SLOVENSKI STANDARD
SIST-TP CLC/TR 50083-2-2:2014

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Kabelska omrežja za televizijske in zvokovne signale ter interaktivne storitve - 2-2. del: Vprašanje motenj za sprejem DVB-T pod vplivom signalov baznih postaj

Cable networks for television signals, sound signals and interactive services - Part 2-2: Interference issues for DVB-T reception in the presence of LTE base station signals

Kabelnetze für Fernsehsignale, Tonsignale und interaktive Dienste - Teil 2-2: Störaspekte für den DVB-T-Empfang unter Einwirkung von LTE-Basisstations-Signalen

Réseaux de distribution par câbles pour signaux de télévision, signaux de radiodiffusion sonore et services interactifs - Partie 2-2: Problèmes de perturbations concernant la réception de signaux DVB-T en présence de signaux émis par les stations de base LTE

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This Technical Report was approved by CENELEC on 2014-10-13.

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European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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Foreword

This document (CLC/TR 50083-2-2:2014) has been prepared by CLC/TC 209 “Cable networks for television signals, sound signals and interactive services”.

This document is currently submitted to voting in accordance with the Internal Regulations, Part 2, Subclause 11.4.3.3 (simple majority) for acceptance as a CENELEC Technical Report.

1 Scope

1.1 General

Standards and deliverables of EN 50083 (all parts) and EN 60728 (all parts) deal with cable networks including equipment and associated methods of measurement for headend reception, processing and distribution of television and sound signals and for processing, interfacing and transmitting all kinds of data signals for interactive services using all applicable transmission media. These signals are typically transmitted in networks by frequency-multiplexing techniques.

For instance, this includes

a) regional and local broadband cable networks,

b) extended satellite and terrestrial television distribution systems,

c) individual satellite and terrestrial television receiving systems,

and all kinds of equipment, systems and installations used in such cable networks, distribution and receiving systems.

The extent of this standardization work is from the antennas and/or special signal source inputs to the headend or other interface points to the network up to the terminal input of the customer premises equipment.

The standardization work will consider coexistence with users of the RF spectrum in wired and wireless transmission systems.

The standardization of any user terminals (i.e. tuners, receivers, decoders, multimedia terminals etc.) as well as of any coaxial, balanced and optical cables and accessories thereof is excluded.

1.2 Specific scope of CLC/TR 50083-2-2

The radiated fields produced by LTE Base Stations (LTE-BS) need special and careful attention when received by individual or community antenna television systems because of high level signals injected at the input port of wideband amplifiers placed on the antenna mast or in the headend. These high level disturbing signals in the 800 MHz band are able to cause interference problems by producing overload and/or strong intermodulation products in wide band amplifiers and to disturb or even prevent the reception of digital television signals (DVB-T) broadcast in VHF/UHF bands.

This interference problem, in a frequency band previously assigned to terrestrial television broadcasting and now to broadband telecommunication services, can be avoided or reduced both with an appropriate suitable screening efficiency of cable network and equipment and by using an appropriate and suitable filter (LTE filter) to attenuate the 800 MHz band signals received by the television antenna system and injected (conducted interference) at the input port of wideband amplifiers.

Some examples of EMC requirements relating to LTE-BS disturbing signals are described (see Clause 7) and the main characteristics of a typical LTE filter (see Clause 8) are indicated.

These additional EMC requirements for cable networks and equipment, resulting from the assignment of the 800 MHz band to LTE services, are based on:

a) the expected field strengths in the 800 MHz band due to both LTE User Equipment (LTE-UE) and LTE Base Station (LTE-BS), considered as disturbing signals;

b) the field strengths planned for terrestrial television broadcasting in the UHF band, up to 790 MHz (e.g. ch. 60),

c) the required protection of television signals with respect to both LTE-UE and LTE-BS disturbing fields.

Both LTE-BS disturbing effects and LTE-UE disturbance effects and protection requirements are therefore considered in this technical report.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50083-2, *Cable networks for television signals, sound signals and interactive services - Part 2: Electromagnetic compatibility for equipment*

IEC 60050-161, *International Electrotechnical Vocabulary (IEV) - Chapter 161: Electromagnetic compatibility*

CEPT Report 30:2009, *The identification of common and minimal (least restrictive) technical conditions for 790 - 862 MHz for the digital dividend in the European Union*

3 Term, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-161 and the following apply.

3.1.1
CATV network
originally defined as Community Antenna Television network; now covering regional and local broadband cable networks, designed to provide sound and television signals as well as signals for interactive services to a regional or local area

3.1.2
electromagnetic-active equipment
all passive and active equipment carrying RF signals is considered as electromagnetic-active equipment because it is liable to cause electromagnetic disturbances or the performance of them and is liable to be affected by such disturbances

3.1.3
extended satellite television distribution networks or systems
distribution networks or systems designed to provide sound and television signals received by satellite receiving antenna to households in one or more buildings

Note 1 to entry: This kind of network or system could eventually be combined with terrestrial antennas for the additional reception of TV and/or radio signals via terrestrial networks.

