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Broadcast Sound Receivers;
Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

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Contents

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Foreword

This final draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Vote phase of the ETSI standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.9] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

Modal verbs terminology

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

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

Introduction

The present document describes the requirements for radio broadcast receivers to meet the essential requirements of article 3.2 of Directive 2014/53/EU [i.1].

1 Scope

The present document specifies technical characteristics and methods of measurements for devices, including the supplied antenna, that receive broadcast sound services, whether analogue or digital modulation is used. Multi-function devices may also fall under the requirements of other documents.

The present document covers the essential requirements of article 3.2 of Directive 2014/53/EU [i.1] under the conditions identified in annex A.

2 References

2.1 Normative references

References are specific, identified by date of publication and/or edition number or version number. Only the cited version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

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

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

[1] ETSI EN 300 401 (V2.1.1) (01-2017): "Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers".

[2] ETSI ES 201 980 (V4.1.1) (01-2014): "Digital Radio Mondiale (DRM); System Specification".

[3] CENELEC EN 55032:2015: "Electromagnetic compatibility of multimedia equipment - Emission Requirements".

[4] IEC 60315-1 (1988): "Methods of measurement on radio receivers for various classes of emission−Part 1: General considerations and methods of measurement, including audio-frequency measurements".

[5] Recommendation ITU-R BS.559-2 (06/1990): "Objective measurement of radio-frequency protection ratios in LF, MF and HF broadcasting".

[6] Recommendation ITU-R BS.468-4 (07/1986): "Measurement of audio-frequency noise voltage level in sound broadcasting".

2.2 Informative references

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

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

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

[i.1] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

[i.2] ETSI TR 100 028 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[i.3] ETSI TR 100 028-2: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".

[i.4] ECA table.

NOTE: Available at www.efis.dk.

[i.5] Recommendation ITU-R BS.1615-1: "Planning parameters for digital sound broadcasting at frequencies below 30 MHz".

[i.6] Recommendation ITU-R BS.641: "Determination of radio-frequency protection ratios for frequency-modulated sound broadcasting".

[i.7] CEPT/ERC/Recommendation 74-01E (2011): "Unwanted emissions in the spurious domain".

[i.8] CISPR 35: "Electromagnetic Compatibility of Multimedia equipment - Immunity Requirements".

[i.9] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in Directive 2014/53/EU [i.1] and the following apply:

adjacent channel selectivity: at a given frequency separation, ratio of the maximum unwanted signal level to the wanted signal level necessary to provide a given level of audio quality

blocking: at a given frequency separation, ratio of the maximum AM unwanted signal level to the wanted signal level necessary to provide a given level of audio quality

built-in antenna: antenna that cannot be detached from the equipment

dBm: decibels relative to 1 mW of power

dBQ: audio decibels after Recommendation ITU-R BS.468-4 [6] noise weighting and a quasi-peak detector have been applied

dBµV: decibels relative to 1 µV

dBµV/m: decibels relative to 1 µV/m

external antenna: antenna designed to be connected to the equipment with the use of a 50 Ω or 75 Ω external connector

integral antenna: antenna which is detachable from the equipment without the use of any tools, and not using a 50 Ω or 75 Ω external connector

NOTE: A device that uses a supplied earphone as the antenna has an integral antenna.

sensitivity: minimum wanted signal level required to provide a given level of audio quality

3.2 Abbreviations

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

AAC Advanced Audio Coding
ACS Adjacent Channel Selectivity

AM	Amplitude Modulation
AMSS	Amplitude Modulation Signalling System
BS	Broadcast service (Sound)
CISPR	Comité International Spécial des Perturbations Radioélectriques
CMAD	Common Mode Absorption Device
DAB	Digital Audio Broadcasting
DRM	Digital Radio Mondiale
ECA	European Common Allocation
EEP	Equal Error Protection
EEP-3A	Equal Error Protection profile 3A
EFTA	European Free Trade Area
FAR	Fully Anechoic Room
FM	Frequency Modulation
GTEM	Gigahertz Transverse ElectroMagnetic
HF	High Frequency
ITU-R	International Telecommunications Union - Radiocommunications
LF	Low Frequency
MF	Medium Frequency
MSC	Main Service Channel
PC	Personal Computer
RDS	Radio Data System
RF	Radio Frequency
RM	Robustness Mode
RMS	Root Mean Square
SAC	Semi Anechoic Chamber
SNR	Signal to Noise Ratio
UI	User Interface
VHF	Very High Frequency

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the manufacturer. The equipment shall comply with all the technical requirements of the present document which are identified as applicable in annex A at all times when operating within the boundary limits of the declared operational environmental profile.

4.2 Conformance requirements

4.2.1 Broadcast radio modulation methods

The following broadcast radio modulation methods are considered feasible within the current authorization regime in Europe:

- Amplitude modulation, with or without AMSS (AM).
- Frequency modulation, with or without RDS (FM).
- Digital Audio Broadcasting (DAB).
- Digital Radio Mondiale (DRM).

Broadcast radio receivers may include demodulation capability for one or more of these modulation methods. Conformance shall only be required for each of the modulation methods included in the receiver.

