercially. This information is given for the convenience of users of the present document and does not constitute an endorsement by ETSI of this product.

**combined equipment:** any combination of non-radio equipment that requires a plug-in radio device to offer full functionality

**Cable Equipment:** cable modem and cable receiver (analogue or digital) within the domestic environment

**Cable Equipment with integrated radio and non-radio functions:** cable equipment with a DOCSIS® [1] and/or DVB-C [2] transceiver and a wireless LAN IEEE 802.11 [3] operating in the 2,4 GHz and 5 GHz frequency bands with their functions integrated either on the same integrated electronic components on the same printed circuit board or by separate integrated components on the same printed circuit boards but housed in the same equipment enclosure

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

**Decibels (dB):** logarithmic unit used to express the ratio of two values of a physical quantity

**Decibel-Millivolt (dBmV):** dB measurement system wherein 0 dBmV is defined as 1 millivolt over 75 Ω

**MOCA 2.0:** set of standards developed by Multimedia Over Coax Alliance.

**USB:** common interface that enables communication between devices and a host controller

### 3.2 Abbreviations

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

BER	Bit Error Rate
C/I	Carrier to Interference
C/N	Carrier to Noise
CENELEC	European Committee for Electrotechnical Standardisation
CMCI	Cable Modem to CPE Interface
CPE	Customer Premises Equipment
DECT	Digital European Cordless Telecommunications
DOCSIS®	Data Over Cable Service Interface Specification
DVB-C	Digital audio broadcast - cable
EMC	Electro-Magnetic Compatibility
EN	European Norm
ETSI	European Telecommunications Institute
EUT	Equipment under test
HDMI	High Definition Multimedia Interface
IP	Internet Protocol
ISM	Industrial, scientific and medical
LAN	Local Area Network

LVD	Low Voltage Directive
MOCA	Multimedia over Coax Alliance
PAL	Phase alternation line
PHY	Physical
QAM	Quadrature Amplitude Modulation
RED	Radio Equipment Directive
RF	Radio Frequency
SECAM	Séquentiel couleur avec mémoire (French colour TV standard)
TV	Television
USB	Universal Serial Bus
WGEMC	Working group electromagnetic compatibility
WiFi	Wireless Fidelity

---

## 4 Overview of Types of Cable Equipment

There are two categories of equipment to consider:

- Cable Modem Equipment supporting DOCSIS® for data and telephony services
- Cable Receiver Equipment either PAL & SECAM video analogue services or DVB-C video digital services

Within the present document these two categories of equipment are covered. There may be several equipment types of these two categories supporting a combination of data, telephony and video services. Such equipment may be classified by the cable industry such as a Residential Gateway of a headend and headless type, a set-top box and a TV receiver, all of which may support both an integrated radio and non-radio network interface.

There may be several types of radio and non-radio network functions integrated within the equipment. There is always a non-radio network interface i.e. a RF fixed line interface supporting DOCSIS® [1] and DVB-C [2] and there may also be other fixed line interfaces such as MOCA 2.0, Ethernet, USB, HDMI [i.9], etc. Similarly there may be one or more different radio functions in addition to the wireless LAN IEEE 802.11 [3] such as DECT, Bluetooth™ and RF wireless remote controller.

The present document refers only to the Equipment's RF cable fixed line function supporting DOCSIS® [1], [4] and DVB-C [2] i.e. its non-radio interface and its wireless LAN IEEE 802.11 [3] function i.e. its radio interface when considering the cable equipment in terms of article 3.1b of the radio equipment Directive 2014/53/EU [i.1].

