



**TV White Space Devices (TVWSD);
Wireless Access Systems operating in the
470 MHz to 694 MHz TV broadcast band;
Harmonised Standard for access to radio spectrum**

ETSI EN 301 598 V2.2.1 (2022-03)

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Contents

Intellectual Property Rights	8
Foreword.....	8
Modal verbs terminology.....	9
Introduction	9
1 Scope	10
2 References	10
2.1 Normative references	10
2.2 Informative references.....	10
3 Definition of terms, symbols and abbreviations.....	11
3.1 Terms.....	11
3.2 Symbols.....	13
3.3 Abbreviations	14
4 Technical requirements specifications	15
4.1 Environmental profile.....	15
4.2 Conformance requirements	15
4.2.1 Void	15
4.2.2 Equipment types	15
4.2.2.1 Definition	15
4.2.2.2 Equipment Type A	15
4.2.2.3 Equipment Type B	15
4.2.3 Nominal Channel Bandwidth and Total Nominal Channel Bandwidth.....	15
4.2.3.1 Definitions.....	15
4.2.3.2 Requirements	15
4.2.4 RF power and RF power spectral density	16
4.2.4.1 Definitions.....	16
4.2.4.1.1 RF power	16
4.2.4.1.2 RF power spectral density	16
4.2.4.2 Limits	16
4.2.4.3 Conformance.....	16
4.2.5 Transmitter unwanted emissions.....	16
4.2.5.1 Transmitter unwanted emissions outside the 470 MHz to 694 MHz band.....	16
4.2.5.1.1 Definition.....	16
4.2.5.1.2 Limits	17
4.2.5.1.3 Conformance	17
4.2.5.2 Transmitter unwanted emissions within the 470 MHz to 694 MHz band.....	17
4.2.5.2.1 Definition.....	17
4.2.5.2.2 Limits	17
4.2.5.2.3 Conformance	18
4.2.6 Transmitter Reverse Intermodulation Attenuation.....	18
4.2.6.1 Definition	18
4.2.6.2 Limits	18
4.2.6.3 Conformance.....	18
4.2.7 Control and monitoring.....	18
4.2.7.1 Control and monitoring mechanisms	18
4.2.7.2 TVWSDB identification.....	19
4.2.7.2.1 Applicability	19
4.2.7.2.2 Definition.....	19
4.2.7.2.3 Requirements	19
4.2.7.2.4 Conformance	19
4.2.7.3 Data exchange and compliance with parameters.....	19
4.2.7.3.1 Applicability	19
4.2.7.3.2 Device parameters, operational parameters and channel usage.....	19
4.2.7.3.3 Transmission in compliance with parameters.....	22
4.2.7.3.4 Reporting of device parameters	23