4.2.2 Broadcast radio frequency bands

The following frequency bands are identified in the ECA table [i.4] for broadcast radio services:

- Low frequency (LF): 148,5 kHz to 283,5 kHz.
- Medium frequency (MF): 526,5 kHz to 1 606,5 kHz.
- High Frequency (HF): 3 950 kHz to 4 000 kHz, 5 900 kHz to 6 200 kHz, 7 200 kHz to 7 450 kHz, 9 400 kHz to 9 900 kHz, 11 600 kHz to 12 100 kHz, 13 570 kHz to 13 870 kHz, 15 100 kHz to 15 800 kHz, 17 480 kHz to 17 900 kHz, 18 900 kHz to 19 020 kHz, 21 450 kHz to 21 850 kHz and 25 670 kHz to 26 100 kHz.
- VHF band I: 47 MHz to 68 MHz.
- VHF band II: 87,5 MHz to 108 MHz.
- VHF band III: 174 MHz to 240 MHz.

Broadcast radio receivers may include tuning capability for one or more of these frequency bands. Conformance shall only be required for each of the frequency bands included in the receiver.

4.2.3 Test signal configurations

4.2.3.1 AM testing

The generated AM signals (wanted, unwanted and blocking) shall be in accordance with table 1. The configuration is based on Recommendation ITU-R BS.1615-1 [i.5].

Table 1: AM configuration

Parameter	**AM signals**		
	Wanted	*Unwanted*	*Blocking*
Audio modulation	1 kHz tone	Weighted noise Recommendation ITU-R BS.559-2 [5], clause 1	1 kHz tone
	Band-limited to 4,5 kHz		
Other modulation parameters	40 %	50 % quasi-peak	80 % depth

4.2.3.2 FM testing

The generated FM signals (wanted and unwanted) and the blocking signal shall be in accordance with table 2. The configuration is based on Recommendation ITU-R BS.641 [i.6].

Table 2: FM configuration

Parameter	**FM signals**		**AM signal**
	Wanted	*Unwanted*	*Blocking*
Audio modulation	1 kHz tone	Weighted noise Recommendation ITU-R BS.559-2 [5], clause 1	1 kHz tone
	Band-limited to 15 kHz		
Other modulation parameters	±60,8 kHz peak deviation	32 kHz quasi-peak deviation (see note)	80 % depth
Pilot tone	None	None	
NOTE: This is equivalent to 19 / √2 = 13,4 kHz RMS deviation in the absence of pre-emphasis.			

4.2.3.3 DAB testing

The generated DAB signals (wanted and unwanted) and the blocking signal shall be in accordance in table 3.

Table 3: DAB configuration

Parameter	DAB signal	AM signal
	Wanted and Unwanted	*Blocking*
Audio modulation	Service label: "Sine+" 1 kHz tone at a level of -3 dBFS Coding: mono, 128 kbit/s AAC	1 kHz tone
Other modulation parameters	DAB signal with EEP-3A to ETSI EN 300 401 [1], clause 15	80 % depth

4.2.3.4 DRM testing

The generated DRM signals (wanted and unwanted) and the blocking signal shall be in accordance in table 4.

Table 4: DRM configuration

Parameter	DRM signal				AM signal
	Wanted and Unwanted				*Blocking*
Audio coding	Service label: "Sine +" 1 kHz tone at a level of -3 dBFS Coding: mono AAC at maximum permitted rate				1 kHz tone
Frequency band		LF/MF	HF	VHF	
Channel coding parameters	RM flag	0	0	1	
	protection level	1	1	2	
	MSC mode	0	0	0	
	interleaver depth	1	1	0	
	robustness mode	B	B	E	
	spectrum occupancy	2	3	0	
Other modulation Parameters	DRM signal to ETSI ES 201 980 [2], clause 8				80 % depth

4.2.4 Sensitivity

4.2.4.1 Definition

The receiver sensitivity is the minimum wanted signal level required to provide a given level of audio quality.

The appropriate measure of audio quality, known as the impairment criteria, are specified for each modulation type.

4.2.4.2 Limits

The limits for sensitivity specified in table 5 shall apply. Each figure quoted is the required level of wanted signal which provides a given level of audio quality. The audio impairment criteria relevant for these tests for the different demodulation types are given in table 6.

Table 5: Sensitivity requirements

Test	De-modulation	Tuned frequency band	Wanted signal centre frequency (MHz)	Required sensitivity limit	
				Conducted (dBm)	Radiated (dBµV/m)
1	AM	LF	0,216	-65	74
2		MF	0,999	-65	66
3		HF	9,9	-65	60
4	FM	VHF band II	98	-90	50 (see note 1)
5	DAB	VHF band III	202,928	-94	37 (see note 2)
6	DRM	LF	0,216	-101	58
7		MF	0,999	-101	52
8		HF1	4	-101	44
9		HF2	19	-101	40
10		VHF band I	65	-102	45
11		VHF band II	100	-102	46
12		VHF band III	200	-102	51
NOTE 1: For products with an integral antenna, the requirement is relaxed to 67 dBµV/m. NOTE 2: For products with an integral antenna, the requirement is relaxed to 50 dBµV/m.					

Table 6: Impairment criteria for sensitivity tests

Demodulation	Impairment criteria
AM	SNR ≥ 28 dBQ ref 40 % AM
FM	SNR ≥ 40 dBQ ref ±60,8 kHz deviation; clean audio (see note 1)
DAB	Clean audio (see note 2)
DRM	Clean audio (see note 2)
NOTE 1: Clean audio is defined as 10 seconds of audio with no subjective impairments (e.g. clicks resulting from FM threshold effects). NOTE 2: Clean audio is defined as 10 seconds of audio with no subjective impairments (e.g. muting, clicks, warbles or squeaks).	

