Received:

Subject: Proposed modification to M.1450-5

Document 5A/xx
13 – 22 September 2023
English only

Institute of Electrical and Electronics Engineers

PROPOSED MODIFICATION TO ANNEX 9 TO DOCUMENT 5A/769-E

Source Information

IEEE 802 LAN/MAN Standards Committee (LMSC) respectfully submits this submission to ITU-R Working Party 5A (WP 5A). IEEE 802 is a committee of the IEEE Standards Association and Technical Activities, two of the Major Organizational Units of the Institute of Electrical and Electronics Engineers (IEEE). IEEE has about 400,000 members in over 160 countries. IEEE's core purpose is to foster technological innovation and excellence for the benefit of humanity. In submitting this document, IEEE 802 acknowledges and respects that other components of IEEE Organizational Units may have perspectives that differ from, or compete with, those of IEEE 802. Therefore, this submission should not be construed as representing the views of IEEE as a whole[1].

Introduction

This document proposes updates to the **Annex 9** to **Doc.5A/769** - Working document towards a preliminary draft revision of Recommendation ITU-R M.1450-5 - Characteristics of broadband radio local area networks. The proposed changes and embedded comments are indicated via the ‘track changes’ and highlighted in yellow.

We applaud the efforts of the participants in WP 5A for undertaking this work and giving IEEE 802 the opportunity to contribute.

Discussion

Since the last revision of ITU-R M.1450-5 (2014), there have been a number of updates and comments to IEEE 802 standards that we would like to share with WP 5A for consideration.

Proposal

Incorporate the proposed updates below into ITU-R M.1450.

IEEE 802 proposes that the revision of Recommendation ITU-R M.1450-5 be completed during the September meeting of WP 5A and submitted to SG 5.

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Incl.: Annex 1

[1] This document solely represents the views of the IEEE 802 LAN/MAN Standards Committee and does not necessarily represent a position of either the IEEE, the IEEE Standards Association or IEEE Technical Activities.

Radiocommunication Study Groups

Source: Document 5A/TEMP/306(Rev.2)

Annex 9 to
Document 5A/769-E
23 May 2023
English only

Annex 9 to Working Party 5A Chairman's Report

WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT REVISION OF RECOMMENDATION ITU-R M.1450-5

Characteristics of broadband radio local area networks

(Questions ITU-R 212/5 and ITU-R 238/5)

(2000-2002-2003-2008-2010-2014)

Note: Terms of mandatory nature, such as 'shall', cannot be used in ITU-R Recommendations, which are voluntary; the working document needs to be amended accordingly.

[Editor's note: Due to time constraints, this document was not agreed, and it is still under consideration and needs to be revised. Administrations are invited to submit input contributions to progress this work at the next meeting of WP5A.]

Summary of the revision

[Editor's Note: To be updated when the preliminary draft revision is agreed.]

This revision includes additional characteristics of broadband radio local area networks (RLANs).

Scope

This Recommendation provides the characteristics of broadband radio local area networks (RLANs) including technical parameters, and information on RLAN standards and some operational characteristics. In Annex 2, bBasic characteristics of broadband RLANs and general guidance for their information for their system design are also addressed.

[Editor's Note - Inserted Abbreviations/Glossary (formerly Table 1) from below and proposed deletion of Note 1 referring to "Table 1" to comport with new mandatory format for ITU-R Recommendations.]

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Abbreviations/Glossary

Access method	Scheme used to provide multiple access to a channel
AP	Access point
ARIB	Association of Radio Industries and Businesses
ATM	Asynchronous transfer mode
Bit rate	The rate of transfer of a bit of information from one network device to another
BPSK	Binary phase-shift keying
BRAN	Broadband Radio Access Networks (A technical committee of ETSI)
Channelization	Bandwidth of each channel and number of channels that can be contained in the RF bandwidth allocation
Channel Indexing	The frequency difference between adjacent channel centre frequencies
CSMA/CA	Carrier sensing multiple access with collision avoidance
DAA	Detect and avoid
DFS	Dynamic frequency selection
DFT	Discrete Fourier Transform
DFT-S OFDM	DFT-spread OFDM
DSSS	Direct sequence spread spectrum
e.i.r.p.	Equivalent isotropically radiated power
ENG	Electronic News Gathering
ETSI	European Telecommunications Standards Institute
Frequency band	Nominal operating spectrum of operation
FHSS	Frequency hopping spread spectrum
HIPERLAN2	High performance radio LAN 2
HiSWANa	High speed wireless access network – type a
HSWA	High speed wireless access
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
LAN	Local area network
LPI	Low power indoor
LBT	Listen before talk
MU	Medium utilisation
MMAC	Multimedia mobile access communication
Modulation	The method used to put information onto an RF carrier
MIMO	Multiple input multiple output
OFDM	Orthogonal frequency division multiplexing
OFDMA	Orthogonal frequency division multiple access
PSD	Power spectral density
PSTN	Public switched telephone network

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QAM	Quadrature amplitude modulation
QoS	Quality of Service
QPSK	Quaternary phase-shift keying
RF	Radio frequency
RLAN	Radio local area network
RU	Resource unit
SSMA	Spread spectrum multiple access
Tx power	Transmitter power – RF power in Watts produced by the transmitter
TCP	Transmission control protocol
TDD	Time division duplex
TDMA	Time-division multiple access
TPC	Transmit power control
TTA	Telecommunications Technology Association (A standards developing organization in the Republic of Korea)
VLP	Very low power
WATM	Wireless asynchronous transfer mode

The ITU Radiocommunication Assembly,

considering

a) that broadband radio local area networks (RLANs) are widely used for fixed, semi-fixed (transportable) and portable computer equipment for a variety of broadband applications;

b) that broadband RLANs are used for fixed, nomadic and mobile wireless access applications;

c) that broadband RLAN standards currently being developed are compatible with current wired LAN standards;

d) that it is desirable to establish guidelines for broadband RLANs in various frequency bands;

e) that broadband RLANs should be implemented with careful consideration to compatibility with other radio applications,

recognizing

a) that the use of the frequency bands 5 150-5 250 MHz, 5 250-5 350 MHz and 5 470-5 725 MHz by RLAN's is covered in Resolution **229 (Rev.WRC-19)**;

~~*b)* that provision 0.4 of the Preamble of Radio Regulations provides that all stations, whatever their purpose, must be established and operated in such a manner as not to cause harmful interference to the radio services or communications of other Members or of recognized operating agencies, or of other duly authorized operating agencies which carry on a radio service, and which operate in accordance with the provisions of these Regulations (No. 197 of the Constitution).;~~

~~*[Editor's Note – this proposed new recognizing referencing Article .4 could be combined with the deletion of Notes 3 & 4 from Option 2 and 4, but is not considered necessary by proponents of Options 1 and 3, which limit recommends 3 to only two Notes.]*~~

Commented [E1]: IEEE 802: IEEE 802 supports Option 1 and therefore addition of this recognize is not applicable and proposes deleting this item and the Editor Note.

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c) that other information on broadband WAS, including RLANs, is contained in Recommendations ITU-R F.1763, ITU-R M.1652, ITU-R M.1739 and ITU-R M.1801,

noting

a) that Report ITU-R F.2086 provides technical and operational characteristics and applications of broadband wireless access systems (WAS) in the fixed service;

[Editor's Note – there was a proposal to delete the reference to ITU-R F.2086 in the above noting but the deletion was not agreed; the continuing relevance of referencing F.2086 may depend on discussions on Annex 2.]

[b), that Table 2 contains the details on the bands that have been made available for RLAN use by some administrations, after sharing analysis was carried out on a regional or national basis;]

[Editor's Note – this concept of sharing assessment could be covered in a Note in Annex 2.]

recommends

[*Editor's Note – a number of Options for revising recommends 1 have been discussed over the last several 5A meetings due to disagreement over whether updating a standards document with international standards designed for bands not previously included first requires ITU-R studies. Further discussion is necessary to find compromise text.*]

[Editor's Note - For ease of review, an embedded companion document shows the integrated options for revising the recommends without track changes.

5A2-2 BWA DG
Companion Doc r3 re*]*

Option 1:

[1 that the broadband RLAN standards in Table 12 should be used by administrations wishing to implement broadband RLANs (see also Notes 1 and, 2 and 3). The frequency bands shown in Table 12 indicate where the broadband RLAN systems conforming with the standards in this Recommendation have been operating;

1*bis* that Table 2 should be used to see the details on the bands that have been made available for RLAN use by Administrations;]

2 that Annex 2 should be used for general information on RLANs, including their basic characteristics;

3 that the following Notes should be regarded as part of this Recommendation.

NOTE 1 – Acronyms and terminology used in this Recommendation are given in Table 1.

NOTE 12 – Annex 1 provides detailed information on how to obtain complete standards described in Table 12.

NOTE 23 – This Recommendation does not exclude the implementation of other RLAN systems.]

Option 2:

[1 For guidance on the characteristic of broadband RLAN systems standards, Table 12 can be referred to. Administrations who wish to implement the RLAN should utilize the ISM bands and the frequency bands identified for RLAN in the ITU Radio Regulations [according to Resolution **229 (Rev.WRC-19)**]. Implementing broadband RLAN standards in any frequency bands not [considered]

Commented [E2]: IEEE 802: IEEE 802 supports deletion of reference to ITU-R F.2086 consistent with its proposal for deleting the proposed new Table "Typical RLAN characteristic and deployment (applied to population density) in 6 425-7 125 MHz " in Annex 2.

Commented [E3]: IEEE 802: IEEE 802 supports Option 1. This item is already covered under *recommends 1bis* and is redundant and inconsistent with Option 1 to be included here. IEEE 802 proposes deleting the Item and following Editor's Note.

Commented [E4]: IEEE 802: IEEE 802 supports Option 1 and is against Options 2 and 4.

