SLOVENSKI STANDARD
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Electromagnetic immunity of broadcast receivers and associated equipment

Electromagnetic immunity of broadcast receivers and associated equipment

Störfestigkeit von Rundfunkempfängern und verwandten Geräten der Unterhaltungselektronik

Immunité électromagnétique des récepteurs de radiodiffusion et des appareils associés

Ta slovenski standard je istoveten z: **EN 55020:1994**

ICS:

33.100.20	Imunost	Immunity
33.160.01	Avdio, video in avdiovizualni sistemi na splošno	Audio, video and audiovisual systems in general

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EN 55020

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English version

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Störfestigkeit von Rundfunkempfängern und verwandten Geräten der Unterhaltungselektronik

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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

FOREWORD

This European Standard has been prepared by CENELEC Sub-Committee 110A, EMC Products.

The first draft, which was submitted to the Unique Acceptance Procedure (UAP) in October 1992, was approved by CENELEC as EN 55020 on 1993-07-06. At the same time a draft amendment, submitted to UAP as prAA in October 1992, was approved for inclusion in the European Standard.

A second draft amendment, which grouped two Draft International Standards containing proposed amendments to CISPR Publication 20, was submitted to UAP in April 1993 and was approved by CENELEC as amendment A11 on 1993-12-08.

A further draft amendment (prAB), which was first submitted to UAP in June 1993 but failed the vote, was re-submitted to the formal vote in May 1994, and was approved.

CLC/SC 110A decided to combine all the drafts into a single document, which was approved by CENELEC as EN 55020 on 4 October 1994.

The following dates were fixed:

- Latest date of publication of an identical national standard	(dop)	1995-12-31
- Latest date of withdrawal of conflicting national standards	(dow)	1998-12-31

For products which have complied with EN 55020:1988 before 1995-12-31, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for placing products on the market until 1998-12-31.

For new products, placed on the market after 1995-12-31, the standard EN 55020:1994 applies.

Annexes designed "normative" are part of the body of the standard. Annexes designated "informative" are given for information only. In this standard all annexes are normative.

The structure of this standard has been brought in line with CENELEC Report R110-001:1993, Guide on EMC standardization for product committees.

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European Standard on IMMUNITY FROM RADIO INTERFERENCE OF BROADCAST RECEIVERS AND ASSOCIATED EQUIPMENT

1. SCOPE

1.1 This standard for immunity requirements applies to television broadcast receivers, sound broadcast receivers and associated equipment intended for use in the residential, commercial and light industrial environment.

1.2 Immunity requirements are given in the frequency range 0 Hz to 400 GHz. Radio-frequency tests outside the specified frequency bands or concerning other phenomena than given in this standard are not required.

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.

European and International Standards

CISPR 16	1987	CISPR specification for radio interference measuring apparatus and measuring methods.

Note: CISPR 16-1, Specification for radio disturbance and immunity measuring apparatus and methods, Part 1: Radio disturbance and immunity measuring apparatus, was published by IEC in August 1993. After Part 2 and Part 3 have also been published, CISPR 16:1987 will be withdrawn.

EN 55022	1994	Limits and methods of measurement of radio disturbance characteristics of information technology equipment (CISPR 22:1993)
IEC 50(161)		International Electrotechnical Vocabulary (IEV), Chapter 161: Electromagnetic Compatibility
IEC 315-1	1988	Methods of measurement on radio receivers for various classes of emission - Part 1: General considerations and methods of measurement, including audio-frequency measurements (harmonized as HD 560.1 S1:1990).
IEC 801	-	Electromagnetic compatibility for industrial-process measurement and control equipment.
IEC 801-2	1991	Part 2: Electrostatic discharge requirements (harmonized as EN 60801-2:1993)
IEC 801-3	1984	Part 3: Radiated electromagnetic field requirements (harmonized as HD 481.3 S1:1987)
IEC 801-4	1988	Part 4: Electrical fast transient/burst requirements.

Other publications

CCIR Recommendation 468-4:1986 - Measurement of audio-frequency noise voltage level in sound broadcasting.

CCIR Recommendation 471-1:1986 - Nomenclature and description of colour bar signals.

CCIR Recommendation 500-4:1990 - Method for the subjective assessment of the quality of television pictures.

CCIR Report 624-4:1990 - Characteristics of television systems.