4.2.4.3 Conformance

Conformance tests as defined in clause 5.3.4 shall be carried out. Only demodulation systems supported by the receiver shall be tested. Only bands supported by the receiver shall be tested.

4.2.5 Adjacent channel selectivity and blocking

4.2.5.1 Definition

The adjacent channel selectivity at a given frequency separation, is the ratio of the maximum unwanted signal level to the wanted signal level necessary to provide a given level of audio quality. The wanted and unwanted signals are of the same modulation type.

The blocking ratio at a given frequency separation, is the ratio of the maximum AM unwanted signal level to the wanted signal level necessary to provide a given level of audio quality.

The appropriate measure of audio quality, known as the impairment criteria, are specified for each modulation type.

In order to provide effective use of spectrum, devices shall be able to demodulate the tuned signal in the presence of similar signals in adjacent channels. The first, second and third adjacent channels both above and below the tuned signal shall be tested. In addition, testing shall also be performed to check the ability of the receiver to work effectively with interfering signals at a greater separation from the wanted signal (blocking). The channel spacings specified in table 7 shall apply.

Table 7: Channel spacing for adjacent channel selectivity and blocking

Demodulation	Tuned frequency band	Unwanted frequency (N = 1, 2, 3)	Unwanted frequency (blocking)
AM	LF	±N × 9 kHz	±90 kHz
	MF	±N × 9 kHz	±90 kHz
	HF	±N × 10 kHz	±100 kHz
FM	VHF band II	±(N + 1) × 100 kHz	±800 kHz
DAB	VHF band III	±N × 1 712 kHz	±12 MHz
DRM	LF	±N × 9 kHz	±90 kHz
	MF	±N × 9 kHz	±90 kHz
	HF	±N × 10 kHz	±100 kHz
	VHF band I	±N × 100 kHz	±800 kHz
	VHF band II	±N × 100 kHz	±800 kHz
	VHF band III	±N × 100 kHz	±800 kHz

4.2.5.2 Limits

The limits for selectivity and blocking specified in table 8 shall apply with the channel spacings given in table 7. Each figure quoted is the minimum acceptable level of unwanted signal, relative to that of the wanted signal, which provides a given level of audio quality. The audio impairment criteria relevant for these tests for the different demodulation types are given in table 9.

Table 8: Adjacent channel selectivity and blocking requirements

Test	De-modulation	Tuned frequency band	C Wanted signal centre frequency (MHz)	C Wanted signal level		Required I/C ratio (see notes 1 and 2)			
				Conducted (dBm)	Radiated (dBµV/m)	N = 1 (dB)	N = 2 (dB)	N = 3 (dB)	Blocking (dB)
1R	AM (built-in or integral antenna, see note 4)	LF	0,216	n/a	80	-30	10	20	20
2R		MF	0,999	n/a	72	-30	10	20	20
3R		HF	9,9	n/a	66	-30	10	20	20
1C	AM (external antenna)	LF	0,216	-59	n/a	-5	25	35	40
2C		MF	0,999	-59	n/a	-5	25	35	40
3C		HF	9,9	-59	n/a	-5	25	35	40
4R	FM (built-in or integral antenna, see note 4)	VHF band II	98	n/a	56 (see note 3)	-15	-3	8	20
4C	FM (external antenna)	VHF band II	98	-84	n/a	3	17	30	30
5	DAB	VHF band III	202,928	-70	61	35	40	45	40
6	DRM	LF	0,216	-91	68	25	35	45	50
7		MF	0,999	-91	62	25	35	45	50
8		HF1	4	-91	54	25	35	45	50
9		HF2	19	-91	54	25	35	45	50
10		VHF band I	65	-91	50	35	40	45	50
11		VHF band II	100	-92	55	35	40	45	50
12		VHF band III	200	-92	61	35	40	45	50

NOTE 1: The frequency of the interferer shall be calculated using the channel spacing data in table 7 for each of the 6 defined adjacent channels N = {-3, -2, -1, +1, +2, +3} and the two blocking offsets. Each row of table 8 thus defines 8 individual tests.

NOTE 2: The minimum level of I for the relevant level of impairment is calculated by adding the I/C ratio to the wanted C level.

NOTE 3: The wanted signal level for receivers with integral antenna is 73 dBµV/m.

NOTE 4: The ACS and blocking requirements for AM and FM devices are currently separated into different limits for radiated and conducted testing methods. These limits are likely to be unified in a future revision of the present document. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Table 9: Impairment criteria for adjacent channel selectivity and blocking tests

Demodulation	Impairment criteria
AM	SNR ≥ 28 dBQ ref 40 % AM
FM	SNR ≥ 40 dBQ ref ±60,8 kHz deviation; clean audio (see note 1)
DAB	Clean audio (see note 2)
DRM	Clean audio (see note 2)
NOTE 1: Clean audio is defined as 10 seconds of audio with no subjective impairments (e.g. clicks resulting from FM threshold effects).	
NOTE 2: Clean audio is defined as 10 seconds of audio with no subjective impairments (e.g. muting, clicks, warbles or squeaks).	

4.2.5.3 Conformance

Conformance tests as defined in clause 5.3.5 shall be carried out. Only demodulation systems supported by the receiver shall be tested. Only bands supported by the receiver shall be tested.

