ETSI TR 103 631 V1.1.1 (2019-03)

TECHNICAL REPORT

Wireless Access Systems including Radio Local Area Networks (WAS/RLANs) in the band 6 725 MHz to 7 125 MHz

Reference
DTR/BRAN-230020

Keywords
broadband, radio

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Broadband Radio Access Networks (BRAN).

Modal verbs terminology

In the present document "**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

License exempt Wireless Access Systems including Radio Local Area Networks (WAS/RLANs) represent the primary broadband wireless access technologies used for wireless internet access.

1 Scope

The present document provides information on the intended applications, the technical parameters, mitigation techniques, the relation to the existing spectrum regulation and additional new radio spectrum requirements for technology neutral wireless access systems including radio local area networks (WAS/RLANs) capable of operating in the 6 725 MHz to 7 125 MHz range.

The information contained in the present document is complementary to the information contained in the ETSI Systems Reference Document ETSI TR 103 524 [i.22] for technology neutral WAS/RLANs although that SRDoc also contained a request to the CEPT for considering additional frequencies up to 6 725 MHz. It should be noted that TC ERM SRDoc ETSI TR 103 524 [i.22] covered the frequency range 5 925 MHz to 6 725 MHz. It should also be noted that draft ETSI TR 103 612 [i.23] describes IMT technology covering the frequency range 6 425 MHz to 7 125 MHz. The frequencies covered by these ETSI deliverables are shown in figure 1.

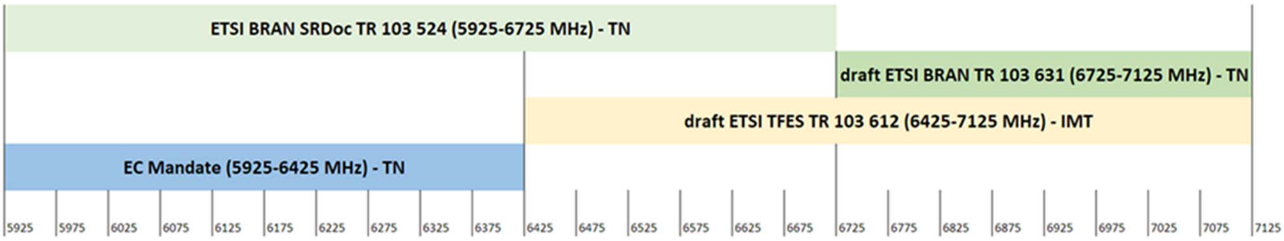

Figure 1: Frequency bands covered by 6 GHz EC Mandate and 6 GHz ETSI deliverables

2 References

2.1 Normative references

Normative references are not applicable in the present document.

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] 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".

[i.2] ETSI EN 301 893 (V2.1.1): "5 GHz RLAN; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".

[i.3] "Wi-Fi Alliance Spectrum Needs Study" conducted by Quotient Associates.

NOTE: Available at http://www.wi-fi.org/file/wi-fi-spectrum-needs-study.

[i.4] Qualcomm Spectrum Needs Study: "A Quantification of 5 GHz Unlicensed Band Spectrum Needs".

NOTE: Available at https://www.qualcomm.com/documents/quantification-5-ghz-unlicensed-band-spectrum-needs.

[i.5] ETSI EN 303 143 (V1.2.1): "Reconfigurable Radio Systems (RRS); System architecture for information exchange between different Geo-location Databases (GLDBs) enabling the operation of White Space Devices (WSDs)".

[i.6] ETSI EN 303 144 (V1.1.1): "Reconfigurable Radio Systems (RRS); Enabling the operation of Cognitive Radio System (CRS) dependent for their use of radio spectrum on information obtained from Geo-location Databases (GLDBs); Parameters and procedures for information exchange between different GLDBs".

[i.7] ETSI EN 303 145 (V1.2.1): "Reconfigurable Radio Systems (RRS); System Architecture and High Level Procedures for Coordinated and Uncoordinated Use of TV White Spaces".

[i.8] ETSI EN 303 387 (V1.1.1): "Reconfigurable Radio Systems (RRS); Signalling Protocols and information exchange for Coordinated use of TV White Spaces; Interface between Cognitive Radio System (CRS) and Spectrum Coordinator (SC)".

[i.9] Complete Visual Networking Index (VNI) Forecast.

NOTE: Available at http://www.cisco.com/c/en/us/solutions/service-provider/visual-networking-index-vni/index.html?stickynav=1.

[i.10] ITU-R Radio Regulations, Articles, Edition of 2012.

NOTE: Available at http://search.itu.int/history/HistoryDigitalCollectionDocLibrary/1.41.48.en.101.pdf.