4.2.7.3.5	Reporting of channel usage parameters	23
4.2.7.3.6	Functionality of a primary TVWSD to support secondary TVWSDs	23
4.2.7.3.7	Conformance	24
4.2.7.4	Primary TVWSD update	25
4.2.7.4.1	Definition.....	25
4.2.7.4.2	Requirements.....	25
4.2.7.4.3	Conformance	25
4.2.7.5	Secondary TVWSD update	25
4.2.7.5.1	Applicability.....	25
4.2.7.5.2	Definition.....	25
4.2.7.5.3	Requirements.....	25
4.2.7.5.4	Conformance	26
4.2.8	Receiver Sensitivity Level	26
4.2.8.1	Applicability.....	26
4.2.8.2	Definition	26
4.2.8.3	Performance Criteria	26
4.2.8.4	Limits	26
4.2.8.5	Conformance.....	26
4.2.9	Adjacent Channel Selectivity.....	26
4.2.9.1	Applicability.....	26
4.2.9.2	Definition	26
4.2.9.3	Performance Criteria	26
4.2.9.4	Limits	26
4.2.9.5	Conformance.....	27
4.2.10	Receiver Blocking	27
4.2.10.1	Applicability.....	27
4.2.10.2	Definition	27
4.2.10.3	Performance Criteria	27
4.2.10.4	Limits	27
4.2.10.5	Conformance.....	28
4.2.11	Receiver spurious emissions	28
4.2.11.1	Definition	28
4.2.11.2	Limits	28
4.2.11.3	Conformance.....	28
4.2.12	Geo-Location capability	28
4.2.12.1	Definition	28
4.2.12.2	Requirements	28
4.2.12.3	Conformance.....	29
4.2.13	User Access Restrictions	29
4.2.13.1	Definition / General.....	29
4.2.13.2	Parameters subject to User Access Restrictions	29
4.2.13.3	Conformance.....	29
5	Testing for compliance with technical requirements.....	29
5.1	Introduction	29
5.2	Conditions for testing.....	30
5.2.1	Normal and extreme test conditions.....	30
5.2.2	Antennas	30
5.2.3	Conducted measurements, radiated measurements, and relative measurements	30
5.2.4	Transmit operating modes	30
5.2.5	Requirements for the test modulation	31
5.2.6	Communication between test TVWSD, primary and secondary UUT.....	31
5.2.7	Operational Parameter set.....	31
5.3	Void.....	32
5.4	Essential test suites	32
5.4.1	Product Information.....	32
5.4.2	RF output power	33
5.4.2.1	Test conditions	33
5.4.2.2	Test method.....	33
5.4.2.2.1	Conducted measurements	33
5.4.2.2.2	Radiated measurements	34
5.4.3	Power Spectral Density and Transmitter unwanted emissions within the 470 MHz to 694 MHz band	35

5.4.3.1	Test conditions	35
5.4.3.2	Test method.....	35
5.4.3.2.1	Conducted measurement.....	35
5.4.3.2.2	Radiated measurement.....	37
5.4.4	Transmitter unwanted emissions outside the 470 MHz to 694 MHz band	37
5.4.4.1	Purpose.....	37
5.4.4.2	Test conditions	38
5.4.4.3	Test method.....	38
5.4.4.3.1	Conducted measurements	38
5.4.4.3.2	Radiated measurements	40
5.4.5	Transmitter Intermodulation	40
5.4.5.1	Objective and Measurement Arrangement.....	40
5.4.5.2	Test Conditions	40
5.4.5.3	Test Method	40
5.4.5.3.1	Conducted Measurements.....	40
5.4.5.3.2	Radiated measurements	41
5.4.6	Primary TVWSD update.....	41
5.4.6.1	Introduction and Test conditions	41
5.4.6.2	Test method.....	42
5.4.6.2.1	Conducted Measurements.....	42
5.4.6.2.2	Radiated Measurements.....	42
5.4.7	Lost connection between the primary TVWSD and the TVWSDB.....	43
5.4.7.1	Test conditions	43
5.4.7.2	Test method.....	43
5.4.7.2.1	Conducted Measurements.....	43
5.4.7.2.2	Radiated Measurements.....	44
5.4.8	Secondary TVWSD update - specific parameters invalidated	44
5.4.8.1	Test conditions	44
5.4.8.2	Test method.....	44
5.4.8.2.1	Conducted Measurements.....	44
5.4.9	Secondary TVWSD update - loss of communication with primary TVWSD.....	45
5.4.9.1	Test conditions	45
5.4.9.2	Test method.....	45
5.4.9.2.1	Conducted Measurements.....	45
5.4.9.2.2	Radiated Measurements.....	45
5.4.10	Receiver Sensitivity level	45
5.4.10.1	Test conditions	45
5.4.10.2	Test method.....	45
5.4.10.2.1	Conducted Measurements.....	45
5.4.10.2.2	Radiated measurements.....	46
5.4.11	Adjacent Channel Selectivity.....	46
5.4.11.1	Test conditions	46
5.4.11.2	Test Method	46
5.4.11.2.1	Conducted measurements	46
5.4.11.2.2	Radiated measurements.....	47
5.4.12	Receiver Blocking	47
5.4.12.1	Test conditions	47
5.4.12.2	Test Method	48
5.4.12.2.1	Conducted measurements	48
5.4.12.2.2	Radiated measurements	49
5.4.13	Receiver spurious emission	49
5.4.13.1	Purpose.....	49
5.4.13.2	Test conditions	49
5.4.13.3	Test method.....	49
5.4.13.3.1	Conducted measurements	49
5.4.13.3.2	Radiated measurements	50
5.4.14	Control and monitoring functions.....	51
5.4.14.1	TVWSDB identification.....	51
5.4.14.1.1	Test condition.....	51
5.4.14.1.2	Test Method.....	52
5.4.14.2	Transmission in compliance with parameters, provision of device parameters, provision of channel usage parameters and primary TVWSD functionality in support of secondary TVWSDs	54