4.2.6 Unwanted emissions in the spurious domain

4.2.6.1 Definition

Unwanted emissions in the spurious domain are emissions from the equipment in the frequency range defined by CEPT/ERC/Recommendation 74-01E [i.7].

4.2.6.2 Limits

The limits in CENELEC EN 55032 [3], table A.4, table A.5, clause A.13.1, clause A.13.3 and in table A.13 of clause A.13.4 shall be respected.

4.2.6.3 Conformance

Manufacturers shall provide a representative sample of the receiver system. The level of spurious emissions shall be measured by either:

a) conducted (conducted differential voltage) emissions from an external RF port; and radiated emissions from the cabinet and structure of the equipment (cabinet radiation); or

b) radiated emissions from the cabinet and the built-in or integral antenna.

Conformance tests as defined in clause 5.3.6 shall be carried out.

5 Testing for compliance with technical requirements

5.1 Environmental conditions for testing

The equipment shall be tested under normal test conditions according to the relevant product and basic standards or to the information accompanying the equipment, which are within the manufacturers declared range of humidity, temperature and supply voltage. The test conditions shall be recorded in the test report.

5.2 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the measurements described in the present document shall be as follows:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report;
- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or less than the figures in table 10.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated and shall correspond to an expansion factor (coverage factor) k = 1,96 or k = 2 (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028 [i.2], in particular in annex D of the ETSI TR 100 028-2 [i.3].

Table 10 is based on such expansion factors.

Table 10: Maximum measurement uncertainty

Parameter	Uncertainty
Uncertainty in conducted measurements	±1 dB
Uncertainty in radiated measurements	±6 dB
Spurious emissions	See CENELEC EN 55032 [3], clause 11

5.3 Methods of measurement

5.3.1 Generic methods of measurement

Two generic methods of measurement are applicable to verifying the performance of the receiving equipment in question. The conducted test methods shall be used for receivers with an external antenna connector. The radiated test methods shall be used for all other receivers.

For both generic methods, two generators are needed. One provides the wanted signal, and the other the unwanted signal, or interferer (when required). The two signals are combined in such a way as to maintain isolation between the generators. It is necessary to provide calibrated attenuators for control of the individual levels; very often these will be built into the generators. Where the attenuators are external, cable lengths should be kept short to avoid cross-coupling effects.

The tests require the audio output of the receiver to be measured. The measurement device for the different modulation methods is given in table 11.

Table 11: Measurement device requirements

Modulation method	Measurement device on audio output
AM	quasi-peak detector employing Recommendation ITU-R BS.468-4 [6], clause 1 weighting
FM	quasi-peak detector employing Recommendation ITU-R BS.468-4 [6], clause 1 weighting
DAB	none (listen to audio)
DRM	none (listen to audio)

5.3.2 Generic measurement set-up for radiated testing

The measurement set-up is shown in figure 1 where © represents the calibration point of the system. The power levels of the two generators are measured here, after which they can be converted into field-strengths within the cell. For a 50 Ω system, if the power at © is *P* mW (0 dBm), the nominal field-strength *E* is given by $\sqrt{(50P)} / h$, where *h* is the height of the cell's septum above its floor. The exact relationship between *P* and *E* should be obtained from the manufacturer of the cell.

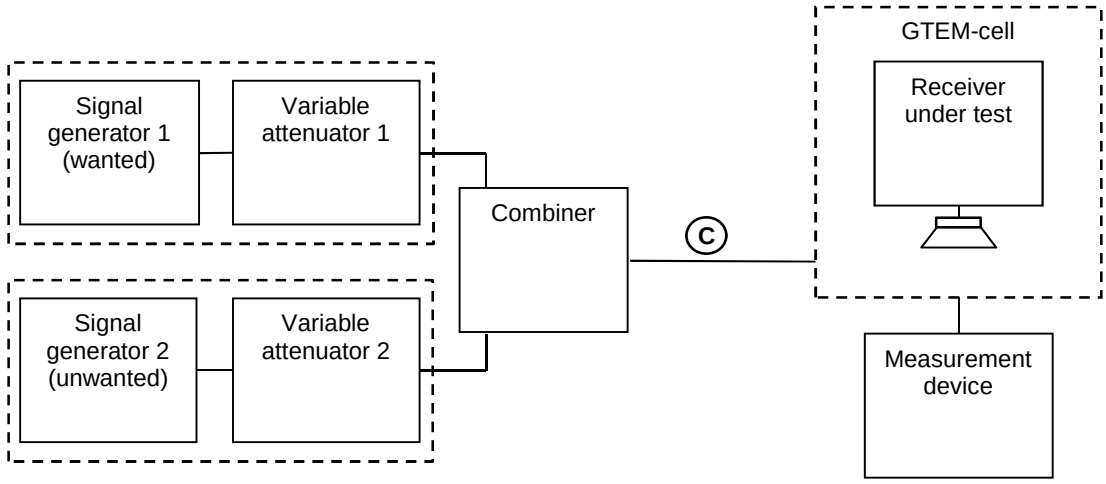

Figure 1: Generic measurement arrangement for receivers with built-in or integral antennas

