BRITISH STANDARD

BS EN
50083-8:2002

Cable networks for television signals, sound signals and interactive services —

Part 8: Electromagnetic compatibility for networks

The European Standard EN 50083-8:2002 has the status of a British Standard

ICS 29.020; 33.060.40

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 50083-8:2002.

The UK participation in its preparation was entrusted by Technical Committee EPL/100, Audio, video and multimedia systems and equipment, to Subcommittee EPL/100/4, Cabled distribution systems, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Additional information

Attention is drawn to Annex A of this standard which gives significant national deviations, particularly for the UK.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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This British Standard, having been prepared under the direction of the Electrotechnical Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 26 July 2002

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EUROPEAN STANDARD **EN 50083-8**

NORME EUROPÉENNE

EUROPÄISCHE NORM May 2002

ICS 29.020; 33.060.40

Supersedes EN 50083-8:2000

English version

Cable networks for television signals, sound signals and interactive services Part 8: Electromagnetic compatibility for networks

Réseaux de distribution par câbles pour signaux de télévision, signaux de radiodiffusion sonore et services interactifs
Partie 8: Compatibilité électromagnétique des réseaux

Kabelnetze für Fernsehsignale, Tonsignale und interaktive Dienste
Teil 8: Elektromagnetische Verträglichkeit von Kabelnetzen

This European Standard was approved by CENELEC on 2001-12-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 50083-8:2002 E

Foreword

This European Standard was prepared by CENELEC Technical Committee TC 209, "Cable networks for television signals, sound signals and interactive services" on the basis of EN 50083-8:2000 and the first amendment to EN 50083-8.

The text of this first amendment was submitted to the Unique Acceptance Procedure and was approved by CENELEC on 2001-12-01 to be published as part of a second edition of EN 50083-8.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2002-12-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2004-12-01

Content

1 Scope

1.1 General

Standards of EN 50083 series deal with cable networks for television signals, sound signals and interactive services including equipment, systems and installations

- for headend-reception, processing and distribution of sound and television signals and their associated data signals and
- for processing, interfacing and transmitting all kinds of signals for interactive services

using all applicable transmission media.

All kinds of networks like

- CATV-networks
- MATV- and SMATV-networks
- individual receiving networks

and all kinds of equipment, systems and installations installed in such networks, are within this scope

The extent of this standardisation work is from the antennas, special signal source inputs to the headend or other interface points to the network up to the system outlet or the terminal input, where no system outlet exists.

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

1.2 Specific scope of this part 8

This standard applies to the radiation characteristics and immunity to electromagnetic disturbance of cable networks for television signals, sound signals and interactive services and covers the frequency range 0,15 MHz to 3,0 GHz.

This standard specifies EMC performance requirements and lays down the methods of measurement.

Cable networks beyond the system outlets (e.g. the receiver lead, in simplest terms) which begin at the system outlet and end at the subscriber's terminal equipment shall comply with these recommendations provided that no other specific provisions apply.

Requirements for the electromagnetic compatibility of receiver leads are laid down in EN 60966–2–4, EN 60966–2–5 and EN 60966–2–6.

To minimise the risk of interference to other radio services caused by possible radiation from a cable network and to limit the possible penetration of external signals which may interfere with the operation of a network, it is necessary not only to use equipment which satisfies the requirements of EN 50083-2 regarding limits of radiation and of immunity to external fields but also to ensure the integrity of all cable connections on each item of active or passive cable network equipment.

Cable networks employing coaxial cables can be a source of interference to a wide range of services that utilise the radio frequency spectrum. These include not only the emergency services, safety of life, broadcasting, aeronautical and radio navigation services but also land mobile, amateur and cellular radio services.

As existing and planned radio services need to be protected, radiation limits specified for cable networks should complied with.

Additional protection for certain services may be required by national regulations.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 50083		Cable networks for television signals, sound signals and interactive services
EN 50083-2	2001	Part 2: Electromagnetic compatibility for equipment
EN 50083-3	2002	Part 3: Active wideband equipment for coaxial cable networks
EN 50083-4	1998	Part 4: Passive wideband equipment for coaxial cable networks
EN 50083-5	2000	Part 5: Headend equipment (to be published)
EN 50083-6	1997	Part 6: Optical equipment
EN 50083-7 + A1	1996 2000	Part 7: System performance
EN 50117	Series	Coaxial cables used in cable networks
EN 60966–2–4	1997	Radio frequency and coaxial cable assemblies - Part 2–4: Detail specification for cable assemblies for radio and TV receivers - Frequency range 0 to 3 000 MHz, IEC 60169–2 connectors
EN 60966–2–5	1998	Radio frequency and coaxial cable assemblies - Part 2–5: Detail specification for cable assemblies for radio and TV receivers - Frequency range 0 to 1 000 MHz, IEC 60169–2 connectors
EN 60966–2–6	1998	Radio frequency and coaxial cable assemblies - Part 2–6: : Detail specification for cable assemblies for radio and TV receivers - Frequency range 0 to 3 000 MHz, IEC 60169–24 connectors
IEC 60050(161)		International Electrotechnical Vocabulary Chapter 161: Electromagnetic compatibility.
CISPR 16–1	1993	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1: Radio disturbance and immunity measuring apparatus

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this standard, the definitions contained in IEC 60050(161) "Electromagnetic compatibility" apply. The most important definitions of IEC 60050(161) are repeated hereafter with the IEV-numbering given in brackets. In addition some more specific definitions, used in this standard, are listed.

3.1.1
(electromagnetic) radiation [IEV 161-01-10]
1. phenomenon by which energy in the form of electromagnetic waves emanates from a source into space

2. energy transferred through space in the form of electromagnetic waves

NOTE By extension, the term "electromagnetic radiation" sometimes also covers induction phenomena.