[i.11] European Gigabit Society: "Connectivity for a European Gigabit Society".

NOTE: Available at https://ec.europa.eu/digital-single-market/en/policies/improving-connectivity-and-access.

[i.12] ERC Report 25 European Common Allocation.

NOTE: Available at http://www.efis.dk/sitecontent.jsp?sitecontent=ecatable.

[i.13] ECO Frequency Information System.

NOTE: Available at http://www.efis.dk/.

[i.14] Commission Decision 2007/344/EC of 16 May 2007 on harmonised availability of information regarding spectrum use within the Community.

[i.15] ECC Decision ECC/DEC/(01)03: "ECO Frequency Information System (EFIS)".

[i.16] 3GPP TR 38.901: "Study on channel model for frequencies from 0.5 to 100 GHz" (Table 7.3-1).

[i.17] ETSI TS 136 211 (V13.7.1) (2017-10): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation (3GPP TS 36.211 version 13.7.1 Release 13)".

[i.18] CEPT/ERC/REC 74-01: "Unwanted Emissions in the Spurious Domain".

[i.19] ECC Report 186: "Technical and operational requirements for the operation of white space devices under geo-location approach".

[i.20] IEEE P802.11ax/D4.0™, February 2019.

NOTE: Available at https://ieeexplore.ieee.org/document/8424259.

[i.21] EC Digital Single Market Report on Roaming on Public Mobile Communications networks, December 2018.

NOTE: Available at https://ec.europa.eu/digital-single-market/en/news/report-implementation-regulation-roaming-public-mobile-communications-networks-within-union.

[i.22] ETSI TR 103 524: "System Reference document (SRdoc); Wireless access systems including radio local area networks (WAS/RLANs) in the band 5 925 MHz to 6 725 MHz".

[i.23] ETSI TR 103 612: "IMT cellular networks; Mobile/Fixed Communication Network (MFCN) in the band 6 425 - 7 125 MHz".

[i.24] Regulation (EU) 2015/2120 laying down measures concerning open internet access, November 2015.

[i.25] Commission Decision 2007/131/EC of 21 February 2007 on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community.

[i.26] Decision No 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community.

[i.27] Recommendation ITU-R SM.1756: "Framework for the introduction of devices using ultra-wideband technology".

[i.28] ETSI TS 136 104 (V14.5.0): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception (3GPP TS 36.104 version 14.5.0 Release 14)".

[i.29] ETSI TS 136 101 (V14.5.0): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101 version 14.5.0 Release 14)".

[i.30] ETSI TS 136 213 (V14.4.0): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (3GPP TS 36.213 version 14.4.0 Release 14)".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

6 GHz RLAN bands: total frequency range that consists of the 5 925 MHz to 7 125 MHz frequency band

channel: minimum amount of spectrum used by a single RLAN device

NOTE: An RLAN device is permitted to operate (transmit/receive) in one or more adjacent or non-adjacent channels simultaneously.

RLAN devices: 6 GHz high performance wireless access systems (WAS) including RLAN equipment

transmit chain: transmitter circuit with an associated antenna

Transmit Power Control (TPC): technique in which the transmitter output power is controlled resulting in reduced interference to other systems

3.2 Symbols

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

dBm	dB relative to 1 milliwatt
fc	carrier frequency
GHz	GigaHertz
Hz	Hertz
kHz	kiloHertz
MHz	MegaHertz
mW	milliWatt

3.3 Abbreviations

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

3GPP	3rd Generation Partnership Project
5GNR	5G New Radio
AP	Access Point
AR/VR	Augmented Reality/Virtual Reality
BS	Base Station
e.i.r.p.	equivalent isotropically radiated power
ECC	Electronic Communications Committee
ECO	European Communications Office
EFIS	ECO Frequency Information System
EIRP	Effective Isotopic Radiated Power
ERC	European Radio Committee (superseded by ECC)
ESV	Earth Station on board a Vessel
EU	European Union
FS	Fixed Service
FSS	Fixed Satellite Service
HD	High Definition
IEEE	Institute of Electrical and Electronic Engineers
IMT	International Mobile Telecommunications
ITS	Intelligent Transportation System
ITU-R	International Telecommunications Union - Radiocommunications
LAA	License-Assisted Access
LTE-eLAA	Long Term Evolution-enhanced Licenced-Assisted Access
MIMO	Multiple Input, Multiple Output
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	Orthogonal Frequency Division Multiple Access
RLAH	Roam-Like-At-Home
RLAN	Radio Local Area Network
TPC	Transmit Power Control
UK	United Kingdom
UWB	Ultra Wide Band
WAS	Wireless Access Systems

4 Executive summary

The continued Wi-Fi™ market expansion, additional throughput demand of wireless applications, and the addition of license exempt LTE-eLAA technologies are placing unsustainable demand on the existing spectrum available for WAS/RLAN thus creating the momentum and justification to secure access to additional new license exempt spectrum.