3. OBJECTIVE

The objective of this standard is to define the immunity test requirements for equipment defined in the scope in relation to continuous and transient, conducted and radiated disturbances including electrostatic discharges.

These test requirements represent essential electromagnetic immunity requirements.

Test requirements are specified for each port considered.

Note 1: This standard does not specify electrical safety requirements for equipment such as protection against electric shocks, unsafe operation, insulation coordination and related dielectric tests.

Note 2: In special cases situations will arise where the level of disturbances may exceed the levels specified in this standard e.g. where a hand-held transmitter is used in proximity to an equipment. In these instances special mitigation measures may have to be employed.

4. DEFINITIONS

For the purpose of this standard, the definitions contained in IEC Publication 50 (161): International Electrotechnical Vocabulary (IEV) Chapter 161: Electromagnetic Compatibility, apply, extended with the following specific definitions:

4.1 Sound receivers are appliances intended for the reception of sound broadcast and similar services for terrestrial-, cable- and satellite transmissions.

Note: For the purpose of this standard, the VHF band II covers frequencies from 87.5 MHz to 108 MHz.

4.2 Television receivers are appliances intended for the reception of television broadcast and similar services for terrestrial-, cable- and satellite transmissions

Note 1: For the purpose of this standard, the following frequency bands are defined:

Band I	from 47 MHz to 68 MHz
Band III	from 174 MHz to 230 MHz
Band IV	from 470 MHz to 598 MHz
Band V	from 598 MHz to 862 MHz
S-bands	U.C.
Hyperband	U.C.

In practice not all television receivers are tunable over these complete frequency ranges. On the other hand many television receivers are tunable over additional channels, exclusively used in cable distribution networks.

Note 2: Modular units which are part of sound or television receiving systems, like tuners, frequency converters, modulators, etc. are considered to be sound or television receivers respectively.
Tuners may be provided with a broadcast-satellite-receiving stage and with demodulators, decoders, demultiplexers, D/A converters, encoders (e.g. PAL encoders) etc.
Frequency converters may be provided with a broadcast-satellite-receiving stage and with devices which convert the signals to other frequency bands.
Receivers, tuners, or frequency converters may be tunable or may only be able to receive a fixed frequency.

4.3 Associated equipment is either intended to be connected directly to sound or television receivers, or to generate or to reproduce audio or visual information. Excluded are information technology equipment even if they are intended to be connected to a television broadcast receiver.

Connections via the mains plug, local area network or home network are considered to be indirect connections.

Note: Information technology equipment is defined in EN 55022.

4.4 Multifunction equipment are appliances in which two or more functions are provided in the same unit, for instance television reception, radio reception, digital clock, tape-recorder or disc player etc.
A non exhaustive survey of receiver and associated equipment types (including the appropriate parts of multifunction equipment) is shown in Table 1.

4.5 A disturbance signal is an unwanted signal which may degrade radio reception or cause malfunction in equipment. An unwanted signal is a radio frequency signal which simulates the disturbance signal.

4.6 Immunity is the ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.

Note: In this standard the specified performance is:
- a specified sound signal-to-interference ratio and/or
- no greater than just perceptible degradation of the picture when a wanted signal and an unwanted signal occur simultaneously.

In the case of digital sound/data information (e.g. D2MAC) the specified performance for the bit error rate (BER) and/or residual bit error rate (BER_r) is under consideration.

4.6.1 Input immunity is the immunity from unwanted signals present at the antenna input terminal.

4.6.2 Immunity from conducted voltages is the immunity from unwanted signal voltages present at the audio and mains input terminals and audio output terminals.

4.6.3 Immunity from conducted currents is the immunity from unwanted signal (common mode) currents present in cables connected to the equipment.

4.6.4 Immunity from radiated fields is the immunity from unwanted electromagnetic fields present at the equipment.

4.7 Screening effectiveness is the characteristic of a coaxial connector terminal to attenuate the transfer of external currents into internal voltages.

Table 1: Survey (non exhaustive) of receiver and associated equipment types, including the appropriate parts of multifunction equipment.