3.1.2
immunity (to a disturbance) [IEV 161-01-20]
ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

3.1.3
electromagnetic disturbance [IEV 161-01-05]
any electromagnetic phenomenon which may degrade the performance of a device, equipment or system, or adversely affect living or inert matter

NOTE An electromagnetic disturbance may be an electromagnetic noise, an unwanted signal or a change in the propagation medium itself.

3.1.4
screening effectiveness
ability of an equipment or system to attenuate the influence of electromagnetic fields from outside the equipment or system or to suppress the radiation of electromagnetic fields from inside the equipment or system

3.1.5
well-screened
A test set-up can be considered "well-screened" if its radiation level, when terminated with a matched load, is at least 20 dB below the expected radiation level of the equipment under test, the test set-up and the equipment being supplied with the same input signal level.

3.1.6
electromagnetic interference EMI (abbreviation) [IEV 161-01-06]
degradation of the performance of an equipment, transmission channel or system caused by an electromagnetic disturbance

3.1.7
operating frequency range
passband for the wanted signals for which the equipment has been designed

3.1.8
carrier-to-interference ratio
minimum level difference measured at the output of an active equipment or at any other interface within the network between the wanted signal and

- intermodulation products of the wanted signal and/or unwanted signals generated due to non-linearities;
- harmonics generated by an unwanted signal;
- unwanted signals that have penetrated into the operating frequency range;
- unwanted signals that have been converted to the frequency range to be protected (operating frequency range)

3.1.9
headend
equipment which is connected between receiving antennas or other signal sources and the remainder of the cable network, to process the signals to be distributed

NOTE The headend may, for example, comprise antenna amplifiers, frequency converters, combiners, separators and generators.

3.1.10
system outlet
device for interconnecting a subscriber feeder and a receiver lead

3.1.11
spur network
cable network normally laid out inside buildings to which splitters, subscriber taps or looped system outlets are connected

3.1.12
ignition noise
unwanted emission of electromagnetic energy, predominantly impulsive in content, arising from the ignition system within a vehicle or device

3.1.13
building penetration loss
ability of buildings, in which networks for distribution of television and sound are located, to attenuate the influence of electromagnetic fields from outside the buildings or to suppress the radiation of electromagnetic fields from inside the buildings

3.1.14
disturbance level
level of an electromagnetic disturbance at a given location, which results from all contributing (interference) sources

3.1.15
degradation (of performance) [IEV 161-01-19]
undesired departure in the operational performance of any device, equipment or system from its intended performance

NOTE The term "degradation" can apply to temporary or permanent failure.

3.1.16
subscriber's feeder
feeder connecting a subscriber tap to a system outlet or, where the latter is not used, directly to the subscriber equipment

NOTE A subscriber feeder may include filters and balun transformer.

3.1.17
receiver lead
lead which connect the system outlet to the subscriber equipment

3.1.18
external immunity [IEV 161-03-07]
ability of a device, equipment or network to perform without degradation in the presence of electromagnetic disturbances entering other than via its normal input terminals or antenna.

3.2 Symbols

3.2.1 Symbols used in equations

A_C cable loss between antenna and spectrum analyser

A_T attenuator loss

E_L field strength limit for the considered frequency

G gain of the low-noise amplifier

G_A gain of the transmitting antenna related to a half-wave dipole

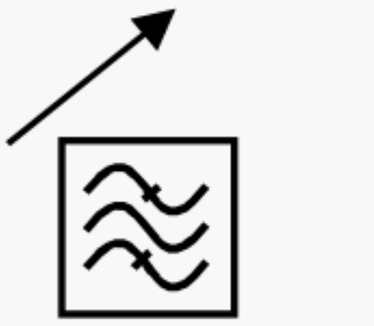
k_A antenna factor

P radiated power of the network related to a half-wave dipole

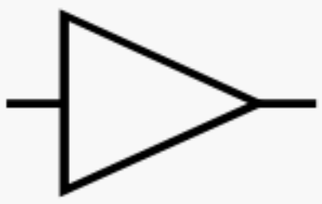
P_{SG} available output power of the signal generator

U_L level corresponding to the permitted limit

3.2.2 Symbols used in figures



tuneable bandpass filter



pre-amplifier

3.3 Abbreviations

AM	Amplitude Modulation
CATV	Community Antenna Television (network)
DSC	Distress, Safety and Calling
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EPIRB	Emergency Position Indicating Radiobeacons
FM	Frequency Modulation
ILS	Instrument Landing System
ITU-R	International Telecommunication Union - Radiocommunication
MATV	Master Antenna Television (network)

RF	Radio Frequency
SMATV	Satellite Master Antenna Television (network)
TV	Television
VOR	VHF Omnidirectional Range
VSB	Vestigial Side Band

NOTE Only the abbreviations used in the English version of this part of EN 50083 are mentioned in this subclause. The German and the French versions of this part may use other abbreviations. Refer to 3.3 of each language versions for details.

4 Methods of measurement

These methods of measurement describe the procedures for the testing of cable networks. The purpose of the measurements is to determine:

- the level of radiation generated by cable networks and
- the immunity of cable networks to external field strengths (e.g. those radiated by other radiocommunication services and RF applications).

The measurements cover the essential parameters and environmental conditions in order to assess:

- cases of electromagnetic incompatibility between cable networks and other electrical or electronic equipment, networks, installations or other cabled networks with respect to the intended operation of such cable networks.

During the test the cable network shall operate with normal signal levels at the subscriber outlets. If the stream is interactive, typical levels of the return path signals shall be maintained during the test.