Regarding Option 2, IEEE 802 does not support the condition regarding inclusion of frequencies of operation as related to sharing studies.

Regarding Option 4, we believe that the text is not clear and there are incomplete placeholder notes. So this can not be considered as a well defined option.

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in Radio Regulations or studied by ITU-R should not beare not allowed, and should be treated under Article **4.4** of the RR, and should be on a non-exclusive, non-interference and non-protected basis.]

[Editor's Note – per Secretariat guidance, Radio Regulations should not be referenced in a recommends and language of a mandatory nature should not be used in Recommendations; ITU should not recommend particular licensing frameworks for administrations; on the contrary, ITU seeks to harmonize spectrum bands. Further discussion will be necessary to improve Option 2.]

2 that Annex 2 should be used for general information on RLANs, including their basic characteristics;

3 that the following Notes should be regarded as part of this Recommendation.

~~NOTE 1 – Acronyms and terminology used in this Recommendation are given in Table 1.~~

NOTE 12 – Annex 1 provides detailed information on how to obtain complete standards described in Table 12.

NOTE 23 – This Recommendation does not exclude the implementation of other RLAN systems.

NOTE 3 –

Option 1 for Note 3 – Table [2][3] should be used to see the details on the bands that have been made available for RLAN use by Administrations.

Option 2 for Note 3 - Administrations wishing to implement RLANS should ensure that those systems do not cause interference or claim protection from certain other primary services as defined in the Radio Regulations.

NOTE 4 *[Editor's note: develop note to address the concern on possible extensions/additions of the frequency bands in Table 2]*

Option 3:

~~1~~ that the broadband RLAN standards in Table 12 should be used.

~~2 that Annex 2 should be used for general information on RLANs, including their basic characteristics;~~

~~3 that the following Notes should be regarded as part of this Recommendation.~~

~~NOTE 1 – Acronyms and terminology used in this Recommendation are given in Table 1.~~

~~NOTE 2 – Annex 1 provides detailed information on how to obtain complete standards described in Table 2.~~

~~NOTE 3 – This Recommendation does not exclude the implementation of other RLAN systems.~~

Option 4

1 that the broadband RLAN standards in Table 12 ~~should be used (see also Notes 1, 2 and 3)~~ can be referred by administrations who wish to implement the RLAN.

2 that Annex 2 and Annex 3 can be referred as ~~should be used for~~ general information on RLANs, including their basic characteristics, the frequency ranges and use conditions in the Radio Regulation and regional/national level;

3 that the following Notes should be regarded as part of this Recommendation.

~~NOTE 1 – Acronyms and terminology used in this Recommendation are given in Table 1.~~

NOTE 12 – Annex 1 provides detailed information on how to obtain complete standards described in Table 2.

NOTE 23 – This Recommendation does not exclude the implementation of other RLAN systems.

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NOTE 3— Table 3 should be used to see the details on the bands that have been made available for RLAN use by Administrations.

NOTE 4 [Editor's note: develop note to address the concern on possible extensions/additions of the frequency bands in Table 2]

[Editor's Note – Some participants are of the option that Note 4 is not necessary.]

[Editor's Note – As noted above "Acronyms and terms" proposed above to be replaced with "Abbreviations/Glossary" and title "Table 1" deleted to comport with mandatory new Recommendation format.]

Option discussed during 16 May DG:

that the broadband RLAN standards in Table 1 should be considered by administrations that wish to implement RLANs [based on their assessment of coexistence with incumbents].

TABLE 1

Acronyms and terms Abbreviations/Glossary used in this Recommendation

Access method	Scheme used to provide multiple access to a channel
AP	Access point
ARIB	Association of Radio Industries and Businesses
ATM	Asynchronous transfer mode
Bit rate	The rate of transfer of a bit of information from one network device to another
BPSK	Binary phase-shift keying
BRAN	Broadband Radio Access Networks (A technical committee of ETSI)
Channelization	Bandwidth of each channel and number of channels that can be contained in the RF bandwidth allocation
Channel Indexing	The frequency difference between adjacent channel centre frequencies
DFT	Discrete Fourier Transform
DFT-S OFDM	DFT-spread OFDM
CSMA/CA	Carrier sensing multiple access with collision avoidance
DAA	Detect and avoid
DFS	Dynamic frequency selection
DSSS	Direct sequence spread spectrum
e.i.r.p.	Equivalent isotropically radiated power
ENG	Electronic News Gathering
ETSI	European Telecommunications Standards Institute
Frequency band	Nominal operating spectrum of operation
FHSS	Frequency hopping spread spectrum
HIPERLAN2	High performance radio LAN 2
HiSWANa	High speed wireless access network – type a
HSWA	High speed wireless access

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IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
LAN	Local area network
LBT	Listen before talk
MU	Medium utilisation
MMAC	Multimedia mobile access communication
Modulation	The method used to put information onto an RF carrier
MIMO	Multiple input multiple output
OFDM	Orthogonal frequency division multiplexing
OFDMA	Orthogonal frequency division multiple access
PSD	Power spectral density
PSTN	Public switched telephone network
QAM	Quadrature amplitude modulation
QoS	Quality of Service
QPSK	Quaternary phase-shift keying
RF	Radio frequency
RLAN	Radio local area network
RU	Resource unit
SSMA	Spread spectrum multiple access
Tx power	Transmitter power – RF power in Watts produced by the transmitter
TCP	Transmission control protocol
TDD	Time division duplex
TDMA	Time-division multiple access
TPC	Transmit power control
TTA	Telecommunications Technology Association (A standards developing organization in the Republic of Korea)
WATM	Wireless asynchronous transfer mode

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TABLE 12-1

Characteristics including technical parameters associated with broadband RLAN standards: IEEE and ATIS (#546)

Characteristics	IEEE Std 802.11-202012 (Clause 167, commonly known as 802.11b)	IEEE Std 802.11-202012 (Clause 178, commonly known as 802.11a(1))	IEEE Std 802.11-202012 (Clause 189, commonly known as 802.11g(1))	IEEE Std 802.11-202012 (Clause 178, Annex D and Annex E, commonly known as 802.11j)	IEEE Std 802.11-202012 (Clause 1920, commonly known as 802.11n)	IEEE Std 802.11-2020ad-2012 (Clause 20, commonly known as 802.11ad)	IEEE Std 802.11-2020 (Clause 21, commonly known as 802.11ac)ETSI EN 300 328	IEEE Std 802.11-2020 ETSI EN 301 893(Clause 23, commonly known as 802.11ah)	IEEE Std 802.11ax-2021ARIB HiSWANa, (1)	IEEE Std 802.11ay-2021 ETSI EN 302 567	ATIS RLAN (*)
Access method	CSMA/ CA, SSMA	CSMA/CA				Scheduled, CSMA/CA	CSMA/CA	CSMA/CA TDMA/TDD	CSMA/CA, Trigger-based access and OFDMA	Scheduled, CSMA/CA	Scheduled, CSMA, TDMA/TDD
Modulation	CCK (8 complex chip spreading)	64-QAM-OFDM 16-QAM-OFDM QPSK-OFDM BPSK-OFDM 52 subcarriers (see Fig. 1)	DSSS/CCK OFDM PBCC DSSS-OFDM	64-QAM-OFDM 16-QAM-OFDM QPSK-OFDM BPSK-OFDM 52 subcarriers (see Fig. 1)	64-QAM-OFDM 16-QAM-OFDM QPSK-OFDM BPSK-OFDM 56 subcarriers in 20 MHz 114 subcarriers in 40 MHz MIMO, 1-4 spatial streams 256-QAM-OFDM 64-QAM-OFDM 16-QAM-OFDM QPSK-OFDM BPSK-OFDM 56 subcarriers in 20 MHz 114 subcarriers in 40 MHz 242 subcarriers in 80 MHz 484 subcarriers in 160 MHz and 80+80 MHz MIMO, 1-8 spatial streams	Single Carrier: DPSK, π/2-BPSK, π/2-QPSK, π/2-16QAM OFDM: 64-QAM, 16-QAM, QPSK, SQPSK 352 subcarriers	No restriction on the type of modulation256-QAM-OFDM 64-QAM-OFDM 16-QAM-OFDM QPSK-OFDM BPSK-OFDM 56 subcarriers in 20 MHz 114 subcarriers in 40 MHz 242 subcarriers in 80 MHz 484 subcarriers in 160 MHz and 80+80 MHz MIMO, 1-8 spatial streams	64-QAM-OFDM 16-QAM-OFDM QPSK-OFDM BPSK-OFDM 52 subcarriers (see Fig. 1) 256-QAM-OFDM 64-QAM-OFDM 16-QAM-OFDM QPSK-OFDM BPSK-OFDM 26 subcarriers in 1 MHz 56 subcarriers in 2 MHz 114 subcarriers in 4 MHz 242 subcarriers in 8 MHz 484 subcarriers in 16 MHz MIMO, 1-4 spatial streams	1024-QAM 256-QAM-OFDM 64-QAM-OFDM 16-QAM-OFDM QPSK-OFDM BPSK-OFDM Non-OFDMA: 242 subcarriers/frequency segment in 20 MHz 484 subcarriers/frequency segment in 40 MHz 996 subcarriers/frequency segment in 80 and 80+80 MHz 1992 subcarriers/frequency segment in 160 MHz OFDMA RU Size: 26, 52, 106, 242, 484, 996, 1992 subcarriers/RU MIMO, 1-8 spatial streams	Single Carrier: DPSK, π/2-BPSK, π/2-QPSK, π/2-8-PSK, π/2-16QAM, π/2-64-QAM, π/2-64-NUC OFDM: DCM BPSK, DCM QPSK, 16-QAM, 64-QAM 355 subcarrriers in 2.16 GHz 773 subcarrriers in 4.32 GHz 1193 subcarrriers in 6.48 GHz 1611 subcarrriers in 8.64 GHz	OFDM: 256-QAM, 64-QAM, 16-QAM, QPSK MIMO 1-4 spatial streams DFT-S-OFDM: 256-QAM, 64-QAM, 16-QAM, QPSK, π/2-BPSK

