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Harmonized European Standard

**White Space Devices (WSD);
Wireless Access Systems operating in the 470 MHz to 790 MHz
TV broadcast band;
Harmonized EN covering the essential requirements
of article 3.2 of the R&TTE Directive**

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Foreword

This Harmonized European Standard (EN) has been produced by ETSI Technical Committee Broadband Radio Access Networks (BRAN).

The present document has been produced by ETSI in response to mandates M/284 and M/512 issued from the European Commission under Directive 98/34/EC [i.1] as amended by Directive 98/48/EC [i.2].

The title and reference to the present document are intended to be included in the publication in the Official Journal of the European Union of titles and references of Harmonized Standard under the Directive 1999/5/EC [i.3].

See article 5.1 of Directive 1999/5/EC [i.3] for information on presumption of conformity and Harmonized Standards or parts thereof the references of which have been published in the Official Journal of the European Union.

The requirements relevant to Directive 1999/5/EC [i.3] are summarized in annex A.

National transposition dates

Date of adoption of this EN:	21 April 2014
Date of latest announcement of this EN (doa):	31 July 2014
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 January 2015
Date of withdrawal of any conflicting National Standard (dow):	31 January 2016

Introduction

The present document is part of a set of standards developed by ETSI and is designed to fit in a modular structure to cover all radio and telecommunications terminal equipment within the scope of the R&TTE Directive [i.3]. The modular structure is shown in EG 201 399 [i.4].

The methods and principles used in the present document for the operation of TV White Space devices in the band 470 MHz to 790 MHz are taken from the ECC Report 186 [i.5], which explains the regulatory principles under which it is envisaged such devices will be permitted to operate in Europe. This approach is also explained in further detail in Chapter 9 of "Dynamic White Space Spectrum Access" [i.11].

A requirement to facilitate coexistence between TVWSDs is not considered essential with respect to compliance with Article 3.2 of Directive 1999/5/EC [i.3] and therefore is not included in the current version of the present document. This may change in the future, resulting in the inclusion of mitigation techniques in a revision of the present document, to improve the coexistence among TVWSDs, if considered essential in order to comply with Article 3.2 of Directive 1999/5/EC [i.3].

1 Scope

The present document applies to TV white space devices (TVWSDs) controlled by a TV white space database (TVWSDB) and which operate in the TV broadcast band 470 MHz to 790 MHz.

The present document applies to the following radio equipment types:

- 1) Master TV white space device (TVWSD)
- 2) Slave TV white space device (TVWSD)

The present document applies to TVWSDs with integral, dedicated or external antennas, where TVWSDs using external antennas are intended only for fixed use. The present document is intended to cover the provisions of Directive 1999/5/EC [i.3] (R&TTE Directive), Article 3.2, which states that "..... radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communications and orbital resources so as to avoid harmful interference".

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the R&TTE Directive may apply to equipment within the scope of the present document.

NOTE: A list of such ENs is included on the web site <http://www.newapproach.org>.

2 References

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

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

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

2.1 Normative references

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

- [1] NIMA Technical Report TR8350.2 (1984, including amendment 1 of 03 January 2000 and amendment 2 of 23 June 2004): "Department of Defense World Geodetic System 1984. Its Definition and Relationships with Local Geodetic Systems".

NOTE: Available at <http://earth-info.nga.mil/GandG/publications/tr8350.2/wgs84fin.pdf>.

- [2] ETSI TR 100 028-1 (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1".
- [3] ETSI TR 100 028-2 (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".
- [4] IETF RFC 4122 (05-2007): "A Universally Unique IDentifier (UUID) URN Namespace".

NOTE: Available at <http://www.ietf.org/rfc/rfc4122.txt>.