NOTE Methods of measurement for digitally modulated signals are under consideration.

4.1 Radiation from cable networks

The methods described hereafter are applicable to the measurement of radiation from cable networks (combination of cables, equipment and networks).

Testing of the cable networks for compliance with the relevant limits may be initially carried out with the terminal equipment connected. Where limits are exceeded, individual sections of the network (e.g. headend, satellite receiving outdoor unit, cable network, distribution installation beyond the system outlets and terminal equipment) may be tested in succession to determine beyond any doubt which section of the network does not comply with the limits.

The number of test frequencies shall be selected to give a realistic representation of the radiation pattern throughout the operating frequency range and to enable the maximum level of radiation to be recorded and the results interpreted accurately.

The field strength measurement procedure is used in order to achieve results which are sufficiently accurate and do not require excessive technical effort.

The substitution measurement technique is applied to carry out more accurate measurements of the radiated disturbance power level generated by any part of the network.

If discussions arise about the actual radiation from a cable network, the substitution method according to 4.1.2 has to be applied.

The maximum permitted radiation level is given in 5.1, Table 1.

The following problems can cause radiation from cable networks:

- poor or faulty screening of passive equipment (plugs, splitters, etc.);
- poor or faulty screening of active equipment (amplifiers, converters, etc.);
- poor or faulty screening of the distribution cables against induced voltages;
- excessive impedance in the ground connections of the input terminals of active and passive equipment;
- insufficient rejection of power supply borne interference on mains powered equiment;
- inadequate mounting of connectors on cables;
- damage of the screening of cables or connectors.

4.1.1 Field strength method

The field strength method uses a suitable magnetic loop antenna in the frequency range from 5 MHz to 30 MHz and a suitable electromagnetic field antenna in the frequency range 30 MHz to 950 MHz.

Usually a loop antenna is conventionally calibrated in terms of "equivalent electric component" of the electromagnetic field. If a loop antenna calibrated in terms of magnetic field is used, the level of the equivalent electric field is deduced from the level of the measured magnetic field according to the following formula:

$$E = H + 51{,}5$$

where

E is the equivalent electric field level in dB(μV/m)

H is the measured magnetic field level in dB(μA/m)

51,5 = 20 lg(120π) is the free space impedance in dB(Ω).

4.1.1.1 Equipment required

The equipment required for the measurement of the radiation from a network is listed below:

- a suitable spectrum analyser (battery powered) with a digital recorder or a plotter;
  The spectrum analyser should cover the frequencies distributed within the network with a resolution bandwidth (IF bandwidth) according to CISPR 16 (see Table 1) and an appropriate slow sweep speed.
- a calibrated loop antenna according to CISPR 16 in the frequency range 5 MHz to 30 MHz;
- calibrated electromagnetic field antennas in the frequency range 30 MHz to 950 MHz;

  NOTE It is strongly recommended that an antenna with very broad bandwidth is used to reduce the expense of the measurements. It is also recommended that a directive antenna is used to be able to test each side of the street independently of the other one.
  A good choice would be, for example, a log-periodic antenna covering the frequency range from 80 MHz to 950 MHz.
- a calibrated low-noise amplifier covering the required frequency range;

- an antenna cable of known loss/frequency characteristic;
- a suitable vehicle to carry the above equipment with the broadband antenna fixed on the top of the vehicle and oriented in order to get the maximum reception level perpendicular to the driving direction.

4.1.1.2 Measurement procedure

The antenna shall be connected to the input of the spectrum analyser via the low-noise amplifier, if necessary, with a well-screened and well-matched coaxial cable.

Before starting measurements, a calibration procedure (see 4.1.1.3) is required to obtain the limit line related to the limit field values (see 5.1). Then, the measurement procedure can start for the first street, following the centre line of the lane closest to the building, where the cable network is installed.

It is important to drive the vehicle slowly along the street, according to the spectrum analyser operation, to get a clear overview on the screen of the spectrum analyser.

A survey is first conducted in order to ascertain the frequencies and field strengths of local transmitters so that these may be eliminated from the measurement results.

If one or more carriers exceed the limit line, the vehicle stops and the operator checks the frequency(ies) of this (or those) carrier(s).

To verify, from which part of the network the measured radiation is coming out, the system signal in the measured frequency range may be temporarily switched off in the area of interest.

If one or more of the exceeding carriers are emanating from the network, then the operator shall record the spectrum analyser pattern and note that place on the map of the town for a future repair. After repair, the field strength should be measured again.

Because of the antenna directivity, the vehicle has to be driven over each street twice to test both sides.

4.1.1.3 Calibration procedure

When a calibrated broadband antenna is used, the limit line shall be obtained for each frequency by calculation with the formula and using the antenna factor given by the antenna manufacturer:

$$U_L = E_L - (k_A + A_C)$$

where:

U_L is the level corresponding to the permitted limit, in dB(µV);

E_L is the field strength limit for the considered frequency, in dB(µV/m);

k_A is the antenna factor, in dB;

A_C is the cable loss between antenna and spectrum analyser, in dB.

If the field strength limit is a very low value, a low noise preamplifier shall be inserted between the antenna and the spectrum analyser.

In that case, the formula shall be:

$$U_L = E_L - (k_A + A_C) + G$$

where G is the gain of the low-noise amplifier, in dB.

4.1.2 Power method (Substitution measurement method)

In order to obtain more accurate results of the equivalent radiated disturbance power generated by a network or if the measurement accuracy achieved on the basis of previous measurement procedures is not sufficient, the substitution measurement method shall be applied.

In the frequency range of 5 MHz to 30 MHz the substitution measurement method is not practical.