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TABLE 1~~2~~-1 (*continued*)

Characteristics	IEEE Std 802.11-2020~~12~~ (Clause 16~~7~~, commonly known as 802.11b)	IEEE Std 802.11-2020~~12~~ (Clause 17~~8~~, commonly known as 802.11a[(1)])	IEEE Std 802.11-2020~~12~~ (Clause 18~~9~~, commonly known as 802.11g[(1)])	IEEE Std 802.11-2020~~12~~ (Clause 17~~8~~, Annex D and Annex E, commonly known as 802.11j)	IEEE Std 802.11-2020~~12~~ (Clause 19~~20~~, commonly known as 802.11n)	IEEE Std 802.11~~ad~~-2020~~12~~ (Clause 20, commonly known as 802.11ad)	IEEE Std 802.11-2020 (Clause 21, commonly known as 802.11ac)~~ETSI EN 300 328~~	IEEE Std 802.11-2020 (Clause 23, commonly known as 802.11ah) ~~ETSI EN 301 893~~	IEEE Std 802.11ax-2021 ~~ARIB HiSWANa, (1)~~	IEEE Std 802.11ay-2021 ~~ETSI~~ ~~ETSI EN 302 567~~	ATIS RLAN (*)
Data rate	1, 2, 5.5 and 11 Mbit/s	6, 9, 12, 18, 24, 36, 48 and 54 Mbit/s	1, 2, 5.5, 6, 9, 11, 12, 18, 22, 24, 33, 36, 48 and 54 Mbit/s	3, 4.5, 6, 9, 12, 18, 24 and 27 Mbit/s for 10 MHz channel spacing 6, 9, 12, 18, 24, 36, 48 and 54 Mbit/s for 20 MHz channel spacing	From 6.5 to 288.9 Mbit/s for 20 MHz channel spacing From 6 to 600 Mbit/s for 40 MHz channel spacing ~~From 6.5 to 693.3 Mbit/s for 20 MHz channel spacing~~ ~~From 13.5 to 1 600 Mbit/s for 40 MHz channel spacing~~ ~~From 29.3 to 3 466.7 Mbit/s for 80 MHz channel spacing~~ ~~From 58.5 to 6 933.3 Mbit/s for 160 MHz and 80+80 MHz channel spacing~~	From 693.00 to 6756.75 Mbit/s	From 6.5 to 693.3 Mbit/s for 20 MHz channel spacing From 13.5 to 1 600 Mbit/s for 40 MHz channel spacing From 29.3 to 3 466.7 Mbit/s for 80 MHz channel spacing From 58.5 to 6 933.3 Mbit/s for 160 MHz and 80+80 MHz channel spacing	From 0.300 to 17.7778 Mbit/s for 1 MHz channel spacing From 0.650 to 34.6667 Mbit/s for 2 MHz channel spacing From 1.350 to 80.000 Mbit/s for 4 MHz channel spacing From 2.925 to 173.3333 Mbit/s for 8 MHz channel spacing From 5.850 to 346.6667 Mbit/s for 16 MHz channel spacing~~6, 9, 12, 18, 27, 36 and 54 Mbit/s~~	From 0.4 to 117.6 Mbit/s for 26-tone RU From 0.8 to 235.3 Mbit/s for 52-tone RU From 1.6 to 500.0 Mbit/s for 106-tone RU From 3.6 to 1 147.1 Mbit/s for 242-tone RU and 20 MHz non-OFDMA channel spacing From 7.3 to 2 294.1 Mbit/s for 484-tone RU and non-OFDMA 40 MHz channel spacing From 15.3 to 4 803.9 Mbit/s for 996-tone RU and non-OFDMA 80 MHz channel spacing From 30.6 to 9 607.8 Mbit/s for 2×996-tone RU and 160 MHz and 80+80 MHz channel spacing	From 630.00 to 8 316.00 Mbit/s for 2.16 GHz From 1 376.25 to 18 166.50 Mbit/s for 3.32 GHz From 2 126.25 to 28 066.50 Mbit/s for 6.48 GHz From 2 872.50 to 37 917.00 Mbit/s for 8.64 GHz	Up to 453 Mbit/s for 20 MHz channel Up to 907 Mbit/s for 40 MHz channel Up to 1 386 Mbit/s for 60 MHz channel Up to 1 857 Mbit/s for 80 MHz channel

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TABLE 12-1 (*continued*)

Characteristics	IEEE Std 802.11-202012 (Clause 167, commonly known as 802.11b)	IEEE Std 802.11-20202012 (Clause 178, commonly known as 802.11a[1])	IEEE Std 802.11-20202012 (Clause 189, commonly known as 802.11g[1])	IEEE Std 802.11-20202012 (Clause 178, Annex D and Annex E, commonly known as 802.11j)	IEEE Std 802.11-20202012 (Clause 1920, commonly known as 802.11n)	IEEE Std 802.11-2020ad-2012 (Clause 20, commonly known as 802.11ad)	IEEE Std 802.11-2020 (Clause 21, commonly known as 802.11ac)ETSI EN 300 328	IEEE Std 802.11-2020 (Clause 23, commonly known as 802.11ah) ETSI EN 301 893	IEEE Std 802.11ax-2021 ARIB HiSWANa, [1]	IEEE Std 802.11ay-2021 ETSI EN 302 567	ATIS RLAN [*]
Frequency band	2 400-2 483.5 MHz	5 150-5 250 MHz[4] 5 250-5 350 MHz[3](#546) 5 470-5 725 MHz[3](#546) 5 725-5 825 MHz [**](#546)	2 400-2 483.5 MHz	4 940-4 990 MHz[2] 5 030-5 091 MHz[2] 5 150-5 250 MHz[4] 5 250-5 350 MHz[3] (#546) 5 470-5 725 MHz[3] (#546) 5 725-5 825 MHz [**](#546)	2 400-2 483.5 MHz 5 150-5 250 MHz[4] 5 250-5 350 MHz[3] (#546) 5 470-5 725 MHz[3] (#546) 5 725-5 825 MHz [**](#546) 5 150-5 250 MHz[4] 5 250-5 350 MHz[3] 5 470-5 725 MHz[3] 5 725-5 825 MHz	57-7166 GHz	2 400-2 483.5 MHz5 150-5 250 MHz[4] 5 250-5 350 MHz[3] (#546) 5 470-5 725 MHz[3] (#546) 5 725-5 825 MHz [**](#546)	755-787 MHz 779-787 MHz 863-868.6 MHz 902-928 MHz 916.5-927.5 MHz 917.5-923.5 MHz 5 150-5 350[5] and 5 470-5 725 MHz[3]	4 900 to 5 000 MHz [2] 5 150 to 5 250 MHz[4] 2 400-2 483.5 MHz 5 150-5 250 MHz(4) 5 250-5 350 MHz(3) 5 470-5 725 MHz(3) 5 725-5 825 MHz 5- 825-5 850 MHz 5- 850-5 895 MHz [5 925-7 125 MHz] [**](#546) 5925-7125 MHz 5945–6425 MHz	57-71 GHz 57-66 GHz	5- 150-5 925 MHz [**](#546)
Channel indexing	5 MHz				5 MHz in 2.4 GHz 20 MHz in 5 GHz 20 MHz	2 160 MHz	20 MHz	1 MHz20 MHz	20 MHz 20 MHz channel spacing 4 channels in 100 MHz	2 160 MHz	20 MHz

Commented [SD6]: Document 548 (#548) proposes to delete this row.

Commented [E5]: EEE 802: 5925-6425MHz is a subrange of 5925-7125MHz that IEEE 802.11ax supports in its entirety, Propose removing 5925-6425MHz.

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Characteristics	IEEE Std 802.11-2020~~12~~ (Clause 16~~7~~, commonly known as 802.11b)	IEEE Std 802.11-2020~~2012~~ (Clause 17~~8~~, commonly known as 802.11a[(1)])	IEEE Std 802.11-2020~~2012~~ (Clause 18~~9~~, commonly known as 802.11g[(1)])	IEEE Std 802.11-2020~~2012~~ (Clause 17~~8~~, Annex D and Annex E, commonly known as 802.11j)	IEEE Std 802.11-2020~~2012~~ (Clause 19~~20~~, commonly known as 802.11n)	IEEE Std 802.11-2020~~ad-2012~~ (Clause 20, commonly known as 802.11ad)	IEEE Std 802.11-2020 (Clause 21, commonly known as 802.11ac)~~ETSI EN 300 328~~	IEEE Std 802.11-2020 (Clause 23, commonly known as 802.11ah) ~~ETSI EN 301 893~~	IEEE Std 802.11ax-2021 ~~ARIB HiSWANa, (1)~~	IEEE Std 802.11ay-2021 ~~ETSI EN 302 567~~	ATIS RLAN (*)
Spectrum mask	802.11b mask (Fig. 4)	OFDM mask (Fig. 1)			OFDM mask (Figs. 2A, 2B for 20 MHz and Figs. 3A, 3B for 40 MHz) ~~OFDM mask (Fig. 2B for 20 MHz, Fig. 3B for 40 MHz, Fig. 3C for 80 MHz, Fig. 3D for 160 MHz, and Fig. 3E for 80+80 MHz)~~	802.11ad mask (Fig. 5)	OFDM mask (Fig. 2b for 20 MHz, Fig. 3b for 40 MHz, Fig. 3c for 80 MHz, Fig. 3d for 160 MHz, and Fig. 3e for 80+80 MHz)	~~Fig. 1x~~ 802.11ah mask (Fig. 6a for 1 MHz, Fig. 6b for 2 MHz, Figure 6c for 4 MHz, Fig. 6d for 8 MHz and Fig. 6e for 16 MHz)	Spectrum Mask (Fig. 7a for 20 MHz, Fig. 7b for 40 MHz, Fig. 7c for 80 MHz, Fig. 7d for 160 MHz and Fig. 7e for 80+80 MHz)~~OFDM mask (Fig. 1)~~	802.11ay mask (Fig .8a for 2.16 GHz, Fig. 8b for 4.32 GHz, Fig. 8c for 6.48 GHz, Fig. 8d for 8.64 GHz and Fig. 8e for 2.16+2.16 GHz) Fig. 8f~~d~~ for 4.32+4.32 GHz)	Fig. 9A for 20 MHz, Fig. 9B for 40 MHz, Fig. 9C for 60 MHz, Fig. 9D for 80 MHz
Transmitter											
Interference mitigation	LBT	LBT/DFS/ TPC	LBT		LBT/DFS/TPC	Entergy Detect, Frequency, Time and Spatial sharing~~LBT~~	LBT/DFS/TPC	Entergy Detect CCA, Frequency, Time and Spatial sharing	LBT/DFS/TPC/AFC*	Entergy Detect, Frequency, Time and Spatial sharing	LBT/DFS/TPC
Receiver											
Sensitivity	Listed in Standard	Listed in Standard	Listed in Standard		Listed in Standard	Listed in Standard	Listed in Standard	Listed in Standard	Listed in Standard	Listed in Standard	Listed in Standard