The present document presents market data and predictions for the continued growth of the Wi-Fi industry, and for the projected rollout of LTE-eLAA, MulteFire and 5G New Radio (5GNR).

The IEEE P802.11ax project (relevant specifications for the present document can be found in [i.20]) and the LTE-eLAA standards (relevant specifications for the present document can be found in [i.28], [i.29] and [i.30]) are example technologies for WAS/RLANs that allows for a wide-range of high efficiency wireless broadband through the use of OFDMA and other enhancements for efficient spectrum utilization and coexistence. The present document describes their salient technical characteristics and features such as transmitter power control, and listen-before-talk.

5 Market Information

The primary methods for internet access at home, schools, businesses and public spaces use is licence exempt spectrum, with Wi-Fi systems carrying the vast majority of this wireless access traffic.

Wireless data traffic is projected to continue to grow dramatically during the 2018 - 2025 timeframe [i.9]. At the same time the licence exempt spectrum is expected to experience significant increase in utilization demand and congestion.

In addition, demand for usage of licence exempt spectrum is expected to experience increased demand due to new technologies utilizing LTE based technologies such as eLAA and MulteFire in the near future, with migration to 5GNR in the 2025 timeframe.

New and high growth application areas such as 4k/8k HD video, AR/VR, gaming and low latency industrial applications, combined with the significant increase of the number of Mobile Broadband wireless devices in homes, schools businesses and public spaces, are expected to be significant drivers of additional traffic.

UK based Quotient Associates conducted projected traffic patterns based analysis and concluded that in Europe there will be a Wi-Fi spectrum shortfall of between 345 MHz and 753 MHz in 2020 and between 655 MHz and 1 713 MHz in 2025 [i.3].

An analysis conducted by Qualcomm on spectrum requirements to enable 1 Gbit/s coverage in dense deployment scenarios for IEEE 802.11ax™ [i.20] technology networks concluded that a total amount of around 1 280 MHz of licence exempt spectrum will be required around the 5 GHz band [i.4].

To enable required throughputs and network capacities, the wireless industry is moving towards the use of wider bandwidth channels. IEEE 802.11ax™ [i.20] based systems use 80 MHz and 160 MHz wide channel bandwidths and system bandwidth of a single 3GPP 5GNR carrier could be up to 100 MHz. Of note here is that in the EU there are currently only five non-overlapping 80 MHz channels, and two 160 MHz channels.

Availability of a sufficient amount of licence exempt spectrum is a necessary requirement to meet the European Commission's objectives for Connectivity for a European Gigabit Society [i.11].

In October 2015, the European Parliament and the Council adopted Regulation (EU) 2015/2120 [i.24] which mandated the end of retail roaming charges in the Union from 15 June 2017, subject to fair use policy and a sustainability derogation. These new roaming rules have been dubbed "Roam-Like-At-Home" (RLAH), and effects are reported in "*an interim report summarizing the effects of the abolition of retail roaming charges*" [i.21]. The EC Single Market Report on Roaming clearly shows RLAH triggered a massive and rapid increase in roaming consumption, and consequently license exempt spectrum is bearing more load.

6 Technical Information

6.1 Detailed technical description

It is expected that WAS/RLANs used in 6 725 MHz to 7 125 MHz frequency range will function as extension to wired LANs utilizing radio as the connectivity media. The range for majority of these systems are expected to be on the order of tens of meters while there can be point-to-point links which provide larger operating range. However, these point-to-point links are likely to be comparatively smaller in number.

6.2 Technical parameters and implications on spectrum

6.2.1 Status of technical parameters

6.2.1.1 Current ITU and European Common Allocations

See clause 7.

6.2.1.2 Sharing and compatibility studies already available

None found. SE45 studies are for 5 925 MHz to 6 425 MHz bands.

6.2.1.3 Sharing and compatibility issues still to be considered

- In band:
    - RLAN and FS.

- RLAN and FSS (Space Stations/ESV).
- RLAN and Radiodetermination.
- RLAN and UWB.

- Adjacent band:
  - RLAN and UWB.