Note 2 to entry: This kind of network or system could also carry control signals for satellite switched systems or other signals for special transmission systems (e.g. MoCA or WiFi) in the return path direction.

3.1.4
extended terrestrial television distribution networks or systems
distribution networks or systems designed to provide sound and television signals received by terrestrial receiving antenna to households in one or more buildings

Note 1 to entry: This kind of network or system could eventually be combined with a satellite antenna for the additional reception of TV and/or radio signals via satellite networks.

Note 2 to entry: This kind of network or system could also carry other signals for special transmission systems (e.g. MoCA or WiFi) in the return path direction.

3.1.5
individual satellite television receiving systems
systems designed to provide sound and television signals received from satellite(s) to an individual household

Note 1 to entry: This kind of system could also carry control signals for satellite switched systems or other signals for special transmission systems (e.g. MoCA or WiFi) in the return path direction.

3.1.6
individual terrestrial television receiving systems
systems designed to provide sound and television signals received via terrestrial broadcast networks to an individual household

Note 1 to entry: This kind of system could also carry other signals for special transmission systems (e.g. MoCA or WiFi) in the return path direction.

3.1.7
local broadband cable networks
networks designed to provide sound and television signals as well as signals for interactive services to a local area (e.g. one town or one village)

3.1.8
LTE
Long Term Evolution service for broadband telecommunication networks

3.1.9
LTE-BS
Base Station used in Long Term Evolution service for broadband telecommunication networks

3.1.10
LTE-UE
User Equipment used in Long Term Evolution service for broadband telecommunication networks

3.1.11
MATV networks
originally defined as Master Antenna Television networks, now covering extended terrestrial television distribution networks or systems designed to provide sound and television signals received by terrestrial receiving antenna to households in one or more buildings

Note 1 to entry: This kind of network or system could eventually be combined with a satellite antenna for the additional reception of TV and/or radio signals via satellite networks.

Note 2 to entry: This kind of network or system could also carry other signals for special transmission systems (e.g. MoCA or WiFi) in the return path direction.

3.1.12
regional broadband cable networks
networks designed to provide sound and television signals as well as signals for interactive services to a regional area covering several towns and/or villages

3.1.13
SMATV networks
originally defined as Satellite Master Antenna Television networks, now covering extended distribution networks or systems designed to provide sound and television signals received by satellite receiving antenna to households in one or more buildings

Note 1 to entry: This kind of network or system could eventually be combined with terrestrial antennas for the additional reception of TV and/or radio signals via terrestrial networks.

Note 2 to entry: This kind of network or system could also carry control signals for satellite switched systems or other signals for special transmission systems (e.g. MoCA or WiFi) in the return path direction.

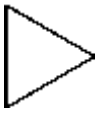
3.2 Abbreviations

For the purposes of this document, the following abbreviations are used.

AM	Amplitude Modulation
BER	Bit Error Ratio
BS	Base Station
CATV	Community Antenna Television (network)
ch.	Channel
DOCSIS	Data Over Cable Service Interface Specification
e.m.	Electromagnetic
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EuroDOCSIS	European Data Over Cable Service Interface Specification
EUT	Equipment Under Test
LO	Local Oscillator
LTE	Long Term Evolution
LTE-BS	Long Term Evolution Base Station
LTE-UE	Long Term Evolution User Equipment
MoCA	Multimedia over Cable Alliance
RBW	Resolution Bandwidth
RF	Radio Frequency
TDMA	Time Division Multiple Access
TV	Television
UE	User Equipment
WiFi	Synonym of WLAN

3.3 Symbols

For the purposes of this document, the following graphical symbols are used. These symbols are either listed in IEC 60617 (all parts) or based on symbols defined in IEC 60617 (all parts).

Graphical symbol	Reference number and title	Graphical symbol	Reference number and title
	Receiving antenna		Amplifier IEC 60617 [S01239]
	Low pass filter IEC 60617 [SO1248]		Band-pass filter IEC 60617 [S01249]
	Level meter		Stop-band filter IEC 60617 [S01250]

4 Implications of the LTE service in the 800 MHz band

4.1 Frequency allocation of LTE signals in the 800 MHz band

The frequency allocation of the LTE signals in the 800 MHz band is indicated in Figure 1. The downlink (from the LTE-BS (Base Station) to the LTE-UE (User Equipment)) is allocated in the frequency range 791 MHz to 821 MHz, while the uplink (from LTE-UE to LTE-BS) is allocated in the frequency range 832 MHz to 862 MHz. The duplex gap, 11 MHz wide, is between 821 MHz and 832 MHz. The guard band, between the last TV channel 60 in the UHF broadcasting band and the mobile communications band, is only 1 MHz wide.