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Characteristics	IEEE Std 802.11-202012 (Clause 167, commonly known as 802.11b)	IEEE Std 802.11-20202012 (Clause 178, commonly known as 802.11a(1))	IEEE Std 802.11-20202012 (Clause 189, commonly known as 802.11g(1))	IEEE Std 802.11-20202012 (Clause 178, Annex D and Annex E, commonly known as 802.11j)	IEEE Std 802.11-20202012 (Clause 1920, commonly known as 802.11n)	IEEE Std 802.11-2020ad-2012 (Clause 20, commonly known as 802.11ad)	IEEE Std 802.11-2020 (Clause 21, commonly known as 802.11ac)ETSI EN 300 328	IEEE Std 802.11-2020 (Clause 23, commonly known as 802.11ah) ETSI EN 301 893	IEEE Std 802.11ax-2021 ARIB HiSWANa, (1)	IEEE Std 802.11ay-2021 ETSI EN 302 567	ATIS RLAN (*)

Notes to Table 12-1

(1) Parameters for the physical layer are common between IEEE 802.11a and ARIB HiSWANa.

(2) Pursuant to Resolution 229 (Rev.WRC-19) recognizes that, outdoor WAS/RLANs operatinguse in the 5 150-5 250 MHz should can be controlled and/or limited. Details can be found in Resolution 229 (Rev.WRC-19).

(3) See 802.11j-2004 and JAPAN MIC ordinance for Regulating Radio Equipment, Articles 49-20 and 49-21.

(23) DFS rules apply in the 5 250-5 350 and 5 470-5 725 MHz bands in many administrations and administrations must be consulted (#546 restores this line).

(4) Pursuant to Resolution 229 (Rev.WRC-12), operation in the 5 150-5 250 MHz band is limited to indoor use.

(*) See ATIS.3GPP.37.213V1640 and related ATIS Standards.

- TTA also issued RLAN standards as identical as the IEEE Std 801.11-2020, IEEE Std 802.11ax-2021 and IEEE Std 802.11ay-2021 listed in the table. (#535)

(**) Pursuant to Resolution 229 (Rev.WRC-19) and subject to not causing interference to existing servicesnational regulation

(***) IEEE 802.11ax supports Standard Power mode under supervision of Automated Frequency Coordination (AFC) for 6 GHz band.

TABLE 12-2

Characteristics including technical parameters associated with broadband RLAN standards: ETSI and ARIB

Characteristics	ETSI EN 300 328 (0)	ETSI EN 301 893 (V2.1.1) (#526) (0)	ARIB HiSWANa, (1)	ETSI EN 302 567 (V2.2.1) (#526) (0)	ETSI EN 303 722 (V1.2.1)) (#526)	Draft ETSI [EN 303 687](V1.0.0) (#526) (0) (**)
Access method		**TDMA/TDD See clause 4.2.7 of the standard (#526)**	**TDMA/TDD**	**See clause 4.2.5 of the standard (#526)**	**See clause 4.2.5 of the standard**	**See clause 4.3.6 of the standardTBD**
Modulation	No restriction on the type of modulation	64-QAM-OFDM 16-QAM-OFDM QPSK-OFDM BPSK-OFDM 52 subcarriers (see Fig. 1) Unspecified (#526)	64-QAM-OFDM 16-QAM-OFDM QPSK-OFDM BPSK-OFDM 52 subcarriers (see Fig. 1)	Unspecified (#526)	Unspecified (#526)	UnspecifiedTBD

Commented [E7]: IEEE 802: ETSI EN 303 687 is ratified as v1.1.1. ETSI BRAN may consider updating this reference.

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Data rate		6, 9, 12, 18, 27, 36 and 54 Mbit/sUnspecified (#526)	6, 9, 12, 18, 27, 36 and 54 Mbit/s	Unspecified (#526)	Unspecified (#526)	UnspecifiedTBD
Frequency band	2 400-2 483.5 MHz	5 150-5 350 MHz(5) and 5 470-5 725 MHz(3) (*)(#526)	4 900 to 5 000 MHz (2) 5 150 to 5 250 MHz(4) (*)	57-6671 GHz (#526)	57-71 GHz) (#526)	[5 925 5 945-6 425 MHz] (#526)
Channel indexing		20 MHz	20 MHz channel spacing 4 channels in 100 MHz	Unspecified (#526)	Unspecified) (#526)	TBD 20 MHz (#526)
Spectrum mask		Fig. 1x	OFDM mask (Fig. 1)	Fig. 2x (#526)	Fig. 3x (#526)	TBD Fig. 1x (5) (#526)
Transmitter						
Interference mitigation	DAA/LBT, DAA/non-LBT, MU	LBT/DFS/TPCSee standard (#526)	LBT	See standard (#526)	See standard (#526)	TBD See standard (#526)
Receiver						
Sensitivity		See standard (#526)		See standard (#526)	See standard (#526)	See standard (#526)

Notes to Table 12-2

(0) These Harmonized Standards (HS) are not technology standards, but rather are used to demonstrate that products, services, or processes comply with relevant EU legislation. *[Editor's Note: Source Doc. 5A/379 (ETSI TC BRAN); to be further updated]*

(1) Parameters for the physical layer are common between IEEE 802.11a and ARIB HiSWANa.

(2) See IEEE 802.11j-2004 and JAPAN MIC ordinance for Regulating Radio Equipment, Articles 49-20 and 49-21.

(3) DFS rules apply in the 5 250-5 350 and 5 470-5 725 MHz bands in many administrations and administrations must be consulted.

(4) Pursuant to Resolution **229 (Rev.WRC-19)**, recognizes that the number of outdoor WAS/RLANs operating outdoor use in the 5 150-5 250 MHz canshould be controlled and/or limited. Details can be found in Resolution **229 (Rev.WRC-19)**. (#546 restores "Details…") Pursuant to Resolution **229 (Rev.WRC-12)**, operation in the 5 150-5 250 MHz band is limited to indoor use. *[EDITOR's NOTE: TO BE UPDATED PER WRC-19]*

(5) Additional masks are specified for multi-channel use cases. (#526)

(*) Pursuant to Resolution **229 (Rev.WRC-19)** and subject to not causing harmful interference to existing services (#546 deletes "and subject to…")

(**) [Editor's Note; this standard is still in draft form; this information is to be updated by ETSI at future meetings]

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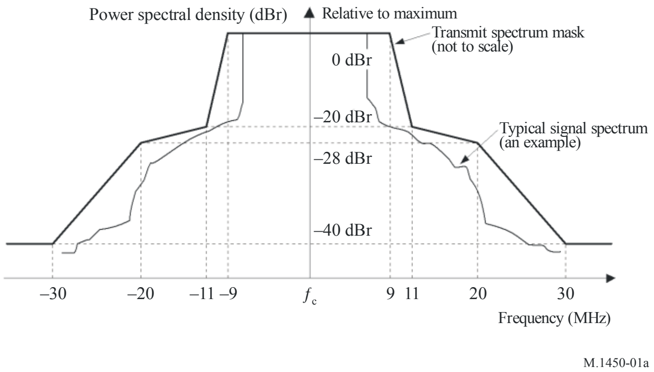
FIGURE 1a

OFDM transmit spectrum mask for 802.11a, 11g, 11j, and HiSWANa systems



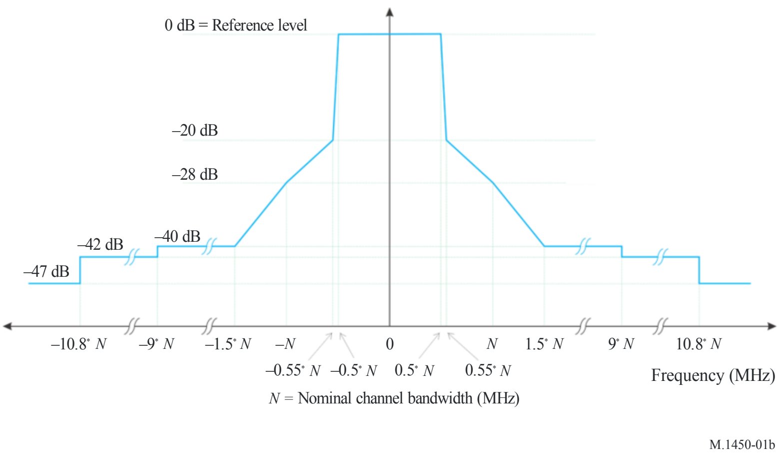
NOTE 1 – The outer heavy line is the spectrum mask for 802.11a, 11g, 11j, HiSWANa and the inner thin line is the envelope spectrum of OFDM signals with 52 subcarriers.