5.4.14.2.1	Test condition	54
5.4.14.2.2	Test Method	55
5.4.15	Geo-location capability	58
5.4.15.1	Purpose	58
5.4.15.2	Test conditions	58
5.4.15.3	Test method	59
5.4.15.3.1	Conducted Measurements	59
5.4.15.3.2	Radiated Measurements	59
5.4.16	User Access Restrictions	60
5.4.16.1	Introduction	60
5.4.16.2	Assessment conditions	60
5.4.16.3	Verification Procedure	60

Annex A (informative):	Relationship between the present document and the essential requirements of Directive 2014/53/EU	61
-------------------------------	---	-----------

Annex B (normative):	Test sites and arrangements for radiated measurement	63
-----------------------------	---	-----------

B.1	Introduction	63
B.2	Radiation test sites	63
B.2.1	Open Area Test Site (OATS)	63
B.2.2	Semi Anechoic Room	64
B.2.3	Fully Anechoic Room (FAR)	65
B.2.4	Measurement Distance	66
B.3	Antennas	67
B.3.1	Antenna types	67
B.3.2	Measurement antenna	67
B.3.3	Substitution antenna	67
B.4	Test fixture	68
B.4.1	Conducted measurements and use of test fixture	68
B.4.2	Description of the test fixture	68
B.4.3	Using the test fixture for relative measurements	68
B.4.4	Using the test fixture for normalized measurements	68
B.4.5	Using the test fixture for level independent measurements	69
B.5	Guidance on the use of radiation test sites	69
B.5.1	Test procedures, equipment and verification	69
B.5.2	Power supplies for the battery powered UUT	69
B.5.3	Site preparation	69
B.6	Coupling of signals	70
B.6.1	General	70
B.6.2	Data Signals	70

Annex C (normative):	Procedures for radiated measurements	71
-----------------------------	---	-----------

C.1	Introduction	71
C.2	Radiated measurements in an OATS or SAR	71
C.3	Radiated measurements in a FAR	72
C.4	Substitution measurement	72

Annex D (informative):	Maximum Measurement Uncertainty	73
-------------------------------	--	-----------

Annex E (informative):	Nominal Channel Bandwidth and Total Bandwidth	74
-------------------------------	--	-----------

Annex F (informative):	Application form for testing	76
-------------------------------	---	-----------

F.1	Introduction	76
F.2	Information as required by ETSI EN 301 598 V2.2.1	76

Annex G (informative):	Bibliography.....	80
Annex H (informative):	Change history	81
History		82

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Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Broadband Radio Access Networks (BRAN), and is now submitted for the combined Public Enquiry and 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.13] 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.3].

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
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Introduction

The present document covers TV band high performance Wireless Access Systems (WAS) including RLAN equipment which is used in wireless local area networks. Such networks provide high speed data communications in between devices connected to the wireless infrastructure. The present document also covers ad-hoc networking where devices communicate directly with each other, without the use of a wireless infrastructure.

The methods and principles used in the present document for the operation of TV White Space devices in the band 470 MHz to 694 MHz are taken from the ECC Report 186 [i.6], 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.12].