Throughout the following clauses the term **Cable Equipment** where used is intended to refer to both categories of equipment, cable modem and cable receiver equipment, with integrated radio and non-radio network interfaces comprising at least a:

- wireless LAN IEEE 802.11 [3] function
- DOCSIS® [1]/DVB-C [2] cable RF function

**NOTE:** During the development of the present document, industry from the cable operator sector were consulted on their evaluation of cable equipment to requirements of article 3.1b of the Directive 2014/53/EU [i.1]. The industry identified no additional EMC tests are carried out beyond those carried out by the equipment manufacture to verify its compliance to the EMC Directive 2014/30/EU [i.3]. The industry primarily implements tests to verify the performance of the cable equipment's DOCSIS® Downstream signal in the presence of its wireless LAN IEEE 802.11 [3] but in absence of any EMC phenomenon. These tests are used to verify the integrity of the DOCSIS® signal is maintained when it is operated within the limits of its minimum and maximum signal levels across its operating frequency range with its wireless LAN IEEE 802.11 [3] radio signal active and operated on each of its radio channels. Performance of the DOCSIS® Downstream signal is measured to verify there are no additional code errors resulting from the wireless LAN 802.11 signals. These measurements are not reported within the present document as they relate to the effective use of the DOCSIS® spectrum which is out of scope of article 3.1b of the radio equipment Directive 2014/53/EU [i.1] and out of scope of the present document.

## 5 Relevant Receiver and Transmitter Parameters

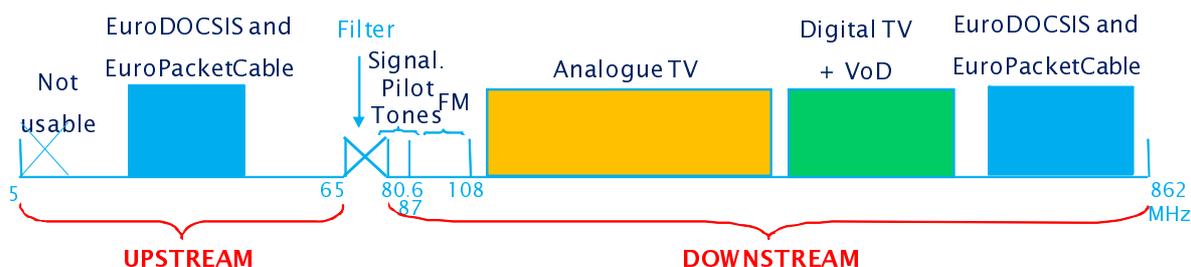
### 5.1 Non-radio function

The cable equipment's non-radio functions are its cable RF based on the DOCSIS<sup>®</sup> and DVB-C signals when delivering data and video services respectively to CPE. The present document only refers to the relevant receiver and transmitter parameters that apply to current cable equipment. Adding new receiver and transmitter parameters would result in a new type of cable equipment and a change to the requirements of ETSI DOCSIS<sup>®</sup> PHY [1] standard and a change to the ETSI DOCSIS<sup>®</sup> Downstream RF Interface standard [4] with respect to reception of data services and a change to ETSI DVB-C [2] base standard with respect to reception of video signals.

Developing cable equipment with new receiver and transmitter signalling parameters would produce a new cable equipment product category and developing a new cable equipment product category is not within the scope of the present document.

The cable equipment for the European Technology option for DOCSIS<sup>®</sup> 3.0 [1] and [4] is operated in the frequency range as illustrated in figure 1.

- Downstream operating frequency ranges 85 MHz to 862 MHz
- Upstream operating frequency ranges 5 MHz to 65 MHz



**Figure 1: Example of cable RF spectrum raster for upstream and downstream**

The cable RF transmitter and receiver has transmission parameters with characteristics for the data communication services specified by ETSI DOCSIS<sup>®</sup> PHY [1] and ETSI DOCSIS<sup>®</sup> Downstream RF Interface standard [4]. There are no additions or changes to these cable RF receiver and transmitter parameters to be specified when considering the cable equipment radio function compliance to Directive 2014/53/EU article 3.1b [i.1].

The RF modulated signals (receive signal parameters) at the input to the cable equipment are as given in Table B-16 of ETSI EN 302 878-3 [4].

A summary of the RF modulated maximum and minimum operating signal requirement and its minimum C/N ratio is as given in table 1 for modulation profiles QAM 64 and QAM 256 within a 8 MHz channel over the centre frequency range 112 MHz to 858 MHz.