NOTE 2 – The measurements shall be made using a 100 kHz resolution bandwidth and a 30 kHz video bandwidth.

NOTE 3 – In the case of the 10 MHz channel spacing in 802.11j, the frequency scale shall be half.

FIGURE 1b

Transmit spectrum mask for EN 301 893



NOTE – dBc is the spectral density relative to the maximum spectral power density of the transmitted signal.

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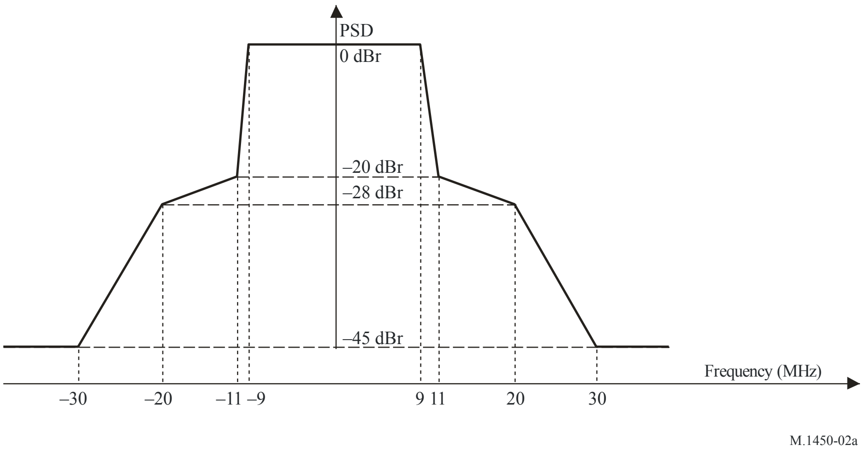
FIGURE 2a

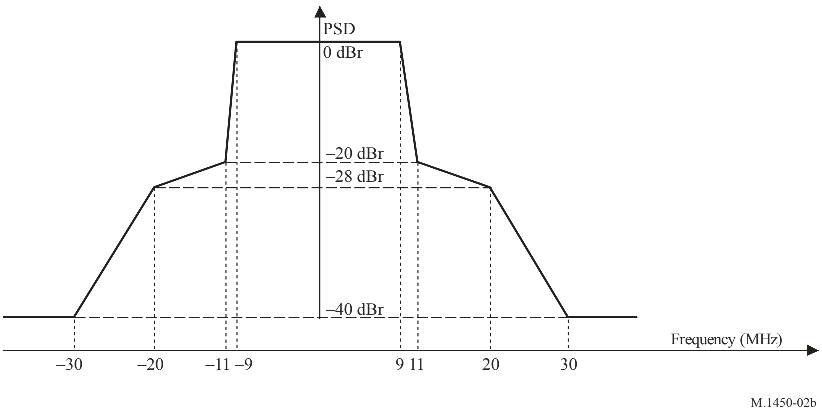
Transmit spectral mask for 20 MHz 802.11n transmission in 2.4 GHz band



NOTE – Maximum of −45 dBr and −53 dBm/MHz at 30 MHz frequency offset and above.

FIGURE 2b

Transmit spectral mask for a 20 MHz 802.11n transmission in 5 GHz band and transmit spectral mask for 802.11ac



NOTE – For 802.11n, the maximum of −40 dBr and −53 dBm/MHz at 30 MHz frequency offset and above. For 802.11ac, the transmit spectrum shall not exceed the maximum of the transmit spectral mask and −53 dBm/MHz at any frequency offset.

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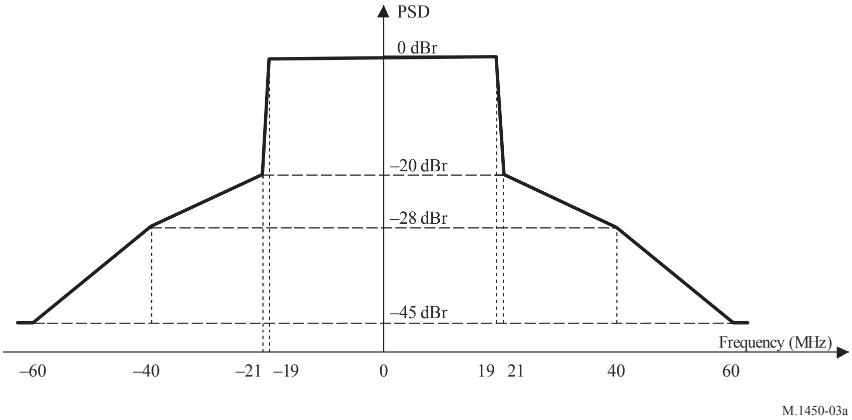
FIGURE 3a

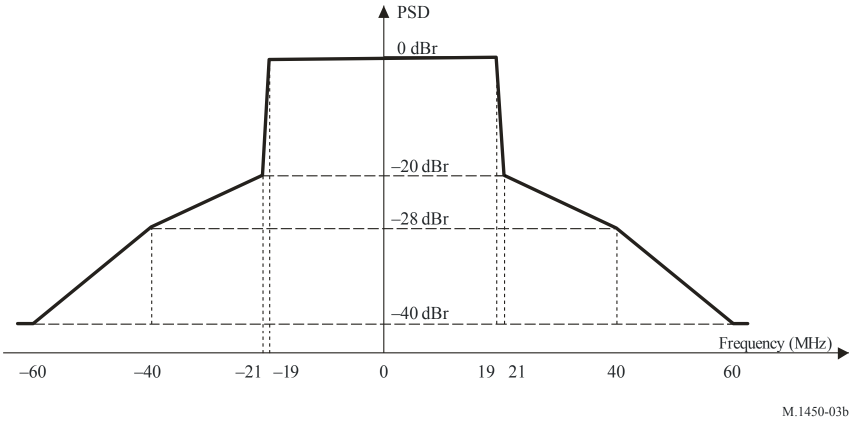
Transmit spectral mask for a 40 MHz 802.11n channel in 2.4 GHz band



NOTE – Maximum of −45 dBr and −56 dBm/MHz at 60 MHz frequency offset and above.

FIGURE 3b

Transmit spectral mask for a 40 MHz 802.11n channel in 5 GHz band and transmit spectral mask for 802.11ac



NOTE – For 802.11n, maximum of −40 dBr and −56 dBm/MHz at 60 MHz frequency offset and above. For 802.11ac, the transmit spectrum shall not exceed the maximum of the transmit spectral mask and −56 dBm/MHz at any frequency offset.

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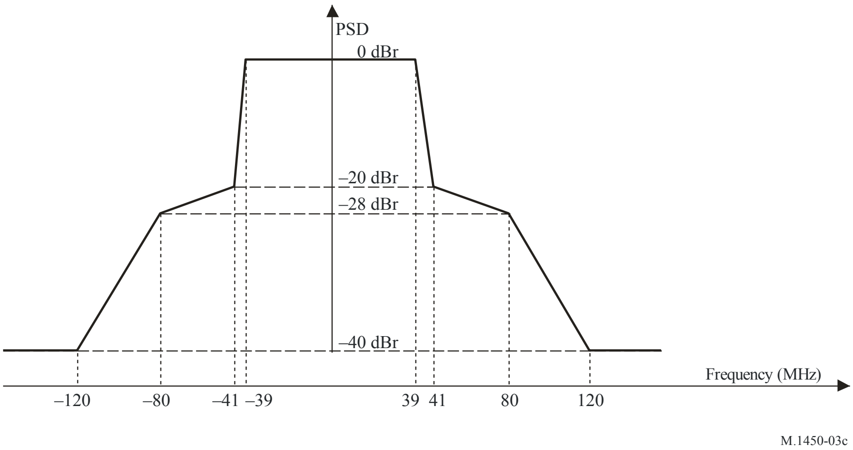
FIGURE 3c

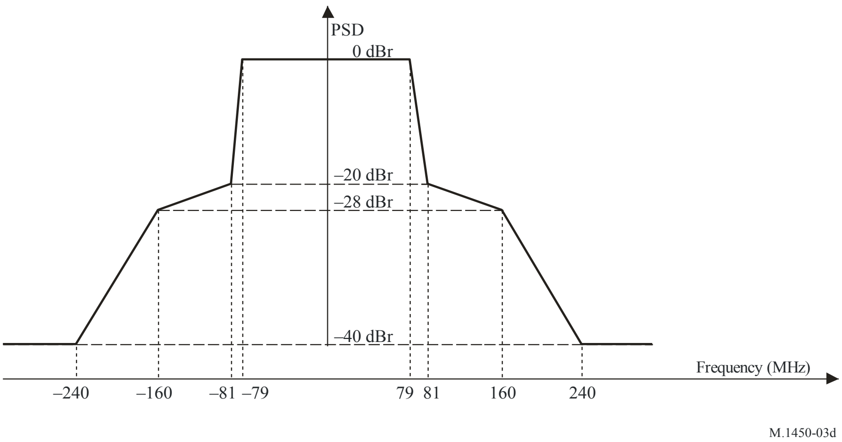
Transmit spectral mask for an 80 MHz 802.11ac channel



NOTE – The transmit spectrum shall not exceed the maximum of the transmit spectral mask and −59 dBm/MHz at any frequency offset.

FIGURE 3d

Transmit spectral mask for a 160 MHz 802.11ac channel



NOTE – The transmit spectrum shall not exceed the maximum of the transmit spectral mask and −59 dBm/MHz at any frequency offset.