4.1.2.1 Equipment required

The equipment required for the measurement of the radiation from a network is listed below:

- a selective measuring receiver covering the frequency range of interest and sufficient sensitivity;
- broadband antennas for the frequency range from 30 MHz to 950 MHz and a log-periodic antenna for the frequency range from 950 MHz to 3000 MHz;
- a signal generator covering the frequency range of interest and sufficient output power;
- a transmitting antenna with a front-to-back ratio of minimum 10 dB and a known gain;
- an attenuator to be connected to the terminals of the transmitting antenna;
- suitable measurement cables;
- suitable mounting equipment to enable the height and polarisation of the transmitting antenna to be adjusted (e.g., a telescopic mast).

4.1.2.2 Measurement procedure

First the maximum radiation of the network in the direction of interest shall be measured at a suitable distance with a broadband receiving antenna and a measuring receiver (spectrum analyser) changing the height and polarisation of the antenna to obtain a maximum reading.

The maximum measured values and their related frequencies shall be noted (level a_1).

Then the cable network (either the complete network or a section of it) is replaced by a transmitting antenna supplied by a calibrated signal generator. The antenna shall be a type with a front-to-back ratio of minimum 10 dB, to minimise the reflection effects from the building.

An attenuator connected to the base of the antenna is required in all cases in order to avoid any mismatch. The transmitting antenna shall be set up in front of the wall of the building in the area of the supposed maximum radiation source.

To minimise other unwanted reflections, the signal generator shall at first be set to a level P_{SG2}, so that a sufficient readable value can be noted on the measuring receiver (level a_2). The level P_{SG2} shall be fixed.

Then the position (height and polarisation) of the transmitting antenna shall be varied in order to get the maximum reading on the measurement receiver (equal or greater than the level a_2). In this position the transmitting antenna shall be fixed. Now the RF level of the signal generator (P_{SG1}) shall be varied to obtain the same level a_1 on the measuring receiver.

The resulting disturbance power shall be calculated by following formula:

$$P = P_{SG1} - A_C - A_T + G_A$$

where:

P is the radiated power of the network related to a half-wave dipole, in dB(pW);

P_{SG1} is the available output power of the signal generator, in dB(pW);

A_C is the cable attenuation, in dB;

A_T is the attenuator loss, in dB;

G_A is the gain of the transmitting antenna related to a half-wave dipole in dB.

The maximum disturbance power shall meet the requirements given in 5.1.

By the above mentioned measurement method, the ground reflections are eliminated with sufficient accuracy.

4.2 Immunity of cable networks

Interference can enter cable networks by the following means:

- poor or faulty screening of passive equipment (plugs, splitters, etc);
- poor or faulty screening of active equipment (amplifiers, converters, etc);
- poor or faulty screening of the distribution cables against induced voltages;
- poor or faulty screening of the distribution cables against induced currents;
- excessive impedance in the ground connections of the input terminals of active and passive equipment;
- insufficient rejection of power supply borne interference on mains powered equipment.
- inadequate mounting of connectors on cables;
- damage of the screening of cables or connectors.

The carrier-to-interference ratio caused by an external field at any system outlet shall be measured by means of a suitable measuring receiver or spectrum analyser. The results shall comply with the limits given in 5.2.

4.2.1 Measurement procedure using a disturbing high-power local transmitter

In the case of disturbance, the carrier-to-interference ratio shall be measured at the outlets subject to disturbance.

At first, the wanted signal level in the disturbed channel shall be measured. After that, the cable network shall be disconnected from the interchange point or the antennas. The disconnected inputs shall be terminated with 75 Ω terminating loads.

The disturbance level of the ingress unwanted signal is then measured by means of a measuring receiver in the peak mode, taking into account the bandwidth of the signal. Care shall be taken to ensure that the measuring receiver is well-matched to the network under test and that the relevant return loss is taken into consideration.

The difference between the wanted signal level and the level of the interfering unwanted signal level shall comply with the RF carrier-to-interference ratio specified in 5.2, Table 3.

If the carrier-to-interference ratio is equal to or greater than the nominal value, the network meets the requirements. If the carrier-to-interference ratio is less than the required ratio, further studies are necessary. All distribution installations beyond the system outlet (receiver leads, receiver, other subscriber installations) shall be disconnected from the network under test for the purposes of these studies. In the majority of cases disturbance is caused by these items. The measurement of the disturbance level shall be repeated. After the measurement, the normal operating condition of the network shall subsequently be restored.

If all these provisions do not lead to a better carrier-to-interference ratio, it must be assumed that the interfering signals intrude into the cable network. Then the interfering field strength outside the building shall be measured in the vicinity of the assumed point of penetration. The maximum field strength shall be determined by changing the site of the antenna. The field strength limit at which the carrier-to-interference ratios according to Table 3 shall be met is indicated in 5.2, Table 2.

If the interfering field strength is equal to or lower than this value, the network does not meet the requirements and measures shall be taken by the network operator to improve the immunity of the network.

If the measured interfering field strength exceeds this value, the cable network requirements do not correspond to the requirements of other radio services (high power local transmitter). Then, a solution to this problem shall be achieved by the national regulatory authorities and the radio services operators (see also note 2 below Table 2).

5 Performance requirements

The relevant conditions applicable to cable networks required to meet the values specified in 5.1 and 5.2 are as follows:

- professional planning;
- compliance with the requirements of the EN 50083 and EN 50117 series;
- use of suitable equipment, components (plugs, connectors etc.) and coaxial cables fulfilling these standards or use of such equipment which can be deemed suitable on the basis of the details of the technical data sheets;
- correct installation of all parts of network equipment including the provision of appropriate connections between cables, plugs and equipment. Therefore, only suitable connections for plugs and clamps shall be used. The installation instructions of the manufacturer of the equipment and components shall be considered.