**Table 1: DOCSIS<sup>®</sup> 3.0, RF Receiver Parameters**

RF transmitter parameter (DOCSIS <sup>®</sup> 3.0) one DOCSIS <sup>®</sup> channel Minimum signal level	RF transmitter parameter (DOCSIS <sup>®</sup> 3.0) one DOCSIS <sup>®</sup> channel Maximum signal level	QAM Modulation	Minimum C/N ratio
-17 dBmV	+13 dBmV	QAM 64	25,5
-13 dBmV	-6 dBmV	QAM 256	34,5
-6 dBmV	+17 dBmV	QAM 256	31,5

For video analogue services, table 2 presents a summary of the requirements for the cable RF input signal transmission parameters minimum and maximum signal power levels as well as the desired carrier to noise ratio and carrier to interference ratio under normal operating conditions. These RF parameters are specified by CENLEC EN 60728-1 [5] and summarized in table 2.

**Table 2: Video Analogue, Receiver Parameters**

Analogue Video System	RF transmitter parameters Minimum signal level	RF transmitter parameters Maximum signal level	Minimum C/N	Minimum C/I
PAL/SECAM	-3 dBmV	17 dBV	> 44 dB	> 57 dB

For the video digital services, table 3 presents a summary of the requirements for the cable RF input signal transmission parameters relevant for the video digital services according to ETSI DVB-C [2] standard. The minimum and maximum signal levels and signal to noise ratio are specified by CENELEC 60728-1 [5] and as summarized in table 3. These values assume a BER of  $10^{-2}$  for Reed Solomon decoder can be achieved and an intermodulation rate that is negligible.

**Table 3: Video Digital, Receiver Parameters**

Digital Video System	RF transmitter parameters Minimum signal level	RF transmitter parameters Maximum signal level	Minimum S/N Ratio
DVB-C 64QAM	-13 dBmV	7 BmV	26 dB
DVB-C 256QAM	-6 dBmV	14 BmV	32 dB

The signal parameters given in table 1 to 3 present the signal limits when the RF cable transceiver is operated across the frequency 87 MHz to 862 MHz in the downstream.

The output transmitter signal characteristics are as specified in table B-15 of ETSI DOCSIS® PHY [1] standard and is as given in table 4.

**Table 4: Cable equipment non-radio interface transmitter signal characteristics**

Parameter	Value
Frequency	5 MHz to 65 MHz edge to edge
Level range per channel (Multiple Transmit Channel mode disabled, or Multiple Transmit Channel mode enabled with only one channel in the TCS)	TDMA: $P_{min}$ to +57 dBmV (32-QAM, 64-QAM) $P_{min}$ to +58 dBmV (8-QAM, 16-QAM) $P_{min}$ to +61 dBmV (QPSK) S-CDMA: $P_{min}$ to +56 dBmV (all modulations) where $P_{min}$ = +17 dBmV, 1 280 kHz modulation rate $P_{min}$ = +20 dBmV, 2 560 kHz modulation rate $P_{min}$ = +23 dBmV, 5 120 kHz modulation rate
Level range per channel (two channels in the TCS)	TDMA: $P_{min}$ to +54 dBmV (32-QAM, 64-QAM) $P_{min}$ to +55 dBmV (8-QAM, 16-QAM) $P_{min}$ to +58 dBmV (QPSK) S-CDMA: $P_{min}$ to +53 dBmV (all modulations) where $P_{min}$ = +17 dBmV, 1 280 kHz modulation rate $P_{min}$ = +20 dBmV, 2 560 kHz modulation rate $P_{min}$ = +23 dBmV, 5 120 kHz modulation rate

The signal parameters given in table 4 present the signal limits when the RF cable transmitter is operated across the frequency 5 MHz to 65 MHz in the downstream.

