



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

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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
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Foreword

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

Modal verbs terminology

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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.

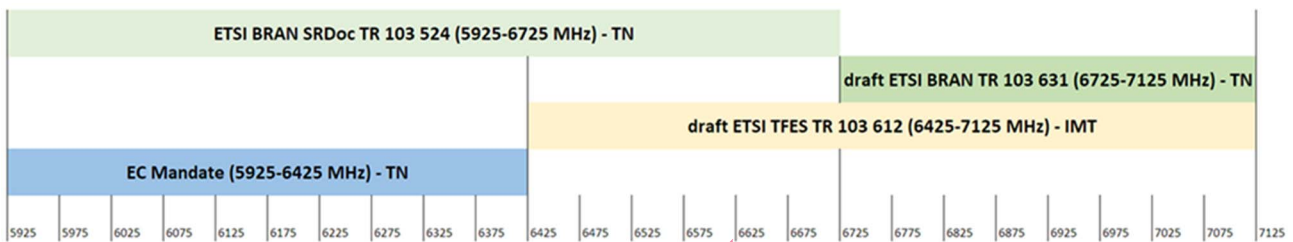


Figure 1: Frequency bands covered by 6 GHz EC Mandate and 6 GHz ETSI deliverables

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	3 rd Generation Partnership Project
5G NR	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 Isotropic 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 (5G NR).

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 5G NR 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 5G NR 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.