5.1 Radiation from cable networks

The maximum permitted radiation levels, given in Table 1, shall apply according to the method of measurement specified in 4.1, unless other values for each service to be protected are given in national radio regulations.

In case of broadband interference (no single carrier interference) the radiation level is measured with a receiver having a quasi-peak detector and measuring bandwidths as stated in Table 1 (according to CISPR 16–1).

For single carrier measurements also other receivers can be used.

Table 1 - Radiation limits

Frequency range	**Limits (quasi-peak)** [a]		**Measuring bandwidth**
MHz	**Field strength at 3 m distance** dB(µV/m)	**Equivalent** [b] **disturbance power** dB(pW)	kHz
5 to 30	34 to 27 [c]	27 to 20 [c]	9
30 to 950	27	20	120
950 to 2 500	50	43	1 000
2 500 to 3 000	64	57	1 000
[a] At frequencies above 1 GHz the peak detector is used.			
[b] Equivalent power radiated in free space from an elementary loop (f < 30 MHz) or dipole (f > 30 MHz)			
[c] Decreasing linearly with the logarithmic of the frequency			

NOTE 1 If the radiated field strength is assumed to be the result of a point source of radiation at a distance of 3 m, the two methods are equivalent.

NOTE 2 Additional protection may be required for safety of life services operating within the above frequency ranges. Frequency ranges of typical safety of life services are given in the informative Annex B.

5.2 Immunity of cable networks

The external immunity limit (Table 2) specifies the reference field strength level immediately outside the building at which a defined RF carrier-to-interference ratio (performance criterion as specified in Table 3) shall be obtained in the wanted channel at any point in the cable network.

Table 2 - Immunity limits

Frequency range MHz	**Field strength** dB(µV/m)
0,15 to 950	106
950 to 3000	106

NOTE 1 The interdependence between the maximum allowable field strength and the minimum carrier-to-interference ratio according to EN 50083-7 is given in the informative Annex C.

NOTE 2 If an external field strength higher than specified in Table 2 occurs and this field strength disturbs the corresponding channel in the cable network, special measures have to be taken (e.g. increasing signal level at the system outlet, improving the screening effectiveness of the network or changing/not using the affected cable channel, etc.).

The performance criteria for the cable networks refer to AM VSB TV signals in the frequency range 30 MHz to 950 MHz and to FM TV signals in the frequency range 950 MHz to 3000 MHz.

Where other signals (e.g. digitally modulated signals) are distributed, the lower permissible carrier-to-interference ratios of these signals shall not be applied in order to reduce the immunity of the cable network.

The method of measurement shall be chosen as specified in 4.2.1.

Table 3 - Carrier-to-interference ratio to the reference field strength (immunity level)

Frequency range MHz	Carrier-to-interference ratio dB
5 to 30	under consideration
30 to 950	≥ 57 (AM)
950 to 3000	≥ 33 (FM)

NOTE These requirements may be relaxed only for those channels on which the distributed television or FM radio signals are at their original broadcast frequencies, i.e. the wanted and unwanted carriers are synchronous. In this case, the required immunity is governed by the subjective acceptability of echoes on the signals distributed on these channels.

Annex A
(informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CENELEC member.

This European standard does not fall under any directive of the EC.

In the relevant CENELEC countries these A-deviations are valid instead of the provisions of the European Standard until they have been removed.

A.1 United Kingdom

The methods of measurement for radiation from networks as described in clause 4 of this standard as well as the performance requirements according to clause 5 of this standard are replaced by the following regulation:

MPT 1510: Radiation Limits and Measurement Standard; Electromagnetic radiation from cabled distribution systems operating in the frequency range 30 - 1000 MHz; May 1984 (Revised 1989 + 1997 + 1999)

A.1.1 Principle

The method describes the measurement of radiation from complete systems at the distribution frequencies in use and at other relevant frequencies as covered in A.1.3.

A.1.2 Equipment

A.1.2.1 A field strength measuring set complying with BS 727 (1983) [1] and with frequency and sensitivity ranges appropriate to the system under examination.

A.1.2.2 Calibrated dipole antennas covering the frequency range 30 MHz to 1000 MHz, suitable for connection to the field strength measuring set.

A.1.2.3 A four metre non-metallic mast with accessories suitable for mounting and orienting dipole antennas in the horizontal and vertical planes.

A.1.2.4 A low noise broadband preamplifier with a minimum of 20 dB gain.

A.1.2.5 A tuneable bandpass filter to prevent local off-air signals overloading the preamplifier.

NOTE The test equipment and interconnections used shall be well matched and correctly terminated.

A.1.3 Measurement frequencies

Measurement shall be at the highest and lowest vision carrier frequency used in each band (but see NOTE) and a selection of intervening frequencies chosen to give a realistic representation of the radiation level over the operating frequency range.

Measurements should also be made at frequencies where harmonically related products of the signal frequencies, or of frequency converters, may be expected to lie. Particular attention should be given to those harmonically related products which fall in prohibited bands.

NOTE Except when this frequency occurs in an off-air channel, in which case the next higher or lower vision carrier frequency should be used.

A.1.4 Procedure

A.1.4.1 Ensure that the cabled system is operating with normal signal levels at the subscribers outlets. If the stream is interactive, typical levels of reverse path (upstream) signalling should be maintained during the tests.

A.1.4.2 With the equipment connected as shown in Figure A.1.1 carry out a mobile survey of the cabled system at the frequencies given in A.1.3 using vertical and horizontal polarisation of the monitoring antenna.