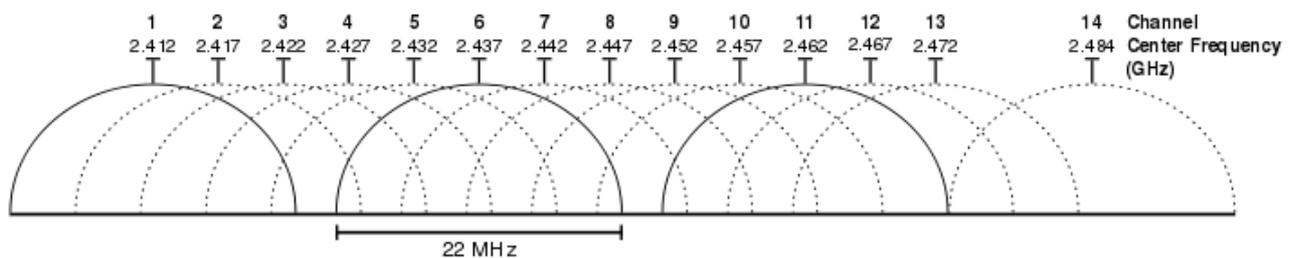
## 5.2 Radio Function

The cable equipment's radio function is its wireless LAN IEEE 802.11 [3] operating the variants of the protocol as specified in IEEE 802.11 [3]. The radio interface transmit signals are as specified by IEEE 802.11 [3] for the different wireless LAN protocol variants. There are no requirements to specify any additional radio signal parameters when considering the radio interface integrated within a cable equipment for its compliance verification to article 3.1b of Directive 2014/53/EU [i.1].

The wireless LAN IEEE 802.11 [3] radio interface in the 2,4 GHz ISM Band is operated in the frequency range as illustrated in figure 2.

The 2,4 GHz band is divided into 14 channels spaced 5 MHz apart, beginning with channel 1, which is centered on 2,412 GHz.

- Frequency range 2,412 GHz to 2,484 GHz
- Channels 1 to 14



**Figure 2: Illustration of the wireless LAN IEEE 802.11 [3] channels in 2,4 GHz ISM band**

The wireless LAN IEEE 802.11 [3] radio interface in the 5 GHz ISM Band is operated in the frequency range 5 180 MHz to 5 825 MHz divided into channels spaced 20 MHz apart, beginning with channel 36 and ending with channel 165.

The wireless LAN IEEE 802.11 [3] variants operate on the frequency bands as given below:

2,4 GHz ISM Frequency band:

- LAN IEEE 802.11b [i.6]
- IEEE 802.11g [i.7]
- IEEE 802.11n [i.8]

5 GHz ISM Frequency band:

- LAN IEEE 802.11a [i.9]
- IEEE 802.11n [i.8]
- IEEE 802.11ac [i.12]

---

## 6 Primary and Secondary network interfaces

### 6.1 General

The cable equipment's primary network interface is its Cable RF function, the non-radio interface. Since a wireless LAN IEEE 802.11 [3] network interface is integrated then the complete radio equipment is termed as being a radio equipment under Directive 2014/53/EU [i.1].

Its wireless LAN IEEE 802.11 [3] interface may be considered as a secondary network interface since it simply transfers the wanted signal over wireless to the CPE. The transfer of the wanted signal from the cable equipment to the CPE could also be accomplished by connecting the CPE to the cable equipment's fixed line ports such as to its USB port and/or its Ethernet port.

## 6.2 Functional representation of the cable equipment

The Cable Equipment is located in the customer's home. It delivers the operators communication services to the CPE such as a personal computer, TV, or any other compatible consumer electronic CPE. The connectivity from the Cable Equipment to the consumers CPE within the home network may be either by a fixed port using Ethernet, USB or by its WiFi antenna. This is the CMCI interface as specified by CableLabs [i.10] and ETSI TS 103 161-14 [i.11].

The primary signal source to the input of the cable equipment cable RF port is the signals that are communicated over its non-radio function, the RF cable interface. The transmitter and receiver characteristics of the signal are as specified in clause 5.

The cable modem equipment comprises an e-router, wifi, POTS and processing functions. It has input and output ports that receive and transmit signals using DOCSIS<sup>®</sup> 3.0 [1] and [4], DVB-C [2] and IP. The prime source of the signals from the service provider are delivered to the cable equipment's RF input cable port over the cable access network using DOCSIS<sup>®</sup> 3.0 [1] and [4] (data services) and DVB-C [2] (video services). After being processed the contents are delivered using IP to the connected CPE's by its fixed network Ethernet/USB ports and by its radio wireless LAN IEEE 802.11 port. These output ports from the cable equipment are as defined by CMCI specifications [i.10].