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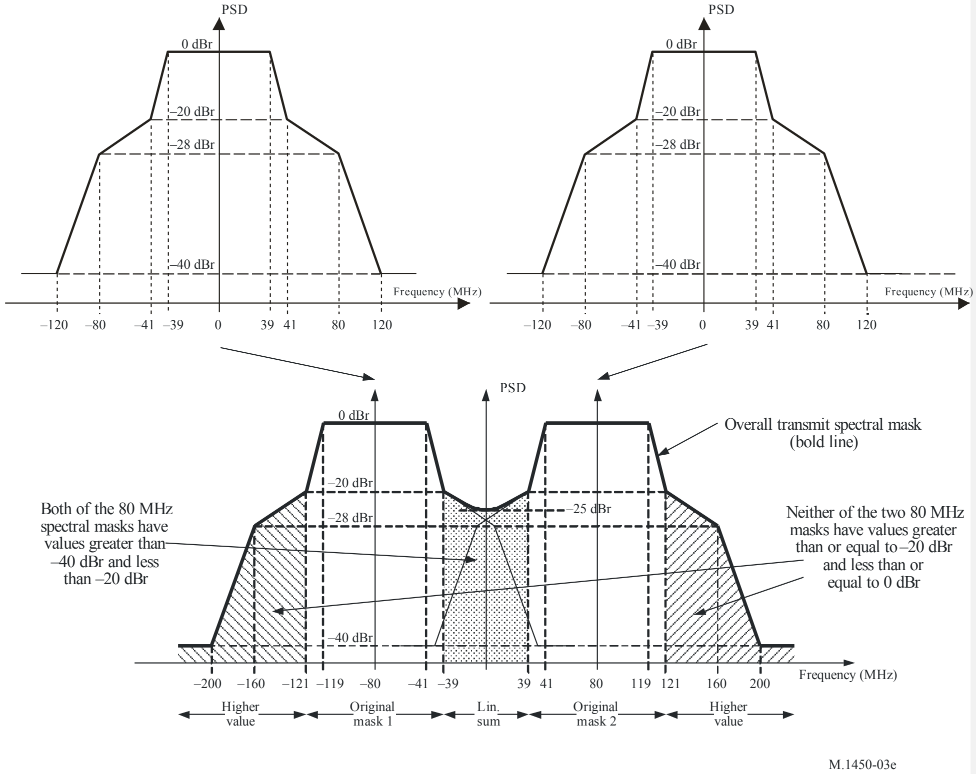
FIGURE 3e

Transmit spectral mask for a 80+80 MHz 802.11ac channel



NOTE – The transmit spectrum shall not exceed the maximum of the transmit spectral mask and −59 dBm/MHz at any frequency offset.

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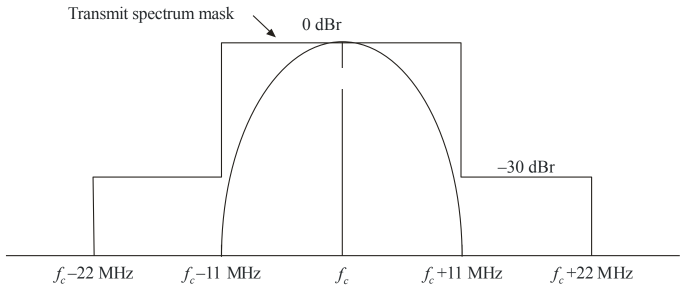
FIGURE 4