			Intended for mains powering and portable with external power connection facility		Battery powered portable, without exernal power connection facility (Portable)	Car radio (Car)	Satellite (Satellite)
			With a connection facility for an external antenna	Without a connection facility for an external antenna			
Sound broadcast receivers (Radio)	VHF band II (FM)		FM Radio Ant.	FM Radio	Portable Radio	Car Radio FM	Satellite Radio
	LW, MW, SW (AM)		AM Radio Ant.	AM Radio		Car Radio AM	
Television broadcast receivers (TV)			TV Ant.	TV	Portable TV		Satellite TV
Associated equipment (Ass)	Video tape equipment (recording and/or play-back)	With* (Tun)	Ass. Video Tun. Ant.		Portable Ass. Video		
		Without*	Ass. Video				
	Audio tape equipment		Ass. Audio		Portable Ass. Audio		
	Other, e.g. audio amplifiers, record and compact disk players, decoders, electronic organs.		Ass. Other		Portable Ass. Other		

* Built-in television broadcast receiving facility.

4.8 *Port:* Particular interface of the specified apparatus with the external electromagnetic environment (see figure 1).

Enclosure port: The physical boundary of the apparatus through which electromagnetic fields may radiate or impinge.

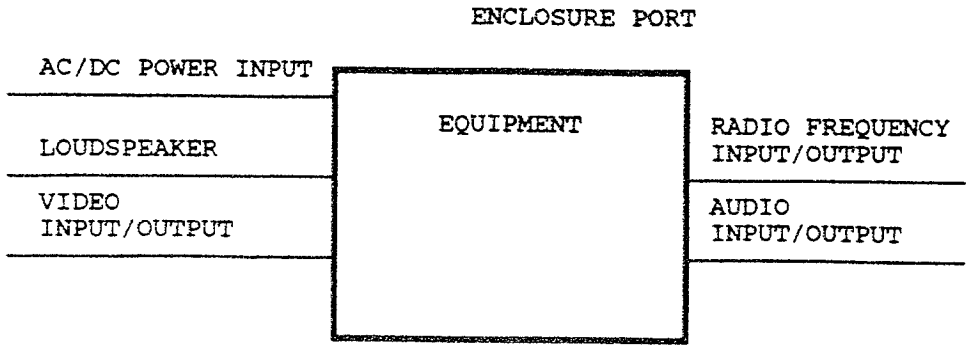

Figure 1 *Examples of ports*

5. DESCRIPTION OF LOCATIONS

The environments encompassed by this standard are residential, commercial and light-industrial locations, both indoor and outdoor. The following list, although not comprehensive, gives an indication of locations which are included:

- residential properties, e.g. houses, apartments, etc.
- retail outlets, e.g. shops, supermarkets, etc.
- business premises, e.g. offices, banks, etc.
- areas of public entertainment, e.g. cinemas, public bars, dance halls, etc.
- outdoor locations, e.g. petrol stations, car parks, amusement and sports centres, etc.
- light-industrial locations, e.g. workshops, laboratories, service centres, etc.

Locations which are characterized by being supplied directly at low voltage from the public mains are considered to be residential, commercial or light industrial.

6. PERFORMANCE CRITERIA

6.1 PERFORMANCE CRITERION A:

The equipment shall continue to operate as intended during the test. No change of actual operating state for example change of channel is allowed as a result of the application of the test.
Multifunction equipment shall for each function meet the relevant requirements.
Evaluation is carried out for audio and video functions.

6.1.1 EVALUATION OF AUDIO QUALITY

Unless otherwise specified in this standard, the criterion of compliance with the requirement is a wanted to unwanted audio signal ratio of ≥ 40 dB at a wanted audio signal level of 50 mW.
For A.M. sound receivers the criterion is ≥ 26 dB at 50 mW. However the criterion for the audio part of TV receivers is ≥ 40 dB.
For A.M. and F.M. car radios, the criterion is ≥ 26 dB at 500 mW.

6.1.2 EVALUATION OF PICTURE QUALITY

In the evaluation of picture interference the wanted test signal produces a standard picture (in the case of video tape equipment on the screen of the test-tv-set) and the unwanted signal produces a degradation of the picture. The degradation may be in a number of forms, such as a superposed pattern, disturbance of synchronization, geometrical distortion, loss of picture contrast, of colour, etc.

The criterion of compliance with the requirement is just perceptible degradation by observation of the picture. The screen shall be observed under normal viewing conditions (brightness 15-20 Lux), at a viewing distance of six times the height of the screen.

In the case of video tape equipment the test criteria relate to the picture, assessed on a test-tv-set, which is connected to the video output terminal of the equipment.