Figure 3 illustrates the functional representation of a typical cable modem and figure 4 for a digital cable receiver.

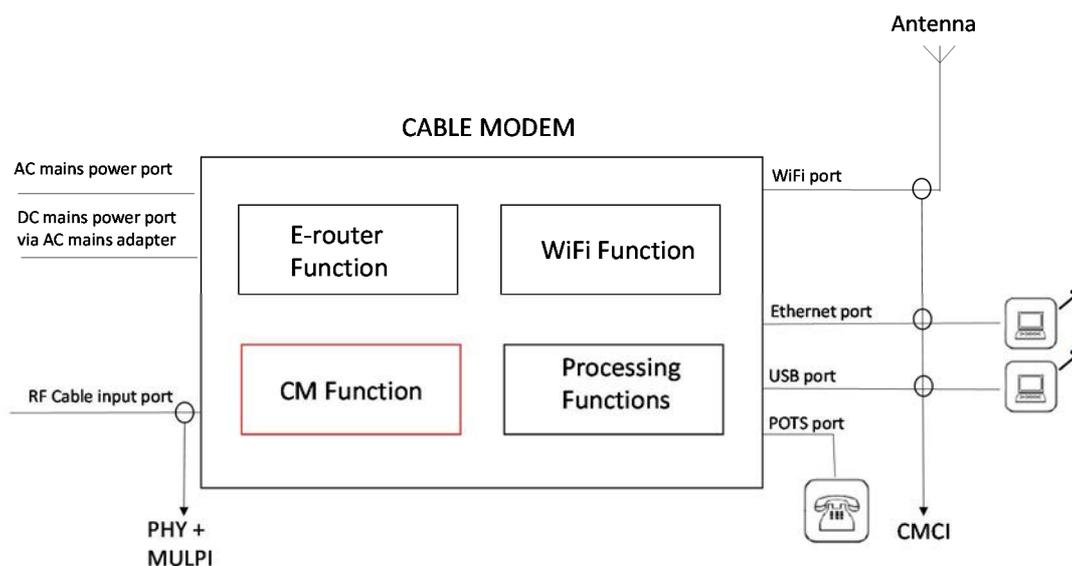


Figure 3: Illustration of the functional representation of a typical cable modem

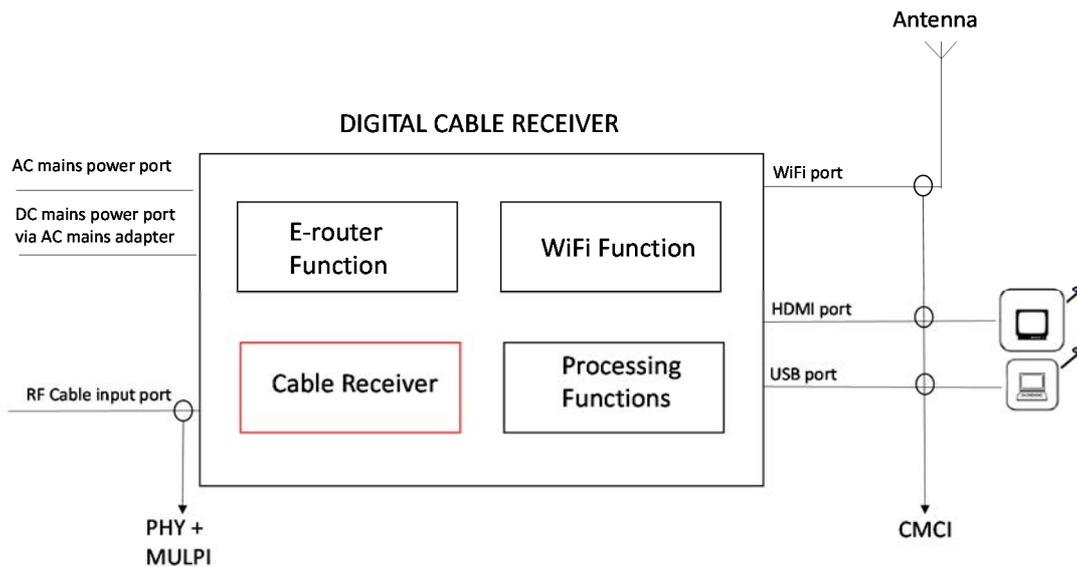


Figure 4: Illustration of the functional representation of a typical digital cable receiver