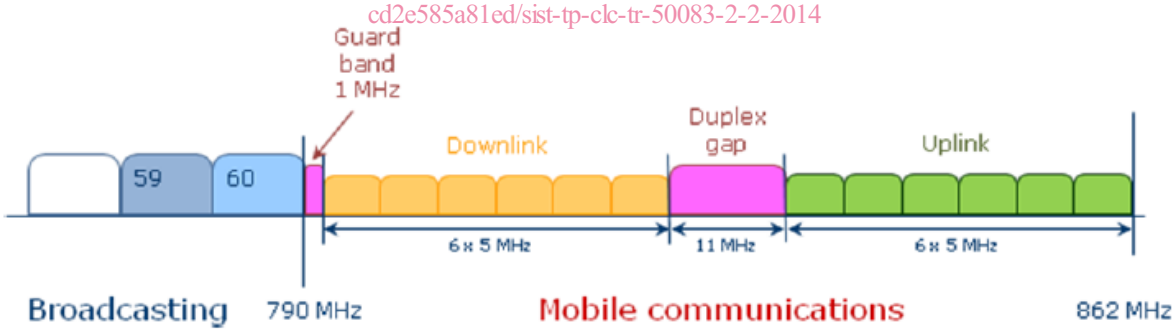


Figure 1 — Allocation of the LTE signals in the 800 MHz band

4.2 Propagation models

The field produced by the LTE-UE at short distances (a few metres) inside a room of a building can be calculated considering that the interfered apparatus or network is in line of sight and therefore a free space model is used. This model allows simple calculations and worst case approach.

The field produced by the LTE-BS at the location of the television antenna used for DVB-T signals reception can be calculated considering

a) the LTE-BS transmitting antenna radiation diagram (vertical pattern),

b) the television receiving antenna is in line of sight but at a different height with respect to LTE-BS transmitting antenna.

In this instance, therefore, the CEPT Report 30 propagation model (Annex 6), instead of the free space model, is used.

NOTE The transmitting antenna height (LTE-BS) is assumed to be 30 m and the television receiving antenna height is assumed to be 10 m or lower.

4.3 LTE-UE field strength in the 800 MHz band

The maximum radiated power P by a LTE User Equipment (LTE-UE) in the 832 MHz to 862 MHz band, can reach 25 dB(mW) and can produce a field strength E at the distance D, to be calculated by the formula:

$$E = \frac{\sqrt{30P}}{D} \cdot \qquad (1)$$

In Table 1 the calculated values of field strength E at different distances D (in free space) are presented.

Table 1 — Field strength E produced at a distance D (free space) by a radiated power P of 25 dB(mW) of a LTE-UE

D m	E V/m	E dB(μV/m)
3	1,0	120
5	0,6	116
10	0,3	110

With reference to Table 1, at a distance of 3 m, the LTE-UE can produce a field strength of **120 dB(μV/m) (1 V/m)** in the 832 MHz to 862 MHz band and, therefore, may be considered as a disturbing signal mainly within a room of a building.

4.4 LTE-BS field strength in the 800 MHz band

The radiated power P by a LTE Base Station (LTE-BS) in the 791 MHz to 821 MHz band, due to the LTE transmitter power P_T and the LTE antenna gain G_a, can produce a field strength E at the distance D, to be calculated using the CEPT Report 30 propagation model.

In Table 2 the calculated values of field strength E at different distances D (in free space) are indicated. The radiated power P (EIRP) depends on the site location (rural or urban) of the LTE Base Station. The distances D considered in Table 2 are related to field strengths in the range from 120 dB(μV/m) to 106 dB(μV/m).

Table 2 — Field strength E produced at a distance D by a radiated power P of a LTE-BS placed in rural or urban sites

Site	Transmitter power P_T dB(mW)	Antenna gain G_a dB	Equivalent transmitted power P dB(mW)	Transmitted power (EIRP) P W	Distance D m	Field strength E V/m	Field strength E dB(μV/m)
Rural	50,0	17	67,0	5 011,9	100	1,0	120
Rural	50,0	17	67,0	5 011,9	180	0,5	114
Rural	50,0	17	67,0	5 011,9	300	0,2	106
Urban	42,0	17	59,0	794,3	40	1,0	120
Urban	42,0	17	59,0	794,3	100	0,5	114
Urban	42,0	17	59,0	794,3	180	0,2	106