6.2.2 Transmitter parameters

6.2.2.1 Transmitter Output Power/Radiated Power

RLAN devices used in different applications will have different power levels. Most devices are expected to use e.i.r.p. levels lower than the maximum limit for various reasons such as power consumption and transmit power control. Devices that serve as base stations may transmit at the higher power level than the devices that serve as mobile stations.

Base station transmit power is typically fixed. Table 1 has the percentages of the indoor devices that transmit at a certain maximum power levels.

Table 1: WAS (including RLANs) power distribution for indoor (98 %)

Weighted EIRP Distribution (mW): Indoor								
Indoor Use Case	**Weight**	**1 000**	**250**	**100**	**50**	**13**	**1**	**Total**
Indoor Client	26,32 %	0 %	0,00 %	1,82 %	12,03 %	12,47 %	0 %	26,32 %
Indoor Enterprise AP	2,63 %	0 %	1,06 %	0,90 %	0,58 %	0,09 %	0,01 %	2,63 %
Indoor Consumer AP	66,31 %	0 %	7,90 %	2,76 %	11,20 %	38,94 %	5,51 %	66,31 %
Indoor High Performance Gaming Router	4,74 %	0,71 %	0,20 %	0,73 %	1,97 %	0,97 %	0,16 %	4,74 %
Sub-Total	100 %	0,71 %	9,15 %	6,21 %	25,79 %	52,47 %	5,68 %	100 %

Table 2 has the percentages of the outdoor devices that transmit at a certain maximum power levels.

Table 2: WAS (including RLANs) power distribution for outdoor (2 %)

Weighted EIRP Distribution (mW): Outdoor								
Outdoor Use Case	**Weight**	**1 000**	**250**	**100**	**50**	**13**	**1**	**Total**
Outdoor High Power AP	20 %	2,99 %	0,83%	3,05 %	8,37 %	4,10 %	0,66 %	20 %
Outdoor Low Power AP	30 %	0,25 %	3,41%	1,33 %	5,73 %	16,87 %	2,41 %	30 %
Outdoor Client	50 %	0 %	0 %	3,46 %	22,85 %	23,68 %	0 %	50 %
Sub-Total	100 %	3,24 %	4,24 %	7,84 %	36,95 %	44,65 %	3,07 %	100 %

This results in weighted average EIRPs for indoor RLANs of 17,48 dBm, outdoor RLANs of 17,53 dBm, and combined indoor/outdoor of 17,48 dBm are used in the simulations.

6.2.2.2 Antenna Characteristics

For majority of the indoor deployments for RLAN use, the RLAN antenna can be modelled as omni-directional antenna with 0 dB gain for both mobile stations and the base stations. Access points/BS can be equipped with directional antennas; the antenna gain can be assumed to be 6 dBi typically, which also implies a certain discrimination in the vertical plane.

Table 3 provides the characteristics of a typical antenna for 5 150 MHz to 5 250 MHz. A similar antenna performance is assumed for outdoor operation in the 6 GHz band.

Table 3: Typical antenna performance

Antenna Parameter	Value
Vertical 3 dB bandwidth	30 degrees
Horizontal 3 dB beam width	90 degrees
Suppression at 30 deg elevation	At least 15 dB
Front-to-back-ratio	-20 dB

Antenna height depends on regions where users are located and can be modelled as following for different deployment zones.

Table 4: Typical antenna heights by region

		Building Construction Type Probability									
		Urban Indoor			Suburban Indoor			Rural Indoo			All Outdoor
Building Story	Height (m)	Corporate	Public	Home	Corporate*	Public	Home	Corporate	Public	Home	
1	1,5	69,0 %	69,0 %	60,0 %	69,0 %	69,0 %	60,0 %	70,0 %	70,0 %	70,0 %	95,0 %
2	4,5	21,0 %	21,0 %	30,0 %	21,0 %	21,0 %	30,0 %	25,0 %	25,0 %	25,0 %	2,0 %
3	7,5	7,0 %	7,0 %	7,0 %	7,0 %	7,0 %	5,0 %	5,0 %	5,0 %	5,0 %	2,0 %
4	10,5	0,7 %	0.7%	0,7 %	0,7 %	0,7 %	5,0 %	0,0 %	0,0 %	0,0 %	0,50 %
5	13,5	0,58 %	0,58 %	0,58 %	0,58 %	0,58 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %
6	16,5	0,50 %	0,50 %	0,50 %	0,50 %	0,50 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %
7	19,5	0,43 %	0,43 %	0,43 %	0,43 %	0,43 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %
8	22,5	0,35 %	0,35 %	0,35 %	0,35 %	0,35 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %
9	25,5	0,28 %	0,28 %	0,28 %	0,28 %	0,28 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %
10	28,5	0,2 %	0,2 %	0,2 %	0,2 %	0,2 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %
Total		100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %

For outdoor deployments, the base station device height is typically 4,5 m for urban, suburban and rural deployment zones. For outdoor deployments, omni directional model for a base station device is not adequate. A commonly used reference model for the outdoor 3D antenna element pattern is given in 3GPP TR 38.901 [i.16].