2.2 Informative references

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 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations and of rules on Information Society services.
- [i.2] Directive 98/48/EC of the European Parliament and of the Council of 20 July 1998 amending Directive 98/34/EC laying down a procedure for the provision of information in the field of technical standards and regulations.
- [i.3] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).
- [i.4] ETSI EG 201 399: "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of Harmonized Standards for application under the R&TTE Directive".
- [i.5] ECC Report 186: "Technical and operational requirements for the operation of white space devices under geo-location approach", January 2013.
- [i.6] ETSI TR 102 273-2: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 2: Anechoic chamber".
- [i.7] ETSI TR 102 273-3: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 3: Anechoic chamber with a ground plane".
- [i.8] ETSI TR 102 273-4: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 4: Open area test site".
- [i.9] ETSI TR 103 231: "White Space Devices (WSD); Wireless Access Systems operating in the 470 MHz to 790 MHz TV broadcast band; Information on weblisting of TV White Space Databases (TVWSDBs)".
- [i.10] ECC Report 159: "Technical and operational requirements for the possible operation of cognitive radio systems in the "white spaces" of the frequency band 470-790 MHz", January 2011.
- [i.11] Dynamic White Space Spectrum Access; By William Webb and contributors.

NOTE: Available at <http://www.webbsearch.co.uk/publications/>.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ECC Report 159 [i.10] and the following apply:

Adjacent Channel Leakage Ratio (ACLR): ratio of the in-band transmit power measured in an 8 MHz TV channel, to the out-of-band emission measured in 100 kHz in an adjacent TV channel

altitude: height above the reference level defined by WGS84

association: process whereby a slave TVWSD provides its device parameters to a master TVWSD and initially identifies itself to its serving master TVWSD

Authentication: ability to verify the identity of a server, and that a message was truly sent by the asserted sender

channel usage parameters: parameters sent by a TVWSD to inform the TVWSDB of the actual radio resources that will be used by both the master and the slave TVWSDs

dedicated antenna: removable antenna supplied and assessed with the radio equipment, designed as an indispensable part of the equipment

device emission class: classification declared by the manufacturer that identifies the level of ACLR for the device

device parameters: parameters that specify the technical characteristics of an individual TVWSD, and its location

Digital Terrestrial Television (DTT): platform for the delivery of digital TV content via terrestrial broadcasting

DTT channel: 8 MHz channel in accordance with the European harmonized DTT channel raster

external antenna: removable antenna which is designed for use with a broad range of radio equipment and has not been designed for use with a specific product

NOTE: An external antenna is not assessed together with the equipment against the requirements of the present document.

generic operational parameters: transmission parameters communicated by a master TVWSD to any slave TVWSD within the coverage area of that master TVWSD to allow the slave TVWSD to operate as required

geographic validity: geographic area within which the operational parameters for a geo-located TVWSD are valid

geo-location capability: capability of a TVWSD to determine and report the latitude, longitude and altitude coordinates of its antenna

geo-location uncertainty: 3D position error defined by the difference in metres between the point reported by the TVWSD device to the TVWSDB and the actual position of the TVWSD antenna

horizontal geo-location capability: capability of a TVWSD to determine and report the latitude and longitude coordinates of its antenna

in-block emissions: intended emissions that fall within a single or multiple DTT channel(s)

integral antenna: antenna designed as a fixed part of the equipment, without the use of an external connector, which cannot be disconnected from the equipment by a user with the intent to connect another antenna

NOTE: An integral antenna may be fitted internally or externally. In the case where the antenna is external, a non-detachable cable can be used.