NOTE 1 A check shall first be made to ensure that signals other than those being monitored do not materially affect the measurements.

NOTE 2 For horizontal polarisation, the dipole should have its elements in line with the direction of travel.

A.1.4.3 Identify those locations within the cabled system area where the radiation appears excessive, and the frequency at which this occurs.

A.1.4.4 Determine the median value of the cabled system radiation at these locations using the following procedure;

A.1.4.5 Tune the bandpass filter to the frequency to be monitored.

A.1.4.6 Adjust the length of the dipole to $\lambda/2$ at the frequency to be monitored.

A.1.4.7 Rotate the dipole to achieve vertical polarisation.

A.1.4.8 Position the mast such that the centre of the dipole is 4 metres above ground level and a minimum of 10 metres from the system.

A.1.4.9 Record the field strength reading (allowing for any correction factors provided by the antenna and instrument manufacturers). The measurements shall be taken at 21 random sample points over a total measurement distance of 30λ metres and at a minimum distance of 10 metres from the system.

NOTE For vision carriers the field strength shall be expressed in terms of the RMS value at the peak of the modulation envelope.

A.1.4.10 Repeat the procedure from A.1.4.7 after adjusting the antenna for horizontal polarisation with its elements in line with the chosen sampling route.

A.1.5 Expression of results

Determine the median (50 percentile) value of the field strength at each location for vertical and horizontal polarisation of the monitoring antenna at the test frequency, taking into account the preamplifier gain, cable and filter losses.

NOTE The median value of the field strength is obtained by arranging the 21 samples in order of increasing magnitude. The eleventh sample value is then the median field strength.

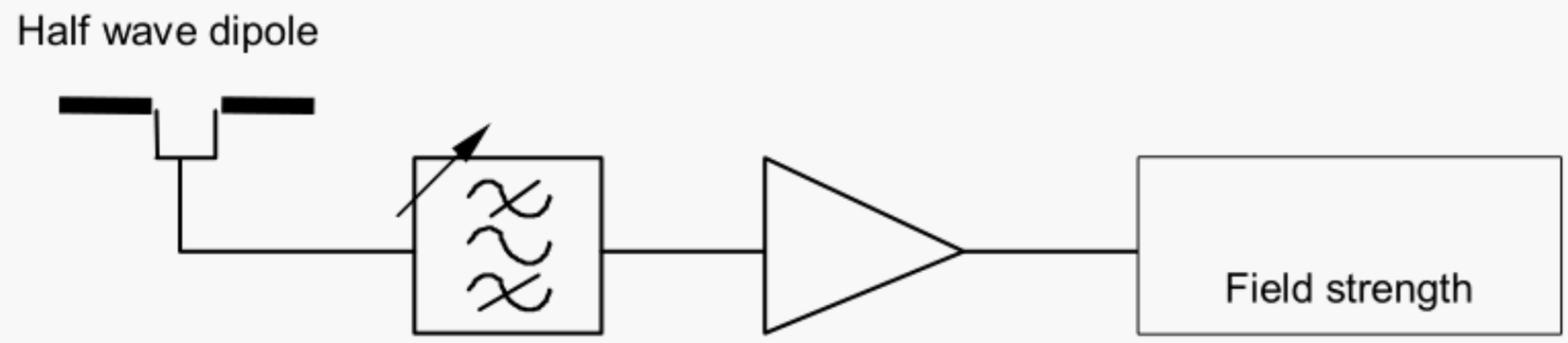


Figure A.1.1 - Arrangement of test equipment for the measurement of radiation from complete systems

A.1.6 Permitted limits

The median value determined for vertical and horizontal polarisation at each location shall not exceed the maximum field strengths given in Table A.1.1 for measurements at 10 metres distance from the system or the proportionally reduced value, in accordance with the values given in Table A.1.2, for distances greater than 10 metres.

A.1.7 Interpretation

In cases of doubt about the interpretation of this standard or the method of carrying out the measurements, the decision of the Radiocommunications Agency[1)] shall be final.

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Table A.1.1 - Radiation from complete systems: maximum permitted field strengths

Frequency range MHz	Maximum permitted interfering field strength at 10 metres distance from the system dB(μV/m)
30 - 41	+26 (NOTE 1)
41 - 50	+6
50 - 54	–8
54 - 68	+6
68 - 74,8	+6
74,8 - 75,2	Use prohibited (NOTE 2)
75,2 - 108	+5 (NOTE 1) (NOTE 3)
108 - 117,975	Use prohibited (NOTE 2)
117,975 - 121,3	+29
121,3 - 121,7	Use prohibited (NOTE 2)
121,7 - 136	+29
136 - 144	+6 (NOTE 1)
144 - 146	–18
146 - 156,6	+6 (NOTE 1)
156,6 - 157	Use prohibited (NOTE 2)
157 - 225	+5
225 - 235	+21
235 - 242,8	+11
242,8 - 243,2	Use prohibited (NOTE 2)
243,2 - 328,6	+11
328,6 - 335,4	Use prohibited (NOTE 2)
335,4 - 400	+11
400 - 405,85	+21
405,85 - 406,25	Use prohibited (NOTE 2)
406,25 - 425	+32 (NOTE 1)
425 - 432	+12
432 - 440	–15
440 - 470	+12
470 - 854	+13 (NOTE 1) (NOTE 3)
854 - 1000	+18

NOTE 1 Where systems operate close to radio astronomy and space service stations, tighter radiation limits may be necessary in one or more of the frequency ranges 37,75-38,25; 80,5-82,5; 136-144; 150,05-153; 406,25-410 and 608-614 MHz to protect such services.