The GTEM cell shall be of sufficient dimensions to provide a uniform field with the antenna fully extended; a minimum floor to ceiling height of 2 m is recommended. Figure 2 shows the usable volume of the GTEM cell. Details of the positioning of the receiver under test within the GTEM-cell are shown in figure 3. If the receiver under test is capable of running on internal batteries, then the testing shall be performed with new batteries fitted and no connection made to any external power source; the receiver shall be placed in the centre of the usable volume. If the receiver under test can only be operated with mains power or another external power source, the receiver shall be placed as close to the floor as possible whilst remaining in the calibrated zone and the power connection shall be run vertically from the receiver to the floor and then along the floor of the cell. Receivers using an earphone as the integral antenna shall be placed close to the floor, but separated from it by a non-conducting spacer, and the earphone shall be attached to a non-conducting support which holds the earpieces 15 cm apart with the lead running vertically downwards to its full extent to connect to the receiver. Receivers using a wire antenna (typically clock radios) shall be placed in the measuring environment such that the wire is fully contained within the calibrated zone. This may require the wire to be supported on a non-conducting structure. Most portable AM receivers have internal ferrite rod antennas. GTEM cells generate E and H fields in the same proportion as would exist in free space. The axis of the ferrite rod should be perpendicular to the current flow in the septum and parallel to the plane of the septum, as shown in figure 3. Receivers which have a choice of antenna need not be tested for all antennas: in this case the results shall be recorded against each antenna that is used for the testing. The measurement device, which shall be external to the GTEM-cell, shall be connected in such a way as to avoid either disturbance to the field within the cell or ingress of external interference. The following methods of connection for the audio output of the receiver to the external environment can be used:

- Optical.
- Acoustic: reference to CISPR 35 [i.8], annex G may be made for guidance on appropriate methods but the band pass filter specified in CISPR 35 [i.8], annex G shall not be used.