6.2 PERFORMANCE CRITERION B:

The equipment shall continue to operate as intended after the test. No loss of function is allowed after the test when the apparatus is used as intended. No change of actual operating state for example change of channel or stored data and settings is allowed as a result of the application of the test. During the test, degradation of performance is allowed.

6.3 PERFORMANCE CRITERION C:

Temporary loss of function is allowed, provided the function is self recoverable or can be restored by the operation of the controls.

7. CONDITIONS DURING TESTING

Immunity measurements are performed by the application of a wanted test signal and an unwanted signal to the equipment under test. These signals and methods of application are specified in clause 14.

For the vision component of the wanted TV signal the level refers to the R.M.S. value of the carrier at the peak of the modulation.
The signal level refers in all other cases to the R.M.S. level of the unmodulated carrier.

At transition frequencies the more stringent limit shall apply.

The limit values specified for the input immunity correspond to a nominal antenna impedance of 75 Ω. For receivers with nominal antenna impedance other than 75 Ω, these limits values and the level of the wanted signals on the antenna terminals are modified, according to the following formula:

Limit in RΩ, dB(μV) = (Limit in table, dB(μV)) + $10\log_{10}$ R/75
R is defined as the nominal input impedance.

There shall be 80% confidence that at least 80% of the series-produced appliances comply with these limits.

If in the case of video tape (or similar) equipment, the equipment under test has no active audio and/or video output terminals in the relevant operating mode the test-tv-set shall be connected to the modulator output terminal. In this case the sound criterion relates to the audio output terminal of the test-tv-set if appropriate.

The picture quality is assessed as in sub-clause 6.1.2.
The specification of the test-tv-set is given in Annex A.

Note: The modulator of the equipment under test should be tuned to the centre channel of its tuning range and the test-tv-set tuned to this channel. Care should be taken that the modulator channel is not equal to the tuned input channel of the equipment under test or to the unwanted channels M as specified in Tables 5 and 6.

The modulator output level shall be within the limits 60 to 75 dB(μV) at 75 Ω.

Equipment under test with switchable or adjustable gain at the antenna input (e.g. High/low-switch) shall be tested in position High or highest gain respectively.

7.1 MEASUREMENT PROCEDURE FOR AUDIO ASSESSMENT

First the wanted test signal is applied to the equipment under test. This produces a wanted audio signal which is measured. The volume control of the equipment under test or test set-up is adjusted to set this audio signal at the required level. The wanted audio signal is then removed by switching off the modulation or the audio test signal.

The "unwanted" disturbance signal is applied in addition and its frequency is swept through the test range; its level is kept at the relevant limit value.

The evaluation of the interference is made by measuring the level of the unwanted output signal and comparing this to the wanted output signal level.

Note: Concerning the measurement procedure for the criterion of sound interference of television receivers the frequency of the unwanted signal is adjusted to the relevant values.

Concerning the measurement procedure for the criterion of sound interference of video tape equipment with automatic modulation control the modulation of the sound carriers of the wanted test signal or the wanted audio test signal must not be switched off continuously but switched off and on at an appropriate low rate (e.g. 10 seconds off and 1 second on).

The equipment under test is considered to meet the requirements if the level of the unwanted audio signal does not at any time exceed the 40 dB or 26 dB level below the wanted audio signal level as appropriate.

7.2 AUDIO POWER-OUTPUT MEASUREMENT

a. For equipment under test with audio power output available through an external loudspeaker connector, the levels of the wanted and the unwanted audio signals are measured at the external loudspeaker terminals across the load impedance specified by the manufacturer. See figure 2a.

b. For equipment under test with no audio power output, such as a radio tuner, tape or record deck, an audio amplifier shall be provided and connected to the audio output under test. Level measurements are made at the output of the amplifier. The volume control, if any, of the equipment under test shall be set at the midway position. See figure 2b.

   The volume control of the audio amplifier provided shall then be adjusted to obtain the required level of the wanted audio signal. The amplifier noise shall be at least 50 dB below the level of the wanted signal. Care shall be taken to ensure that the amplifier is not subjected to the effects of the unwanted signal.

c. For equipment under test with audio power output fed to a built-in loudspeaker having no external loudspeaker connector, the audio signal levels are measured by placing a small high quality microphone (a directional type may be required) close to the front of the built-in loudspeaker under test. The microphone output is fed

through a screened cable (ferrite loaded as required) to an external amplifier, filter and audio voltmeter to measure the audio output powers. See figure 2c.