When deployed at the base station, the antenna techniques are seen as an effective method to limit the interference in a given direction. This use case is particularly relevant for the equipment compliant with the Release 13 LTE LAA standard ETSI TS 136 211 [i.17], since the standard supports downlink only transmission direction and conduct all uplink transmissions on a separate licensed band, thus limiting the impact to the primary users of the band.

6.2.2.3 Operating Frequency

According to the IEEE 802.11.ax amendment [i.20], the *Nominal Centre Frequencies* (fc) for a *Nominal Channel Bandwidth* of 20 MHz are defined by the following formula, where g = channel number:

$$fc_{(g)} = 5\,940 + (g \times 5) \text{ MHz, where } 1 \leq g \leq 253$$

Within the band 5 925 MHz to 7 125 MHz, the upper bound for the value of g is 233.

Equipment is envisaged to use simultaneous transmissions on more than one *Operating Channel* with a *Nominal Channel Bandwidth* of 20 MHz.

Figure 2 shows the IEEE P802.11ax [i.20] channel arrangement adopted for the 6 GHz band.

Equipment compliant with the existing LTE-LAA standard could support wider channel bandwidth via carrier aggregation up to 32 carriers (including at least one anchor carrier in a licensed band). Such configurations, among other things, will be potentially used in the coming 3GPP 5G New Radio standard, too.

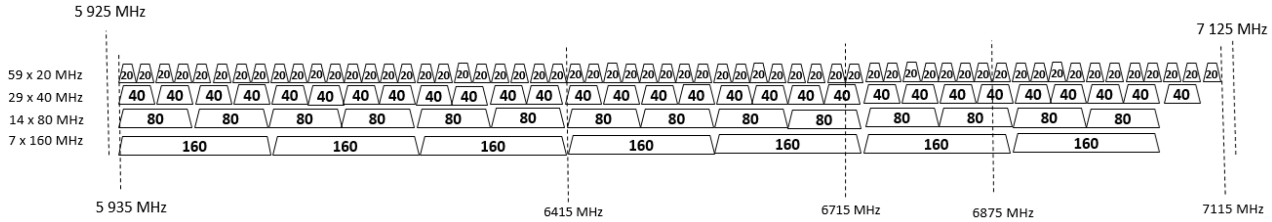

Figure 2: IEEE P802.11ax [i.20] channel arrangement for the 6 GHz band

NOTE: ETSI TC ITS has requested that the band plan provide a 20 MHz guard band at 5 925 MHz, instead of the 10 MHz shown here.

6.2.2.4 Bandwidth

The 6 GHz band will be greenfield operation for most RLAN system and is expected to be used for high data-rate applications. Correspondingly, most common deployments will be 80 MHz and 160 MHz capable devices while lower bandwidth operation, such as 20 MHz and 40 MHz might also be used. Table 5 shows a prediction for channel bandwidth used in 6 GHz band.

NOTE: The table 5 is an initial assumption.

Table 5: Bandwidth distribution

Channel bandwidth	20 MHz	40 MHz	80 MHz	160 MHz
RLAN Device Percentage	10 %	10 %	50 %	30 %

6.2.2.5 Unwanted emissions

6.2.2.5.1 Transmitter unwanted emissions in the 6 GHz bands

It is likely that RLANs that operate in the 6 GHz band will use modulations similar to the ones currently used in 5 GHz band, i.e. OFDM. Hence, spectral emissions would follow similar pattern. For sharing studies, the spectral mask given in figure 3 can be used.