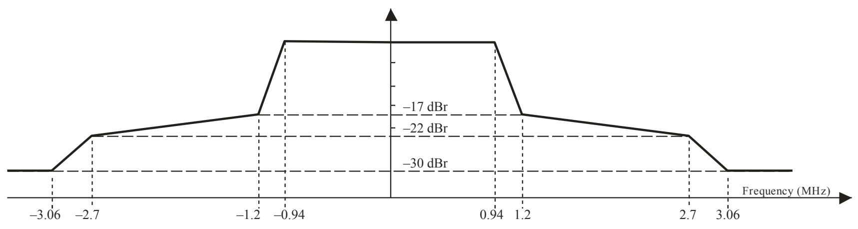
Transmit spectrum mask for 802.11b



M.1450-04

FIGURE 5

Transmit spectrum mask for 802.11ad



M.1450-05

FIGURE 6a

Transmit spectrum mask for 1 MHz 802.11ah channel

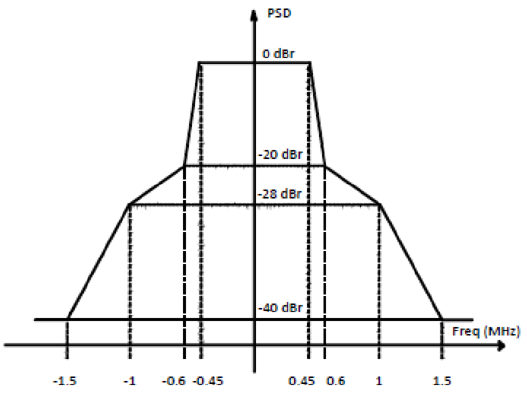


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FIGURE 6b

Transmit spectrum mask for 2 MHz 802.11ah channel

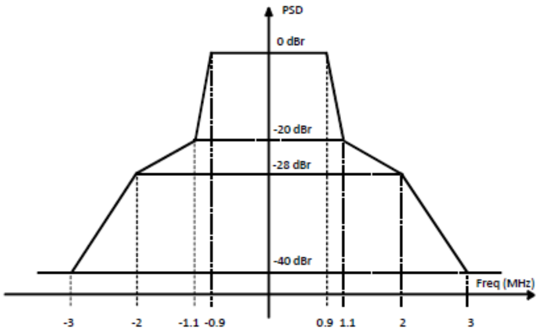

FIGURE 6c

Transmit spectrum mask for 4 MHz 802.11ah channel

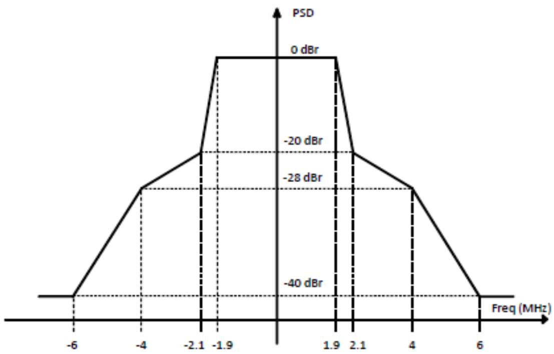

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FIGURE 6d

Transmit spectrum mask for 8 MHz 802.11ah channel

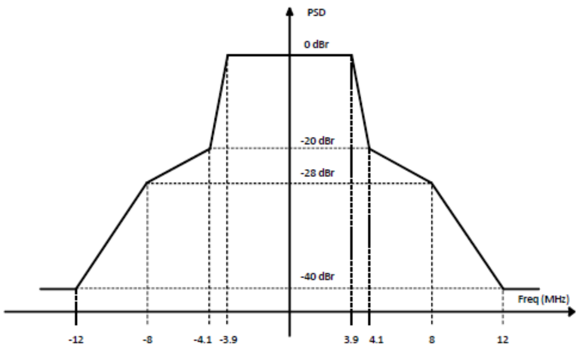

FIGURE 6e

Transmit spectrum mask for 16 MHz 802.11ah channel

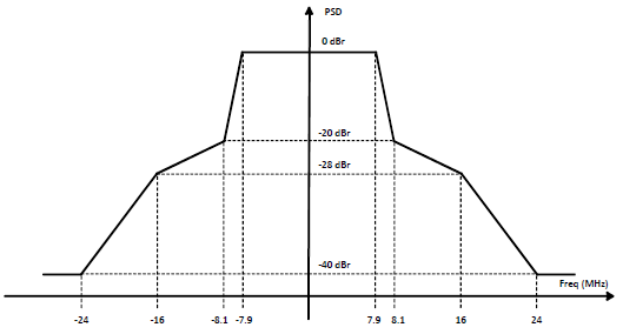

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FIGURE 7a

Transmit spectrum mask for 20 MHz 802.11ax channel

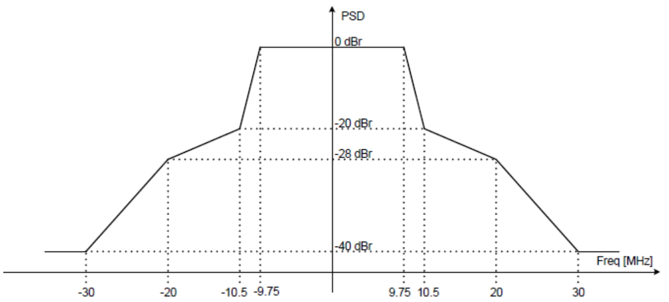

FIGURE 7b

Transmit spectrum mask for 40 MHz 802.11ax channel

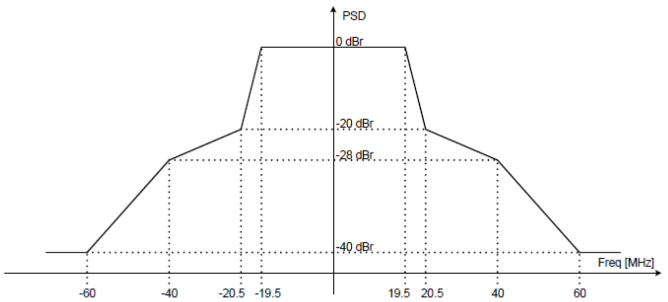

FIGURE 7c

Transmit spectrum mask for 80 MHz 802.11ax channel

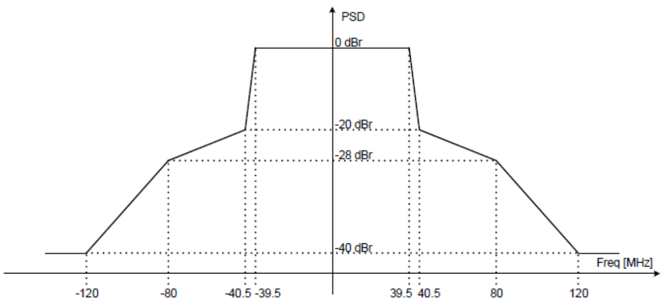

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FIGURE 7d

Transmit spectrum mask for 160 MHz 802.11ax channel

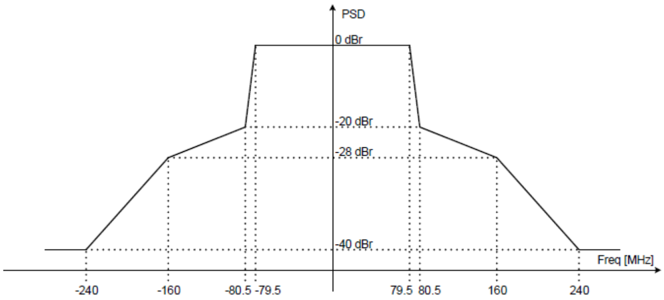

FIGURE 7e

Transmit spectrum mask for 80+80 MHz 802.11ax channel

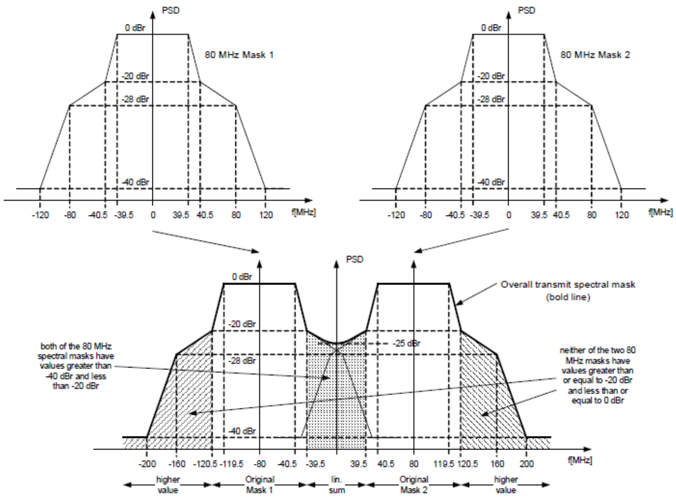

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FIGURE 8a

Transmit spectrum mask for 2.16 GHz P802.11ay channel

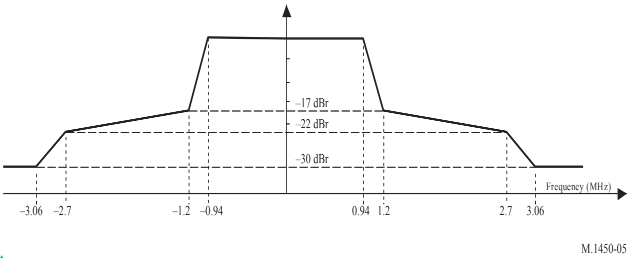

FIGURE 8b

Transmit spectrum mask for 4.32 GHz P802.11ay channel

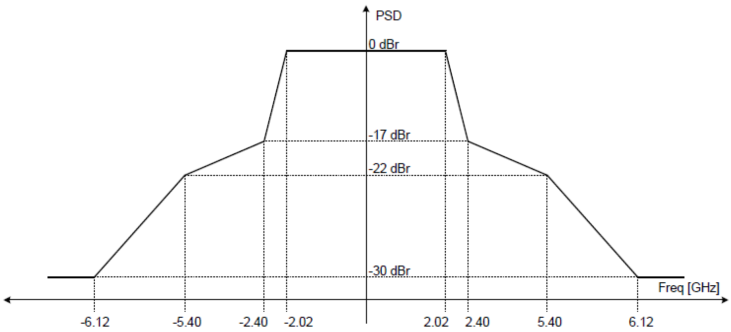

FIGURE 8c

Transmit spectrum mask for 6.48 GHz P802.11ay channel

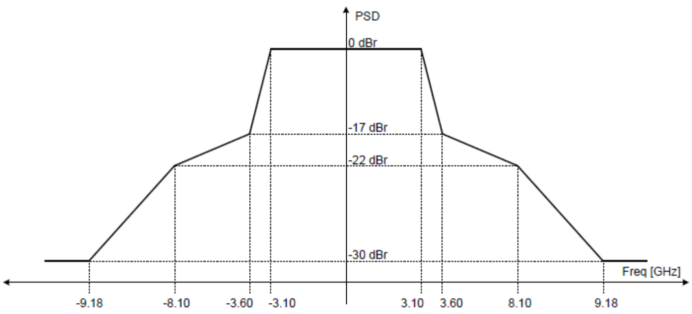

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FIGURE 8d

Transmit spectrum mask for 8.64 GHz P802.11ay channel

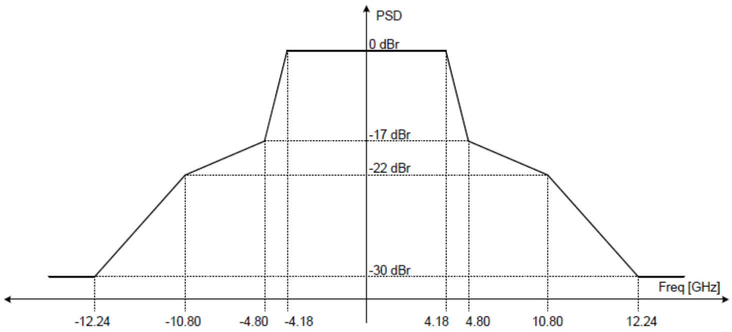

FIGURE 8e

Transmit spectrum mask for 2.16+2.16 GHz P802.11ay channel

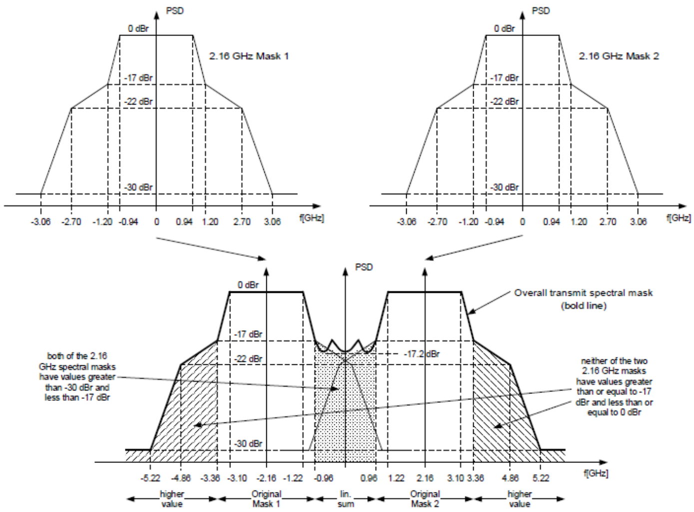

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FIGURE 8f

Transmit spectrum mask for 4.32+4.32 GHz P802.11ay channel

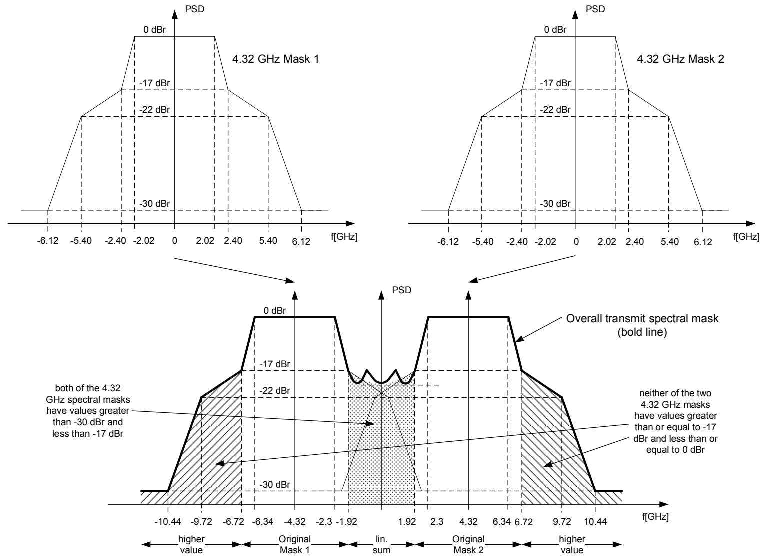
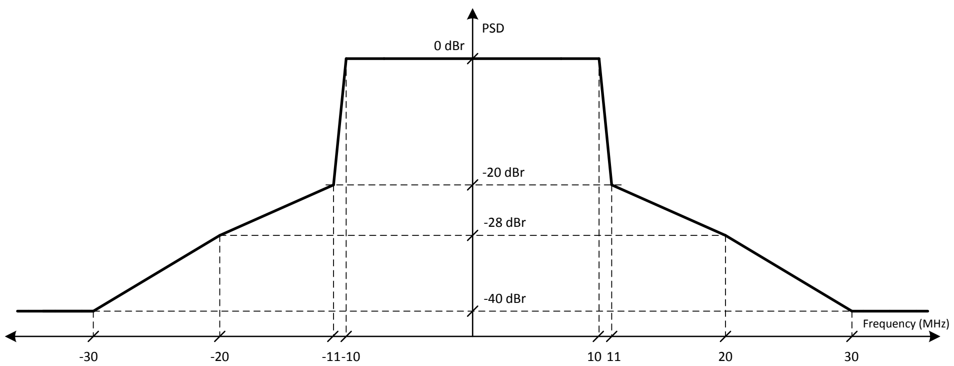


FIGURE 9a

Transmit spectrum mask for 20 MHz ATIS RLAN



NOTE – The spectrum emission mask is defined relative to the maximum power density in a 1 MHz measurement bandwidth within the channel bandwidth. The relative power of any transmitter emission shall not exceed the levels indicated by the mask or –30 dBm/MHz whichever is the greatest.