NOTE 2 The use of vision, sound, pilot and narrow band data carriers and colour sub-carriers in this frequency range is prohibited. The radiated levels of any sidebands or any intermodulation products or spurious frequencies on the system falling within this frequency range shall not exceed -21 dB(μV/m) at a distance of 10 metres from the system. However, broadband digitally modulated signals with a noise-like characteristic are permitted provided that the radiated levels do not exceed –59,0 dB(μV/m/√(Hz)) at a distance of 10 metres from the system. This is equivalent to:

10 dB(μV/m) in 8 MHz bandwidth,
–19 dB(μV/m) in 9 kHz bandwidth,
–23 dB(μV/m) in 4 kHz bandwidth.

NOTE 3 This limit will apply where distribution in a cabled system is on the same, or overlapping, frequencies as used for off-air television and FM radio reception in the area and at frequencies used by video cassette recorders. In cases where distribution in a cabled system is not on the same, or overlapping, frequencies as used for off-air reception, consideration may be given to a relaxation of this limit.

Table A.1.2 - Distance correction factor

Distance m	Reduction factor dB
15	3,5
20	6,0
25	8,0
30	9,5
NOTE Intermediate values of reduction factor should be obtained by interpolation.	

A.2 United Kingdom

The methods of measurement for radiation from networks as described in clause 4 of this standard as well as the performance requirements according to clause 5 of this standard are replaced by the following regulation:

MPT 1520: Radiation Limits and Measurement Standard; Electromagnetic radiation from cabled distribution systems operating in the frequency range 300 kHz - 30 MHz; July 1984 (Revised 1989 + 1997 + 1998)

A.2.1 Principle

The method describes the measurement of electromagnetic radiation from complete systems at the distribution frequencies in use and at other relevant frequencies as covered in A.2.3.

A.2.2 Equipment

A.2.2.1 A field strength measuring set complying with BS 727 (1983) [1] and with frequency and sensitivity ranges appropriate to the system under examination.

A.2.2.2 A calibrated loop antenna covering the frequency range 300 kHz to 30 MHz, with sensitivity such that when connected to the receiver the system is capable of measuring field strengths down to 0 dB(µV/m).

A.2.2.3 A tripod or other suitable means of mounting the loop antenna at a height of between 1,5 and 2 metres above ground level in the vertical plane, with a facility for orientating the loop in the horizontal plane.

NOTE The test equipment and interconnections used shall be well matched and correctly terminated.

A.2.3 Measurement frequencies

Measurements shall be taken at the highest and lowest significant carrier frequencies in use and at a selection of intervening frequencies chosen to give a realistic representation of the radiation level over the frequency range 300 kHz to 30 MHz (but see NOTE). Measurements shall also be taken at frequencies where harmonically related products of the signal frequencies, or of frequency converters, may be expected to lie. Particular attention should be given to those harmonically related products which fall in prohibited bands.

NOTE Except when this frequency occurs in an off-air channel, in which case the next higher or lower carrier frequency should be used.

A.2.4 Procedure

A.2.4.1 Ensure that the cabled system is operating with normal signal levels at the subscribers outlets. If the system is interactive, typical levels of reverse path (upstream) signalling should be maintained during the tests.

A.2.4.2 Using the calibrated loop antenna and measuring receiver carry out a mobile survey of the cabled system at the frequencies indicated in A.2.3. The loop antenna should be mounted vertically and orientated for maximum signal pick up as indicated on the field strength measuring receiver.

NOTE A check shall first be made to ensure that signals other than those being measured do not materially affect the results.

A.2.4.3 Identify those locations within the cabled system area where the radiation appears excessive, and the frequency at which this occurs.

A.2.4.4 Determine the electromagnetic field strength level of the radiation emanating from the cabled system at these locations using the following procedure.

A.2.4.5 Mount the loop antenna vertically on a tripod or other supporting structure with the base of the antenna at a height of between 1,5 and 2 metres above ground level, at a minimum distance of 10 metres from the system.

A.2.4.6 Rotate the loop antenna in the horizontal plane for maximum signal pick up as indicated on the field strength measuring receiver.

A.2.4.7 Record the field strength reading (allowing for any correction factors provided by the antenna and instrument manufacturers). Take two further field strength measurements at approximately one metre either side of the first at the same distance from the source.

A.2.4.8 If the last two results do not differ from the first by more than 1,0 dB, then record the first reading as the radiated field at that location.

A.2.4.9 If the field strengths measured deviate by more than 1,0 dB, then record a median field strength value derived from the three measurements.

NOTE 1 The field strength should be expressed in dB(μV/m).

NOTE 2 For vision carriers the field strength shall be expressed in terms of the RMS value at the peak of the modulation envelope.

A.2.5 Permitted limits

The field strength value obtained at each location shall not exceed the maximum field strengths given in Table A.2.1 for measurements at 10 metres distance from the system or the proportionally reduced value, in accordance with the values given in Table A.2.2, for distances greater than 10 metres.

A.2.6 Interpretation

In cases of doubt regarding the interpretation of this standard or the method of carrying out the measurements, the decision of the Radiocommunications Agency [1)] shall be final.

Table A.2.1 - Radiation from complete systems: maximum permitted field strengths

Frequency range kHz	Maximum permitted interfering field strength at 10 metres distance from the system dB(μV/m)
300 - 499	26
499 - 505	Use prohibited
505 - 2173,5	20
2173,5 - 2190,5	Use prohibited
2190,5 -30 000	20

Table A.2.2 - Distance correction factor

Distance m	Reduction factor dB				
	300 kHz-1,6 MHz	1,6 MHz-2 MHz	2 MHz-3,3 MHz	3,3 MHz-5 MHz	5 MHz-30 MHz
15	7,0	7,0	7,0	7,0	3,5
20	12,0	12,0	12,0	9,5	6,0
25	16,0	16,0	14,0	11,5	8,0
30	19,0	17,5	15,5	13,0	9,5
NOTE Intermediate values of reduction factor should be obtained by interpolation.					