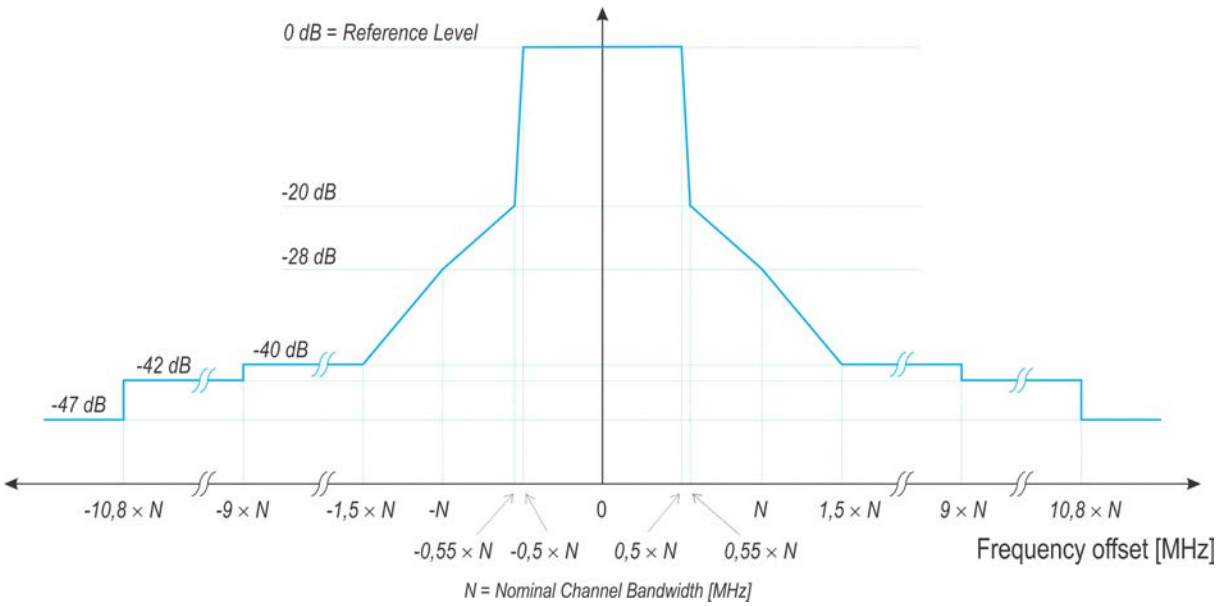

Figure 3: Transmit spectral power mask

Smart antenna system (devices with multiple transmit chains) parameters will be similar to those already defined for the 5 GHz band in ETSI EN 301 893 [i.2].

For transmitter unwanted emissions within the 6 GHz bands, simultaneous transmissions in adjacent channels may be considered as one signal with an actual Nominal Channel Bandwidth of "n" times the individual Nominal Channel Bandwidth where "n" is the number of adjacent channels used simultaneously.

For simultaneous transmissions in multiple non-adjacent channels, the overall transmit spectral power mask is constructed in the following manner. First, a mask as provided in figure 2 is applied to each of the channels. Then, for each frequency point, the highest value from the spectral masks of all the channels assessed should be taken as the overall spectral mask requirement at that frequency.

6.2.2.5.2 Transmitter unwanted emissions outside the 6 GHz bands

The level of transmitter unwanted emissions outside the 6 GHz RLAN bands will comply with the ERC Recommendation 74.01 [i.18].

6.2.3 Receiver parameters

Receiver parameters will be similar to those already defined for the 5 GHz band in ETSI EN 301 893 [i.2]. ETSI EN 301 893 [i.2] currently includes receiver spurious emissions and receiver blocking. During the development of ETSI EN 301 893 [i.2], the inclusion of other receiver requirements such as receiver sensitivity will be considered.

6.2.4 Interference mitigation techniques

Critical to incumbent protection are the techniques used to access the spectrum. This may be variations on tested and proven methods, used as is or in combination, or may be entirely new methods. Some examples are:

- Transmit Power Control (TPC): reduce transmit power to prevent harmful interference to incumbents.
- Geolocation Database approach: use of location data to prevent harmful interference to incumbents [i.5], [i.6], [i.7], [i.8] and [i.19].
- Antenna Characteristics of the base station devices: reduction of skyward transmissions to reduce aggregate interference.
- Minimum bandwidth: setting minimum bandwidth requirements or power spectral density limits to reduce aggregate interference.
- Indoor operation: limitation to indoor operation to utilize Building Entry Loss.
- Massive MIMO: antenna techniques such as Massive MIMO, which could be a very useful interference mitigation technique for outdoor deployments.

6.3 Information on relevant standards

ETSI EN 301 893 [i.2] is the current version of the harmonised standard covering WAS/RLANs operating in the current 5 GHz frequency bands. Once new spectrum in the 6 GHz range has been made available, ETSI BRAN will develop or revise an appropriate harmonised standard.

7 Regulations

7.1 International and European Allocations and their limitations

7.1.1 International Allocations

The ITU (Region 1) frequency allocation 5 925 MHz to 6 700 MHz is allocated to FIXED, FIXED SATELLITE (EARTH-TO-SPACE) and MOBILE. See table 6.

The ITU (Region 1) frequency allocation 6 700 MHz to 7 075 MHz is allocated to FIXED, FIXED SATELLITE (EARTH-TO-SPACE) (SPACE-TO-EARTH) and MOBILE. See table 6.