Integrity: capability to protect messages against accidental or malicious changes during transit

master operational parameters: transmission parameters communicated from a TVWSDB to a master TVWSD to allow the master TVWSD to operate as required

master TVWSD: geo-located TVWSD that is able to communicate directly with a TVWSDB and with TVWSDs

out-of-block emissions: unwanted emissions that fall within the 470 MHz to 790 MHz band

regulatory domains: geographical area where a set of regulatory rules applies

NOTE: This is normally a country.

reverse intermodulation attenuation: measure of the capability of the transmitter to inhibit the generation of intermodulation signals in its non-linear components caused by the presence of the transmitter wanted signal and an unwanted signal reaching the transmitter via the antenna

reverse intermodulation attenuation improvement: measure of the improvement in reverse intermodulation attenuation beyond the minimum value required, as a function of in-block transmitter power

slave operational parameters: transmission parameters communicated from a TVWSDB via a master TVWSD to enable a slave TVWSD to operate as required

slave TVWSD: TVWSD that is only able to communicate with other TVWSDs, when under the control of a master TVWSD

sleep mode: mode of operation for which the TVWSD is inactive but is not powered-down

specific operation parameters: transmission parameters communicated from a TVWSDB to a specific TVWSD (master or slave), taking account of the device parameters of that specific TVWSD

test equipment: equipment that provides the means to operate and control a UUT for the purposes of testing against the requirements contained in the present document

test master TVWSD: test equipment that emulates the functionalities of a master TVWSD for the purposes of testing a slave TVWSD against the requirements contained in the present document

test slave TVWSD: test equipment that emulates the functionalities of a slave TVWSD for the purposes of testing a master TVWSD against the requirements contained in the present document

test white space database: test equipment that emulates the functionalities of a TVWSDB for the purposes of testing a TVWSD against the requirements contained in the present document

time validity: period of time when a set of operational parameters is valid, determined by the $T_{ValStart}$ and T_{ValEnd} parameters contained in the said operational parameter set

TV white spaces: frequencies within the 470 MHz to 790 MHz band which have been identified by a TVWSDB for use by a TVWSD

TV White Space Database (TVWSDB): database system approved by the relevant national regulatory authority which can communicate with TVWSDs and provide information on TV white space availability

TV White Space Device (TVWSD): TVWSD controlled by a TVWSDB and which operates in TV white spaces

UHF TV band: 470 MHz to 790 MHz band

NOTE: This corresponds to DTT channels 21 to 60.

vertical geo-location capability: capability of a TVWSD to determine and report the altitude of its antenna

weblisting: publically available Internet listing of approved TVWSDB(s) relevant to a regulatory domain, and which is hosted by, or on behalf of the national regulatory authority for that regulatory domain

3.2 Symbols

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

A_{ch}	Number of active transmit chains
dB	decibel
dBc	decibel relative to carrier
dBm	decibel relative to 1 milliwatt
f	Frequency of measurement
f_c	Centre frequency of the assigned channel
$f_{l,i}$	Frequency at the lower edge of the i^{th} channel
$f_{u,i}$	Frequency at the upper edge of the i^{th} channel
f_{un}	Centre frequency of the unwanted signal
f_w	Centre frequency of the wanted signal
$P_{0,i}$	Maximum mean EIRP in a given (i^{th}) 100 kHz channel
$P_{1,i}$	Maximum mean EIRP in a given (i^{th}) 8 MHz channel
P_{IB}	Measured in block EIRP spectral density over 8 MHz
P_{IBk}	An intermediate (k^{th}) value of P_{IB}
P_{IBMax}	Maximum value of P_{IB}
PIM3	Power of the third order intermodulation product at frequency $(2 \times f_w - f_{un})$, measured in a 100 kHz bandwidth
P_{OOB}	Mean out of block EIRP spectral density
$P_{0,i}$	In-block EIRP spectral density (dBm/100 kHz) which a TVWSD intends to use within each DTT channel
$P_{1,i}$	In-block EIRP which a TVWSD intends to use within each (8 MHz) DTT channel
RIM3	third order reverse intermodulation attenuation
$\Delta RIM3$	Improvement in the third order reverse intermodulation attenuation (RIM3)

T _{Dur}	Time duration of the operational parameters
T _{ValEnd}	Absolute time of the end of the period of validity of the operational parameters
T _{ValStart}	Absolute time of the start of the period of validity of the operational parameters