A.2.7 Bibliography of A-deviations A.1 and A.2

[1] BS 727 1983 Specification for radio interference measuring apparatus

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A.3 Finland

A.3.1 In Finland, based on Radio Act and Telecommunications Market Act the Telecommunications Administration Centre can restrict or prohibit the use of certain channels in cable networks for the reason that radiation from the network causes excessive interference to co-frequency radiocommunications, even if the network fulfils the radiation limits as stated in this standard.

A.3.2 In Finland, based on Telecommunications Market Act the Telecommunications Administration Centre can restrict or prohibit the use of certain channels in cable networks for the reason that the signal quality in the network will be degraded because of interference caused by leakage to the network of co-frequency radiocommunication signals.

A.3.3 Bibliography of A-deviation A.3

- Radio Act (517/88) section 12.
- Telecommunications Market Act (396/97) sections 37 and 38.

A.4 Germany

Usage-Provision No. 30 of Frequency Range Allocation Plan Regulation (FreqBZPV, 2001-04-26) (Nutzungsbestimmung NB 30 der Frequenzbereichszuweisungsplanverordnung (FreqBZPV) vom 26.04.2001)

NOTE The national deviation is based on the German Telecommunications Law (TKG) and the Frequency Range Allocation Plan Regulation (FreqBZPV), Usage-Provision No. 30. It treated exclusively the interfering radiations of the utilisable frequencies transferred in the cable and serves the protection of radio services, even if their frequencies are used in cable systems.

A.4.1 Usage-Provision No. 30

A.4.1.1 Frequencies for telecommunications systems and telecommunications networks in the frequency band from 9 kHz to 3 GHz may be used freely in and along conductors

a) where the frequency usage is in a frequency band in which no safety-related radiocommunication services are operated, and

b) where, at the location of operation and along the conductor route, the interfering field strength (peak value) of the frequency usage does not exceed the values in Table 1 at a distance of three metres from the telecommunications system or network or from the connected conductors; the interfering field strength shall be measured on the basis of applicable EMC standards in accordance with Measurement Specification Reg TP 322 MV 05 "Measurement of Interfering Fields at Telecommunication Systems and Conductors in the Frequency Band from 9 kHz to 3 GHz".

A.4.1.2 The frequency usage as provided for by A.1.1 may claim no protection from interference caused by emissions from radio transmitting equipment.

A.4.1.3 The limiting conditions as set out in A.1.1 shall apply to frequencies up to 30 MHz as from 1 July 2001 and to frequencies above 30 MHz as from 1 July 2003.

A.4.1.4 In the case of frequency usages in and along conductors for which no free use is provided for by A.1.1, the geographical, temporal and technical conditions may be laid down for each individual case in either the frequency usage plan or the required frequency assignment by the Regulatory Authority for Telecommunications and Posts, on the basis of proportionality and after hearing the parties concerned. Where safety-related radiocommunication services are concerned, account is to be taken in particular of the extent to which a specific threat to safety is to be feared.

Table A.4.1 – Limits of the interfering field strength of telecommunications systems and networks

Frequency f in the band MHz	**Limit of the interfering field strength (peak value) at a distance of 3 metres** dB(μV/m)
0.009 to 1	$40 - 20 \cdot \log_{10}(f/MHz)$
Above 1 to 30	$40 - 8.8 \cdot \log_{10}(f/MHz)$
Above 30 to 1000	27 [1)]
Above 1000 to 3000	40 [2)]

[1)] This corresponds to an effective radiated power of 20 dBpW.
[2)] This corresponds to an effective radiated power of 33 dBpW.

Annex B
(informative)

Frequency ranges of typical safety of life services

Frequency range MHz			Service
74,800	to	75,200	Aeronautical radionavigation; ILS marker beacons
108,000	to	117,975	VOR and ILS localiser Aeronautical radionavigation;
121,450	to	121,550	Emergency Position Indicating Radiobeacons (EPIRBs)
156,525			DSC distress, safety, and calling
156,7625	to	156,8375	International marine distress, safety, and calling
242,950	to	243,050	EPIRBs
406,000	to	406,100	EPIRBs

In some areas additional protection is also required for radio astronomy bands and other radio services.

Annex C
(informative)

Interdependence between the maximum allowable field strength and the minimum carrier-to-interference ratio

The external immunity limit of 106 dB(µV/m) for field strength can be calculated taking into account the minimum signal level at the system outlet and the minimum carrier-to-interference ratio, both according to EN 50083-7, and assuming a building penetration loss and a coupling factor from field strength to a $\lambda/2$ dipole, both corresponding to the frequency 166 MHz, as follows:

Maximum field strength outside the building		106 dB(µV/m)
Minus building penetration loss	–8 dB	
Maximum field strength inside the building		98 dB(µV/m)
Minus coupling factor	–11 dB(1/m)	
Minus screening effectiveness for passive equipment (EN 50083-2, Class A)	–85 dB	
Maximum distortion level on cable network		2 dB(µV)
Plus minimum carrier-to-interference ratio (EN 50083-7)	+57 dB	
Plus tolerance margin	+1 dB	
Minimum signal level on cable network / at system outlet (EN 50083-7)		60 dB(µV)

This calculation shows that the minimum signal level at the system outlet of 60 dB(µV) according to EN 50083-7 corresponds with a maximum allowable field strength outside the building of 106 dB(µV/m).

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