The ITU (Region 1) frequency allocation 7 075 MHz to 7 145 MHz is allocated to FIXED and MOBILE. See table 6.

Table 6: 5 925 MHz to 7 145 MHz ITU (Region 1) Allocation

Frequency band	Allocations
5 925 MHz to 6 700 MHz (5.149) (5.440) (5.458)	FIXED-SATELLITE (EARTH-TO-SPACE) (5.457A) (5.457B) MOBILE (5.457C) FIXED (5.457)
6 700 MHz to 7 075 MHz (5.458) (5.458A) (5.458B)	FIXED MOBILE FIXED-SATELLITE (EARTH-TO-SPACE) (SPACE-TO-EARTH) (5.441)
7 075 MHz to 7 145 MHz	FIXED MOBILE (5.458) (5.459)

7.1.2 European Allocations

The European Common Allocation for 5 925 MHz to 6 700 MHz is allocated to FIXED, FIXED SATELLITE (EARTH-TO-SPACE), MOBILE and on a secondary basis to Earth Exploration-Satellite (passive). See table 7.

The European Common Allocation for 6 700 MHz to 7 075 MHz is allocated to FIXED, FIXED SATELLITE (EARTH-TO-SPACE) (SPACE-TO-EARTH) and on a secondary basis to Earth Exploration-Satellite (passive). Note there is no MOBILE allocation which is a departure from the ITU (Region 1) frequency allocation. See table 7.

Table 7: Spectrum use in Europe in the frequency band 5 925 MHz to 7 145 MHz

5925 MHz - 6700 MHz

Approved October 2018

ERC REPORT 25
Page 127 / 275

RR Region 1 Allocation and RR footnotes applicable to CEPT	*European Common Allocation and ECA Footnotes*	*ECC/ERC harmonisation measure*	*Applications*	*Standard*	*Notes*
FIXED 5.457 FIXED-SATELLITE (EARTH-TO-SPACE) 5.457A 5.457B MOBILE 5.457C 5.149 5.440 5.458	FIXED FIXED-SATELLITE (EARTH-TO-SPACE) MOBILE Earth Exploration-Satellite (passive) 5.149 5.440 5.458		-		
		ECC/DEC/(05)09	ESV	EN 301 447	Within the band 5925-6425 MHz
		ECC/DEC/(05)09	FSS Earth stations	EN 301 443	Priority for civil networks
		ECC/REC/(14)06 ERC/REC 14-01 ERC/REC 14-02	Fixed	EN 302 217	Point-to-point
			Passive sensors (satellite)		For sea surface temperature, sea surface wind speed and soil moisture measurements
			Radio astronomy		Spectral line observations (e.g. methanol line), VLBI.
		ECC/DEC/(11)02 ERC/REC 70-03	Radiodetermination applications	EN 302 372 EN 302 729	Within the band 4500-7000 MHz for TLPR application and 6000-8500 MHz for LPR applications
		ECC/DEC/(06)04 ECC/DEC/(12)03	UWB applications	EN 302 065	Generic UWB as well as UWB on-board aircraft regulation within the band 6.0- 8.5 GHz

6700 MHz - 7075 MHz

ERC REPORT 25
Page 128 / 275

RR Region 1 Allocation and RR footnotes applicable to CEPT	*European Common Allocation and ECA Footnotes*	*ECC/ERC harmonisation measure*	*Applications*	*Standard*	*Notes*
FIXED FIXED-SATELLITE (EARTH-TO-SPACE) (SPACE-TO-EARTH) 5.441 MOBILE 5.458 5.458A 5.458B	FIXED FIXED-SATELLITE (EARTH-TO-SPACE) (SPACE-TO-EARTH) 5.441 Earth Exploration-Satellite (passive) 5.458 5.458A 5.458B		FSS Earth stations	EN 301 443	Within the band 6725-7025 MHz. Priority for civil networks
			Feeder links		
		ECC/REC/(14)06 ERC/REC 14-02	Fixed	EN 302 217	Point-to-point
		ERC/REC 25-10	PMSE	EN 302 064	Portable or mobile wireless video, cordless cameras, temporary P-t-P video links in 7-8.5 GHz tuning range
			Passive sensors (satellite)		For sea surface temperature, sea surface wind speed and soil moisture measurements
		ECC/DEC/(11)02 ERC/REC 70-03	Radiodetermination applications	EN 302 372 EN 302 729	Within the band 4500-7000 MHz for TLPR application. Within the band 6000-8500 MHz for LPR applications
		ECC/DEC/(06)04 ECC/DEC/(12)03	UWB applications	EN 302 065	Generic UWB as well as on-board aircraft regulation within the band 6.0-8.5 GHz