3.3 Abbreviations

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

AC	Alternating Current
ACLR	Adjacent Channel Leakage Ratio
BW	Bandwidth
DC	Direct Current
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
DTT	Digital Terrestrial Television
EIRP	Equivalent Isotropically Radiated Power
FAR	Fully Anechoic Room
GHz	GigaHertz
GNSS	Global Navigation Satellite System
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IP	Internet Protocol
LPDA	Logarithmic Periodic Dipole Antenna
MAC	Media Access Control
MHz	MegaHertz
OATS	Open Area Test Site
OUI	Organizationally Unique Identifier
R&TTE	Radio equipment and Telecommunications Terminal Equipment
RBW	Resolution Bandwidth
RF	Radio Frequency
RMS	Root Mean Square
SAR	Semi Anechoic Room
TE	Test Equipment
TV	Television
TVWSD	TV White Space Device
TVWSDB	TV White Space Database
UE	User Equipment
UHF	Ultra High Frequency
UUID	Universally Unique Identifier
UUT	Unit Under Test
VSWR	Voltage Standing Wave Ratio

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 supplier. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared normal and extreme operating conditions.

4.2 Conformance requirements

To meet the essential requirements under article 3.2 of the R&TTE Directive [i.3] the essential parameters have been identified. Table A.1 provides a cross reference between these essential parameters and the corresponding technical requirements for equipment within the scope of the present document. To fulfil an essential parameter the compliance with all the corresponding technical requirements in table A.1 shall be verified.

Where the technical requirements in the present document do not contain values for the operating limits, these values will be supplied individually by the TVWSDB according to national regulations.

4.2.1 Equipment types

For the purpose of the present document, two equipment types have been defined.

NOTE: It is envisaged that a TVWSD which is not fixed, will operate with an integral or dedicated antenna.

4.2.1.1 Equipment Type A

A Type A TVWSD is a device that is intended for fixed use only. This type of equipment can have integral, dedicated or external antennas.

4.2.1.2 Equipment Type B

A Type B TVWSD is a device that is not intended for fixed use and which has an integral antenna or a dedicated antenna.

The equipment and the antenna shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

In the case of dedicated antennas, the manufacturer has to specify the antennas that have been assessed together with the equipment against the requirements of the present document. That information shall be included in the user documentation. The use of other antennas is prohibited.

4.2.2 Nominal Channel Bandwidth and Total Nominal Channel Bandwidth

4.2.2.1 Definition

A Nominal Channel is defined as one or more contiguous DTT channels that are used by a TVWSD for its wanted transmissions.

The Nominal Channel Bandwidth is the bandwidth of a Nominal Channel. The Nominal Channel Bandwidth is a multiple of 8 MHz.

The Total Nominal Channel Bandwidth is the sum of all of the Nominal Channel Bandwidths used simultaneously by a TVWSD.

NOTE: A TVWSD may operate in a single DTT channel, or it may operate simultaneously in a group of contiguous DTT channels, multiple non-contiguous DTT channels, or a mixture of contiguous and non-contiguous DTT channels. See the examples in annex E.

4.2.2.2 Requirements

The lower and upper edge frequencies of a nominal channel shall coincide with the European harmonized DTT channel raster shown in figure 1.

DTT channel raster (MHz)	470 to 478	478 to 486	486 to 494	...	766 to 774	774 to 782	782 to 790
DTT channel numbers	21	22	23	...	58	59	60

Figure 1: European harmonized DTT channel raster

The Nominal Channel Bandwidth used by a TVWSD shall not exceed the Maximum Nominal Channel Bandwidth specified by the TVWSDB (see clause 4.2.6.2.1.2).

The Total Nominal Channel Bandwidth used by a TVWSD shall not exceed the Maximum Total Nominal Channel Bandwidth specified by the TVWSDB (see clause 4.2.6.2.1.2).