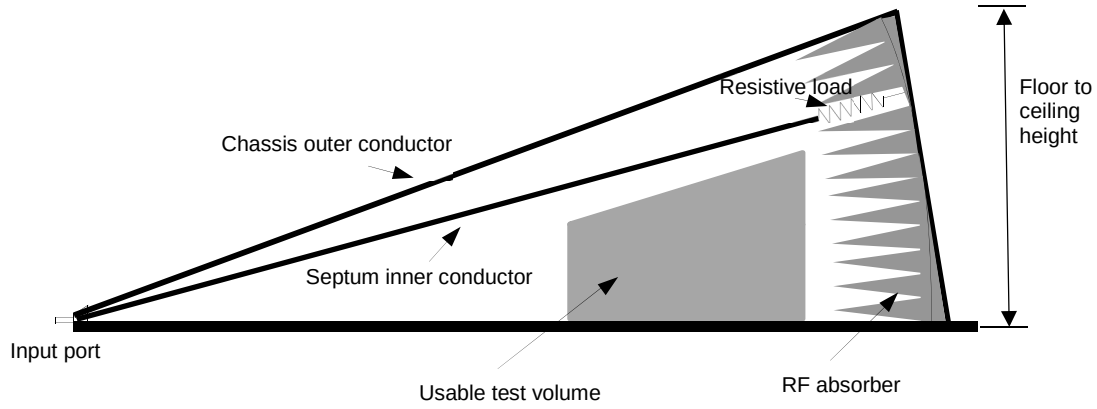

Figure 2: Side elevation of GTEM-cell showing usable test volume

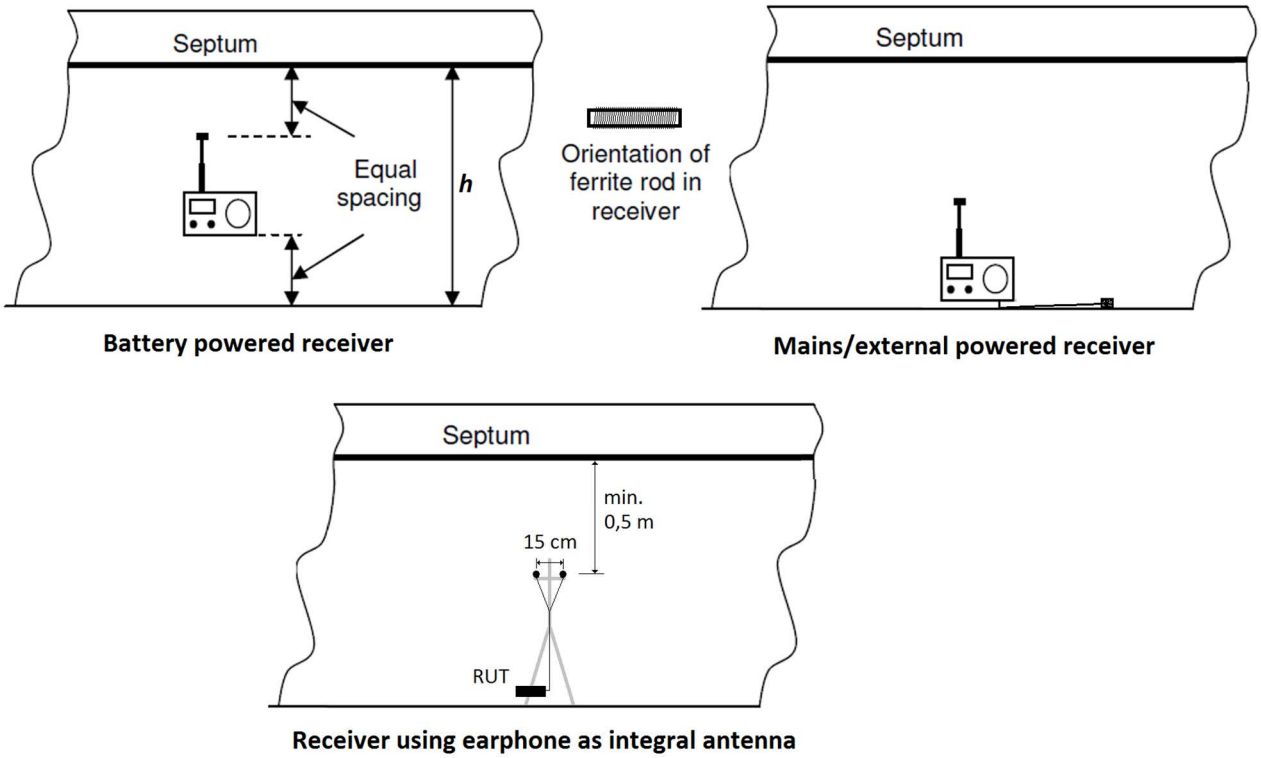

Figure 3: Diagram to show the positioning of receiver within GTEM-cell (viewed from input port)

A Semi Anechoic Chamber (SAC) or Fully Anechoic Room (FAR) in compliance with CENELEC EN 55032 [3], table A.1, annex C and annex D may be used in place of a GTEM cell. In these environments, electrical connections from the receiver to the audio measurement device are permitted provided they can be shown not to disturb the electric field; ferrite cores and/or filters are required. Where no earphone socket is provided, a manufacturer may extend the speaker leads from the internal speaker of the receiver, connected through a relevant filter, to the audio measurement device across the rated load impedance as specified by the manufacturer. An alternative way of generating a known magnetic field for testing AM receivers is by means of a test-loop, typically a single turn of wire about 300 mm in diameter and possessing an internal termination. Loops vary, and the manufacturer's instructions should be followed. The test-loop shall be used in a screened environment. A further way of generating a known magnetic field is given in IEC 60315-1 [4], clause 12, clause 19, clause 20, clause 21, clause 22, appendix B and appendix C. For products using an earphone as antenna, an electrical method can be used if the audio signal is isolated from the RF field by using an adaptor to prevent antenna performance degradation. An example of such an adaptor is shown in figure 4.

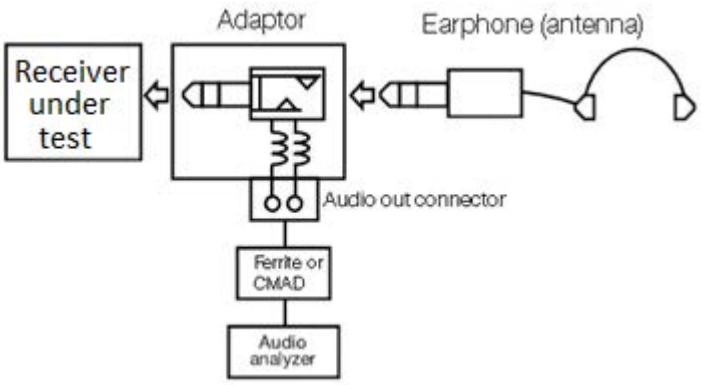

Figure 4: Example adaptor for products using earphone as antenna

5.3.3 Generic measurement set-up for equipment for conducted testing

The measurement set-up is shown in figure 5. In this case, there is no need for careful screening from the external environment, although high field-strengths from potential interferers should be avoided.

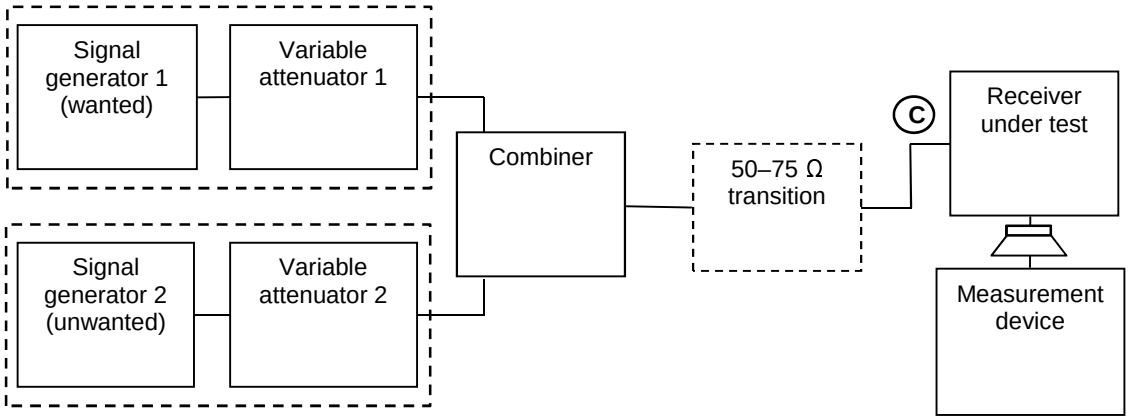

Figure 5: Generic measurement arrangement for receivers with an external antenna connector

© represents the calibration point of the system. The power levels of the two generators are measured here. Most test equipment is designed for 50 Ω systems, whereas domestic equipment is usually 75 Ω. Where the absolute level needs to be known, allowance shall be made for the loss in the transition, typically 6 dB for a minimum loss pad and 0 dB for a transformer. Care should be taken not to mix 50 Ω connectors and 75 Ω connectors, or damage could result.