The microphone-audio voltmeter measurement chain shall be calibrated by the use of a loudspeaker of a type similar to the one in the equipment under test, placed at the same distance as that used in the measurement, and supplied with a 1 kHz tone at the required levels.For the measurement of input immunity, filter FR shall be of a 15 kHz low-pass type (see Annex B). The audio frequency voltmeter shall be provided with a weighting filter according to CCIR Recommendation 468.

For the measurement of immunity from conducted voltages, radiated fields and conducted currents, filter FR shall be of a 0.5 kHz - 3 kHz band-pass type (see Annex B).The audio frequency voltmeter shall be applied without weighting filter.

Figure 2a

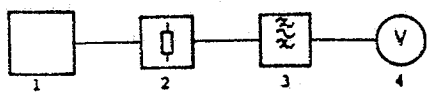

Figure 2b

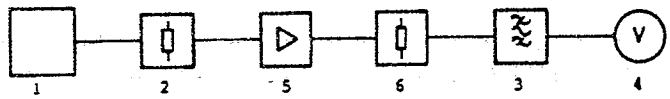

Figure 2c

1 : equipment under test
2 : rated load impedance RL of the audio output
3 : filter, FR (see Annex B) low-pass or bandpass
4 : audio frequency voltmeter V
5 : amplifier A
6 : rated load impedance Ra of the amplifier output
7 : microphone M

Fig. 2 - Audio power output measurement

7.3 MEASUREMENT PROCEDURE FOR VIDEO ASSESSMENT

The standard picture is a pattern consisting of vertical colour bars in accordance with CCIR Recommendation 471, 100/0/75/0 (see figure A1b of the CCIR Recommendation).

First the wanted signal only is applied to the equipment under test. The controls of the equipment under test are set to obtain a picture of normal brightness, contrast, and colour saturation. This is obtained with the following luminance values:

black part of the test pattern	2 cd/m²
magenta part of the test pattern	30 cd/m²
white part of the test pattern	80 cd/m².

Note: The luminance of the magenta bar shall be set to 30 cd/m². If this level cannot be reached, the luminance shall be set as close as possible to 30 cd/m². If a value different from 30 cd/m² is used, it shall be stated together with the results.

The unwanted signal is then applied in addition, its frequency adjusted to the relevant values (an accuracy of ± $f_{line}/2$ may be necessary) (f_{line} = 15625 Hz, hor.scan.freq.). The level of the unwanted signal shall be maintained at the relevant limit value at each frequency. The equipment under test is considered to meet the requirement if the conditions of 6.1.2 are met (See CCIR Recommendation 500).

The degradation is more rapidly discerned and the variation of results due to individuals is reduced, if the unwanted signal is switched on and off at a low rate (about 0.5 Hz) during the test. This can be done manually or automatically by an electronic timer.

8. APPLICABILITY

Tests are applied at the relevant connectors and enclosure port of the equipment according to clauses 9-1 to 9-3. Tests shall only be carried out where the relevant port(s) or function exist. If more than one specific function exists, for example audio functions, then all these functions shall be tested.

It may be determined from consideration of the electrical characteristics and usage of a particular equipment that some of the tests are inappropriate and therefore unnecessary. In such a case it is required that the decision not to test and the rationale leading to this decision shall be recorded in the test report.

8.1 For battery powered
- portable sound broadcast receivers
- portable television broadcast receivers and other
- portable audio and video equipment as well as
- video tape equipment

which have no external power connection facility, immunity requirements are under consideration.

8.2 For
- sound broadcast receivers
- television broadcast receivers and
- video tape equipment with built-in television broadcast receiving facility

without a connection facility for an external antenna, immunity requirements are under consideration.

8.3 For sound broadcast receivers in the long-wave, medium-wave and short-wave operation mode, immunity requirements are restricted to those in Table 2: RF voltage common mode.

8.4 Input immunity requirements apply for the VHF band II part of sound receivers (including car radios), for AM sound receivers, for television receivers and for video tape equipment.
Input immunity requirements for associated equipment other than video tape equipment are under consideration.
Multi-function equipment which perform one or more of the functions included in this clause shall meet the relevant requirements.