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1 Scope

The present document specifies technical characteristics and methods of measurements for TV White Space Devices (TVWSDs) controlled by a TV White Space DataBase (TVWSDB) and which operate in the TV broadcast band 470 MHz to 694 MHz.

The present document applies to the following radio equipment categories:

- 1) Primary TV white space device.
- 2) Secondary TV white space device.

The present document applies to TVWSDs with integral, dedicated or external antennas, where TVWSDs using external antennas is covered only in the case of fixed use.

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.3] is given in annex A.

2 References

2.1 Normative references

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

- [1] IETF RFC 4122 (July 2005): "A Universally Unique Identifier (UUID) URN Namespace".

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

2.2 Informative references

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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] Void.
- [i.2] Void.
- [i.3] 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.4] ETSI TR 100 028-1 (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1".

- [i.5] 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".
 - [i.6] ECC Report 186: "Technical and operational requirements for the operation of white space devices under geo-location approach", January 2013.
 - [i.7] 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.8] 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.9] 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.10] ETSI TR 103 231: "White Space Devices (WSD); Wireless Access Systems operating in the 470 MHz to 790 MHz TV broadcast band; Information on weblistings of TV White Space Databases (TVWSDBs)".
 - [i.11] ECC Report 159: "Technical and operational requirements for the possible operation of cognitive radio systems in the "white spaces" of the frequency band 470-694 MHz", January 2011.
 - [i.12] William Webb and contributors: "Dynamic White Space Spectrum Access".
- NOTE: Available at <http://www.webbsearch.co.uk/publications/>.
- [i.13] 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.
 - [i.14] 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".
 - [i.15] ITU GE06: "Final Acts of the Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Regions 1 and 3, in the frequency bands 174-230 MHz and 470-862 MHz".
- NOTE: Available at https://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-RRC.14-2006-PDF-E.pdf.

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ECC Report 159 [i.11], Directive 2014/53/EU [i.3] 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 [i.14]

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

authentication: ability to verify the identity of a server, and that a message was truly sent by the primary TVWSD

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

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

device emission class: classification specified 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 harmonised 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 primary TVWSD to any secondary TVWSD within the coverage area of that primary TVWSD to allow the secondary 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 meters 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

out-of-block emissions: unwanted emissions that fall within the 470 MHz to 694 MHz band

Packet Error Rate (PER): number of incorrectly received data packets divided by the total number of received packets

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

primary TVWSD: geo-located TVWSD that is able to access a TVWSDB through either a direct or an indirect connection to the Internet and to communicate with TVWSDs

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

secondary operational parameters: transmission parameters communicated from a TVWSDB via a primary TVWSD to enable a secondary TVWSD to operate as required

secondary TVWSD: TVWSD that is only able to communicate with other TVWSDs, when under the control of a primary 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 (primary or secondary), 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 primary TVWSD: test equipment that emulates the functionalities of a primary TVWSD for the purposes of testing a secondary TVWSD against the requirements contained in the present document

test secondary TVWSD: test equipment that emulates the functionalities of a secondary TVWSD for the purposes of testing a primary 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 694 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): TV band high performance wireless access systems (WAS) including RLAN equipment which is used in wireless local area networks and controlled by a TVWSDB

UHF TV band: 470 MHz to 694 MHz band

NOTE: This corresponds to DTT channels 21 to 48

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

weblisting: publicly 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
dB _i	decibel relative to isotropic radiator
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
i	DTT channel number
$P_{0,i}$	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_{min}	minimum level of the wanted signal (in dBm) required to meet a minimum performance criteria
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
ATT	Attenuator
BW	BandWidth
CW	Continuous Wave
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
ID	Identifier
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IP	Internet Protocol
ITU	International Telecommunication Union
LPDA	Logarithmic Periodic Dipole Antenna
MAC	Media Access Control
MHz	MegaHertz
OATS	Open Area Test Site
OUI	Organizationally Unique Identifier
PER	Packet Error Rate
RBW	Resolution BandWidth
RF	Radio Frequency
RLAN	Radio Local Area Network
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