For receivers which use an internal passive splitter to provide signals to multiple tuners and an active antenna which provides level matching, the power level at the calibration point shall be increased by the same factor as that provided by the active antenna (i.e. for the example of a receiver with an internal two-way 3 dB splitter and an active antenna providing a 3 dB gain, the power level at © shall be increased by 3 dB).

5.3.4 Sensitivity measurement methods

5.3.4.1 AM and FM sensitivity measurements

1) The 'unwanted' signal generator remains switched off for the duration of the test.

2) The 'wanted' signal generator is set to the required modulation method and test configuration as specified in clause 4.2.3, and to the frequency specified in clause 4.2.4. The signal level is adjusted to provide the level, as measured at ©, specified in clause 4.2.4 plus 30 dB.

3) The receiver is tuned to the frequency of the 'wanted' signal generator. For a receiver without a digital frequency display, the receiver shall be tuned for optimum THD+N (i.e. as it would be tuned by a user for best quality). The receiver's audio level shall be set so as to provide clean 1 kHz audio tone at the audio output (that is less than 10 % total harmonic distortion) but of sufficient level to drive the measurement device.

4) The level of the 'wanted' signal generator is adjusted to provide the level, as measured at ©, specified in clause 4.2.4.

5) The audio output, measured using the measurement device, is recorded as the signal level, S.

6) The modulating audio signal for the 'wanted' signal generator is removed. The audio output, measured using the measurement device, is recorded as the noise level, N.

7) If the impairment criteria given in clause 4.2.4 are met then the receiver has passed the test.

5.3.4.2 DAB and DRM sensitivity measurements

1) The 'unwanted' signal generator remains switched off for the duration of the test.

2) The 'wanted' signal generator is set to the required modulation method and test configuration as specified in clause 4.2.3, and to the frequency specified in clause 4.2.4. The signal level is adjusted to provide the level, as measured at ©, specified in clause 4.2.4 plus 30 dB.

3) The receiver is tuned to the frequency of the 'wanted' signal generator and the required service is selected using the UI. The audio level shall be set so as to provide clean 1 kHz audio tone at the audio output (that is less than 10 % total harmonic distortion) but of sufficient level to drive the measurement device.

4) The level of the 'wanted' signal generator is adjusted to provide the level, as measured at ©, specified in clause 4.2.4.

5) If the impairment criteria given in clause 4.2.4 are met then the receiver has passed the test.

5.3.5 Adjacent channel selectivity and blocking measurement methods

5.3.5.1 AM and FM adjacent channel selectivity and blocking measurements

The means of generating the noise modulation for AM and FM 'unwanted' signals is shown in figure 6. It is feasible to use a PC to generate these signals, but care is needed to ensure freedom from out-of-band artifacts.

Figure 6: Arrangement for generating AM and FM interferers

Care needs to be exercised in setting up the modulation level. Normally a quasi-peak detector is appropriate. A useful technique for FM is to switch off the pre-emphasis and then apply a 1 kHz audio tone to the modulation input of the generator. The tone is adjusted in level to achieve 19 kHz peak deviation. The tone is measured with an RMS voltmeter and replaced with noise of the same RMS voltage. With the pre-emphasis restored, the deviation should now be 34,9 kHz quasi-peak or 14,6 kHz RMS:

1) The 'wanted' signal generator is set to the required modulation method and test configuration as specified in clause 4.2.3, and to the frequency specified in clause 4.2.5. The signal level is adjusted to provide the level, as measured at ©, specified in clause 4.2.5, with the 'unwanted' generator switched off.

2) The 'unwanted' signal generator is set to the required modulation method and test configuration as specified in clause 4.2.3, and to the frequency calculated from the wanted signal centre frequency and the required offset specified in clause 4.2.5. The signal level is adjusted to provide the level, as measured at ©, specified in clause 4.2.5, with the 'wanted' generator switched off. For the blocking test only, the audio modulation of the 'unwanted' signal shall be removed whilst measuring the level at ©.

3) The 'wanted' signal generator is switched back on.

4) The receiver is tuned to the frequency of the 'wanted' signal generator. For a receiver without a digital frequency display, the receiver shall be tuned for optimum THD+N (i.e. as it would be tuned by a user for best quality). The receiver's audio level shall be set so as to provide clean 1 kHz audio tone at the audio output (that is less than 10 % total harmonic distortion) but of sufficient level to drive the measurement device.

5) The audio output, measured using the measurement device, is recorded as the signal level, S.

6) The modulating audio signal for the 'wanted' signal generator is removed. The audio output, measured using the measurement device, is recorded as the noise level, N.

7) If the impairment criteria given in clause 4.2.5 are met then the receiver has passed the test.

5.3.5.2 DAB and DRM adjacent channel selectivity and blocking measurements

1) The 'wanted' signal generator is set to the required modulation method and test configuration as specified in clause 4.2.3, and to the frequency specified in clause 4.2.5. The signal level is adjusted to provide the level, as measured at ©, specified in clause 4.2.5, with the 'unwanted' generator switched off.

2) The receiver is tuned to the frequency of the 'wanted' signal generator. The audio level shall be set so as to provide clean 1 kHz audio tone at the audio output (that is less than 10 % total harmonic distortion) but of sufficient level to drive the measurement device.