## 7 Test and Measurements

### 7.1 Introduction

For the purpose of the cable equipment within the scope of the present document, the test conditions of ETSI EN 301 489-1 [6], clause 4 together with ETSI EN 301 489-17 [7] for the wireless LAN IEEE 802.11 function applies.

### 7.2 Test configuration

When carrying out the emissions and immunity tests to the radio function the test should follow the requirements of ETSI EN 301 489-1 [6] and for the wireless function operating at the frequency bands 2,4 GHz and 5 GHz as declared to be supported by the manufacture, it shall follow the tests as defined in ETSI EN 301 489-17 [7].

During the assessment of the cable equipment, the operational mode of the cable equipment's radio function shall be selected to cause maximum emissions and minimize on its immunity responses. The tests defined by ETSI EN 301 489-1 [6] and ETSI EN 301 489-17 [7] shall be selected.

No additional tests are required to assess the presumption of conformity of the cable equipment's radio function, the wireless LAN IEEE 802.11 [3].

The radio function shall be tested whilst the cable equipment's non-radio function, its cable RF, is active with its receive signal parameters set to their minimum and maximum limits as given in table 1 for the data service. The tests shall be repeated with the receive signal parameters set to the limits for the video analogue service as given by table 2 and table 3 for the video digital service. The transmitter signal parameters shall be set to the values as given by table 4 for the modulation profiles supported to cause the maximum emissions and minimize on its immunity responses to reflect its normal operation as intended by the manufacturer.

The cable equipment when integrated with a radio network interface becomes a radio equipment in terms of compliance with article 3.1b of Directive 2014/53/EU [i.1].

The use on ETSI EN 301 489-1 [6] together with ETSI EN 301 489-17 [7] covers both conducted emissions from wired network ports and immunity from interference on wired network ports, see applicability tables in clauses 7.1 and 7.2 of ETSI EN 301 489-1 [6] for details.

## 7.3 Measurements

### 7.3.1 General

When a radio wireless LAN IEEE 802.11 [3] is integrated into the cable equipment, measurements of its radio function shall be carried out with the non-radio function (cable RF) active such that it is transmitting and receiving signals within its minimum and maximum transmitter parameter limits as specified in clause 5 for each of the modulation profiles supported.

Measurements of the radio wireless LAN IEEE 802.11 [3] for emissions and immunity shall be carried out in accordance with ETSI EN 301 489-1 [6] and ETSI EN 301 489-17 [7]. No additional measurements are required when assessing the compliance of the cable equipment's radio function to article 3.1b of Directive 2014/53/EU [i.1].

### 7.3.2 Emission Measurements

During emission measurements the radio transmitter shall be in both idle and transmit modes. The following shall be taken into account:

- Harmonics and spurious disturbances associated with the wanted transmit signal, shall be ignored.
- Emission in the exclusion bands shall be ignored.

### 7.3.3 Immunity Measurements

During immunity measurements the radio transmitter shall be in both idle and transmit modes. The transmitter shall operate as intended within specifications defined for its use.

The following shall be taken into account:

- For the radio function, the immunity criteria defined in ETSI EN 301 489-17 [7] for the wireless LAN IEEE 802.11 [3] shall be applied.
- The EUT should not be subject to immunity testing using signals within the frequency range defined as an exclusion band in ETSI EN 301 489-17 [7].

---

## Annex A (informative): Bibliography

CENELEC EN 55024: "Information technology equipment - Immunity characteristics - Limits and methods of measurement".

CENELEC EN 55032: "Electromagnetic compatibility of multimedia equipment - Emission Requirements".

---

## History

<b>Document history</b>		
V1.1.1	July 2016	Publication