7075 MHz - 7145 MHz

FIXED MOBILE 5.458 5.459	FIXED Earth Exploration-Satellite (passive) 5.458	ECC/REC/(02)06 ECC/REC/(14)06 ERC/REC 14-02	Fixed	EN 302 217	Point-to-point
		ERC/REC 25-10	PMSE	EN 302 064	Portable or mobile wireless video, cordless cameras, temporary P-t-P video links in 7-8.5 GHz tuning range
			Passive sensors (satellite)		For sea surface temperature, sea surface wind speed and soil moisture measurements
		ECC/DEC/(11)02 ERC/REC 70-03	Radiodetermination applications	EN 302 729	Within the band 6000-8500 MHz for LPR applications
		ECC/DEC/(06)04 ECC/DEC/(12)03	UWB applications	EN 302 065	Generic UWB as well as on-board aircraft regulation within the band 6.0-8.5 GHz

7.1.3 Limitations of Spectrum Regulations for WAS/RLANs

The European Common Allocation as detailed in ERC Report 25 [i.12] and in the ECO Frequency Information System [i.13] (fulfilling EC Decision 2007/344/EC [i.14] on the harmonised availability of information regarding spectrum use in Europe and the ECC Decision ECC/DEC/(01)03 [i.15] on EFIS) has not implemented the MOBILE allocation as detailed in the ITU (Region 1) frequency allocation for the 6 700 MHz to 7 075 MHz and 7 075 MHz to 7 125 MHz bands.

While there are no international regulatory impediments at an ITU (Region 1) level for MOBILE allocation there is indeed a constraint at a European level on MOBILE allocation for both the 6 700 MHz to 7 075 MHz and the 7 075 MHz to 7 145 MHz bands.

The lack of a MOBILE allocation at a European level is introducing regulatory impediments to the implementation of WAS/RLANs in the 6 725 MHz to 7 125 MHz frequency range.

Constraints on the MOBILE allocation are pursuant to ITU Radio Regulations No. 5.458B [i.10], the space-to-Earth allocation to the fixed-satellite service in the band 6 700 MHz to 7 075 MHz is limited to feeder links for non-geostationary satellite systems of the mobile-satellite service and is subject to coordination under No. 9.11A [i.10]. For the WAS/RLAN systems operating under the MOBILE allocation, this requirement entails a coordination zone in the vicinity of the non-geostationary, mobile-satellite receiving Earth stations of which there is a limited number deployed in Europe.

7.1.4 Limitations on UWB operations in CEPT

Within CEPT, UWB devices cannot claim protection from any other service nor can they cause interference to any other service. The European Commission Decision (2007/131/EC) [i.25] states:

> "*The use of radio spectrum by equipment using ultrawideband technology under this Decision is to be allowed on a non-interference and non-protected basis and therefore should be subject to Article 5(1) of Directive 2002/20/EC of the European Parliament and of the Council of 7 March 2002 on the authorisation of electronic communications networks and services*" [i.15]
>
> and in article 2(2):
>
> "*non-interference and non-protected basis' means that no harmful interference may be caused to any radiocommunication service and that no claim may be made for protection of these devices against harmful interference originating from radiocommunication services*".

At a global level within the Radio Regulations, Recommendation ITU-R SM.1756 [i.27] "Framework for the introduction of devices using ultra-wideband technology" in "recommends 2" states:

> "*2 that the following Notes will be considered as part of this Recommendation.*
>
> *NOTE 1 - Administrations authorizing or licensing devices using UWB technology should ensure, pursuant to the provisions of the RR, that these devices do not cause interference to and do not claim protection from, or place constraints on, the radiocommunication services of other administrations as defined in the RR and operating in accordance with those Regulations.*
>
> *NOTE 2 - Upon receipt of a notice of interference to the radiocommunication services referred to in Note 1, above, from devices using UWB technology, administrations should take immediate action(s) to eliminate such interference.*"

Any coexistence analysis included within the present document is for information only and is not intended as a justification for the revision of the regulatory status of UWB or to place specific restrictions on the deployment of RLAN devices.

8 Conclusions

The present document presents some pertinent technical characteristics of WAS/RLAN systems as well as an example of spectrum access techniques that can be considered for sharing the band with incumbent users. Coexistence with other WAS/RLANs and interference to other radio systems in the spectrum are always concerns when new spectrum designations are considered, hence those impacts should be analysed and quantified.

History

Document history		
V1.1.1	March 2019	Publication