3) The 'unwanted' signal generator is set to the required modulation method and test configuration as specified in clause 4.2.3, and to the frequency calculated from the wanted signal centre frequency and the required offset specified in clause 4.2.5. The signal level is adjusted to provide the level, as measured at ©, specified in clause 4.2.5, with the 'wanted' generator switched off. For the blocking test only, the audio modulation of the 'unwanted' signal shall be removed whilst measuring the level at ©.

4) The 'wanted' signal generator is switched back on.

5) If the impairment criteria given in clause 4.2.5 are met then the receiver has passed the test.

5.3.6 Unwanted emissions in the spurious domain

5.3.6.1 Methods of measurement

Manufacturers shall provide a representative sample of the receiver system. The level of spurious emissions shall be measured according to CENELEC EN 55032 [3], clause 6.3, clause 8, table A.1, table A.6, in table A.8 of clause A.8.5, annex B, clause C.2.1, clause C.2.2, clause C.2.3, clause C.3.1, clause C.3.2, clause C.3.3, clause C.3.4, clause C.3.7, clause C.4.2, clause C.4.4 and annex D and carried out by conducted (conducted differential voltage) emissions from an external RF port as well as radiated emissions from the cabinet and structure of the equipment (cabinet radiation).

The equipment shall be tested in its normal operating mode.

Annex A (informative): Relationship between the present document and the essential requirements of Directive 2014/53/EU

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.9] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table A.1: Relationship between the present document and the essential requirements of Directive 2014/53/EU

Harmonised Standard ETSI EN 303 345				
Requirement			Requirement Conditionality	
No	**Description**	**Reference: Clause No**	**U/C**	**Condition**
1	Sensitivity	4.2.4	U	
2	Receiver adjacent channel selectivity and blocking	4.2.5	U	
3	Unwanted emissions in the spurious domain	4.2.6	U	

Key to columns:

Requirement:

No A unique identifier for one row of the table which may be used to identify a requirement.

Description A textual reference to the requirement.

Clause Number Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

U/C Indicates whether the requirement is unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).

Condition Explains the conditions when the requirement is or is not applicable for a requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

Annex B (informative): Commentary on development of the present document

The present document applies to devices that receive broadcast sound services, whether analogue or digital modulation is used, and such devices have not had such requirements before. Due discussion took place regarding the test requirements and limits that were essential for the fulfilment of the directive, and that discussion revolved around the maturity of the market for analogue and digital broadcast sound receivers.

Regarding digital receivers, the requirements were relatively straightforward to agree since these systems are comparatively new and are only beginning to establish themselves in the market. The risk of product performance being associated with system performance is therefore strong, and the industry has been fairly united in agreeing performance targets that will ensure system acceptance from the public, thus avoiding market failure. Largely, the performance targets from voluntary conformance schemes, such as the UK Digital Radio Tick Mark, have been adopted here.

However, for analogue receivers, the market is long established and mature and no such correlation between the performance of individual products and the performance of the broadcast modulation method is evident. In establishing the relevant limits for analogue receivers, it is has been necessary to make the appropriate decisions between receiver parameters assumed for the purposes of international frequency coordination (so called "planning parameters"), the signals that are actually on-air across Europe, manufacturing process variations, and the extremely wide variety of analogue receivers, with a broad range of price points, that the public has come to expect to be available. Especially in the case of receivers with built-in antennas, commercially successful products exist with performance that would not be seen to be "typical" in ITU-R planning documents, but which nevertheless perform adequately for their chosen usage, generally because the user has the benefit of greater signal strength than that assumed to be at the "edge of coverage".

The present document seeks to capture the essential requirements of the directive whilst respecting the current state of the market. The ACS and blocking requirements for AM and FM devices are currently separated into different limits for radiated and conducted testing methods. These limits are likely to be unified in a future revision of the present document.

Annex C (informative): Measurement set-up for electrical methods during radiated testing

Electrical connections within the field can influence the result to testing unless carefully positioned. The connection to the audio analyser and any external power supply cables should be configured in a perpendicular direction to the electric field, and a CMAD or ferrite with an appropriate impedance over the frequency range of the testing should be applied, see figure C.1.

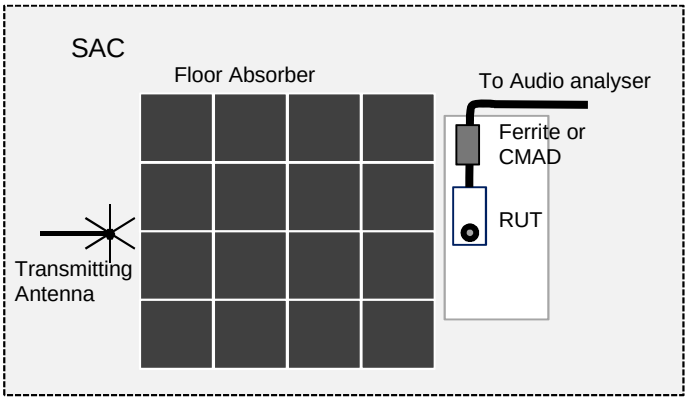

Figure C.1: Example set-up for electrical method (top view).

Annex D (informative): Change History

Version	Information about changes
1.1.7	First published version.

History

Document history			
V1.1.1	July 2016	EN Approval Procedure	AP 20161011: 2016-07-13 to 2016-10-11
V1.1.7	March 2017	Vote	V 20170514: 2017-03-15 to 2017-05-15