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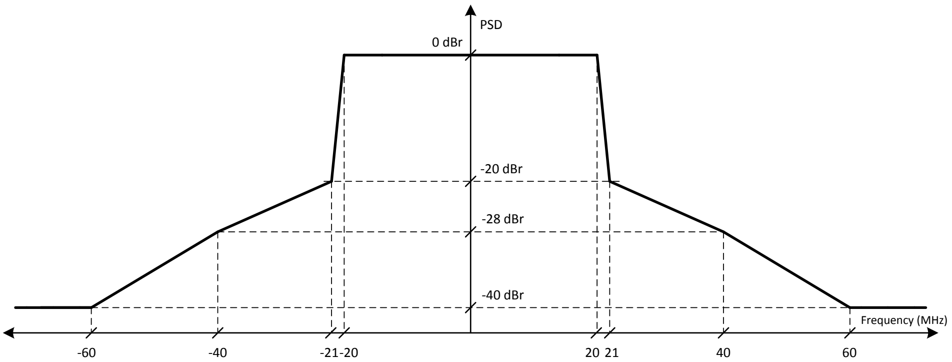
FIGURE 9b

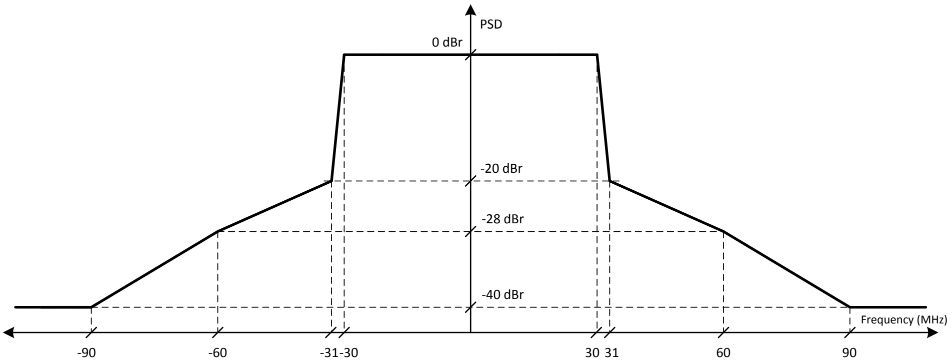
Transmit spectrum mask for 40 MHz ATIS RLAN



NOTE – The spectrum emission mask is defined relative to the maximum power density in a 1 MHz measurement bandwidth within the channel bandwidth. The relative power of any transmitter emission shall not exceed the levels indicated by the mask or –30 dBm/MHz whichever is the greatest.

FIGURE 9c

Transmit spectrum mask for 60 MHz ATIS RLAN



NOTE – The spectrum emission mask is defined relative to the maximum power density in a 1 MHz measurement bandwidth within the channel bandwidth. The relative power of any transmitter emission shall not exceed the levels indicated by the mask or –30 dBm/MHz whichever is the greatest.

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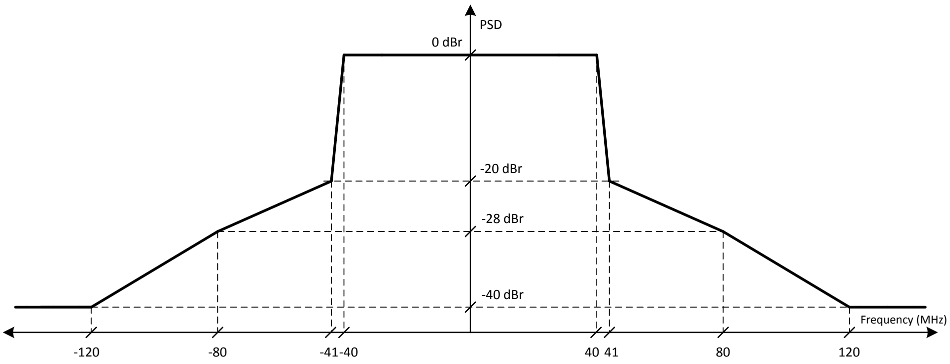
FIGURE 9d

Transmit spectrum mask for 80 MHz ATIS RLAN



NOTE – The spectrum emission mask is defined relative to the maximum power density in a 1 MHz measurement bandwidth within the channel bandwidth. The relative power of any transmitter emission shall not exceed the levels indicated by the mask or –30 dBm/MHz whichever is the greatest.

FIGURE 10A (#526)

Transmit Mask for EN 302 567

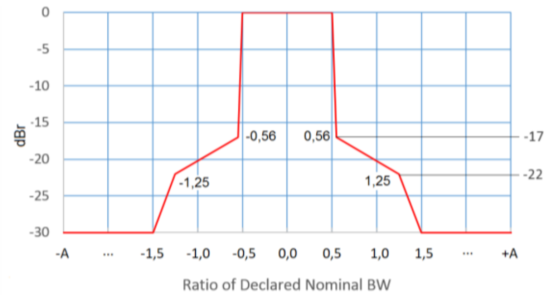


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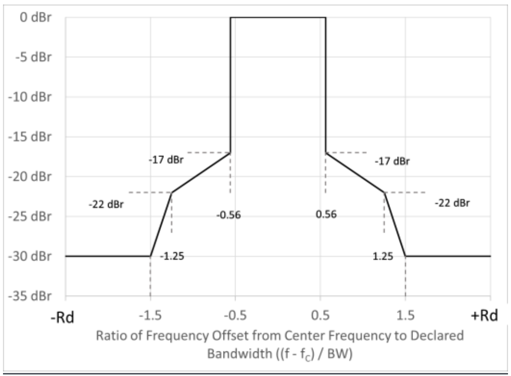
FIGURE 10B (#526)

Transmit Mask for EN 303 722



Annex 1

Obtaining additional information on RLAN standards

The ETSI EN 300 328, EN 301 893 and EN 302 567 standards can be downloaded from http://pda.etsi.org/pda/queryform.asp. In addition to these standards, the Hiperlan type 2 standards can still be downloaded from the above link.

The IEEE 802.11 standards can be downloaded from: http://standards.ieee.org http://standards.ieee.org/getieee802/index.html.

IEEE 802.11 has developed a set of standards for RLANs, IEEE Std 802.11 – 2016202, which has been harmonized withadopted by IEC/ISO as ISO/IEC/IEEE 8802-11:2022[2]. The medium access control (MAC) and physical characteristics for wireless local area networks (LANs) are specified in ISO/IEC/IEEE 8802-11:201822ISO/IEC 8802-11:2005, which is part of a series of standards for local and metropolitan area networks. The medium access control unit in ISO/IEC/IEEE 8802-11:201822ISO/IEC 8802-11:2005 is designed to support physical layer units as they may be adopted dependent on the availability of spectrum. Approved amendments to the IEEE Std 802.11-201620 base standard include IEEE Std 802.11ax-2021, IEEE Std 802.11ay-2021, IEEE Std 802.11ba-2021, IEEE Std 802.11az-2022, and IEEE 802.11bd-2022. IEEE Std 802.11 operates in the frequency bands up to 71 GHz (#546).ISO/IEC 8802-11:2005 contains five physical layer units: four radio units, operating in the 2 400-2 500 MHz band and in the bands comprising 5 150-5 250 MHz, 5 250-5 350 MHz, 5 470-5 725 MHz, and 5 725-5 825 MHz, and one baseband infrared (IR)

[2] ISO/IEC 8802-11:2022ISO/IEC 8802-11:2005, Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications.

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unit. One radio unit employs the frequency-hopping spread spectrum (FHSS) technique, two employ the direct sequence spread spectrum (DSSS) technique, another employs the orthogonal frequency division multiplexing (OFDM) technique, and another employs a multiple input multiple output (MIMO) technique. This ISO/IEC/IEEE 8802-11:2022 standard can be downloaded from https://ieeexplore.ieee.org/document/9930960.

The ATIS RLAN standards can be downloaded from: http://www.atis.org/3gpp-documents/Rel16

Annex 2

[Editor's Note for Annex 2 – mandatory new format for Recommendations provides that Annexes longer than 5 pages require a Table of Contents. To be added later.]

Basic characteristics of broadband RLANs and general information guidance for deployment and system design

[Editor's Note - There is disagreement among participants whether adding specific guidance on deployment parameters typical in sharing and compatibility studies is appropriate, and concern that its inclusion may further compound disagreement. Operational characteristics from SDOs are shared in Table 1.]

1 Introduction

Broadband RLAN standards have been designed to allow compatibility with wired LANs such as IEEE 802.3, 10BASE-T, 100BASE-T and 51.2 Mbit/s ATM at comparable data rates. Some broadband RLANs have been developed to be compatible with current wired LANs and are intended to function as a wireless extension of wired LANs using TCP/IP and ATM protocols. Recent Unlicenced License-exempt use of spectrum allocations by some administrationsglobally further promoted development of broadband RLANs. This allows allowing many applications such as cellular offload, voice/video over RLAN, audio/video streaming, mobile hotspot, real-time gaming, voice/video over RLAN, AR/VR to be supported with high QoSin various segments including enterprise and residential connectivity, health, education, retail, leisure/hospitality, smart cities, transportation, IoT and Industrial IoT.

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Portability is a feature provided by broadband RLANs but not wired LANs. LNew laptop computers and palmtop are portable and have the ability, when connected to a wired LAN, to provide interactive services. However, when they are connected to wired LANs they are no longer portable. Broadband RLANs allow portable computing devices such as notebooks, tablets, smartphones and wearable devices to remain portable and operate at maximum potential. Private on-premise, computer networks are not covered by traditional definitions of fixed and mobile wireless access and should be considered. The nomadic users are no longer bound to a desk. Instead, they are able to carry their computing devices with them and maintain contact with the wired LAN in a facility. In addition, mobile devices such as cellular telephones are beginning to incorporate the ability to connect to wireless LANs when available to supplement traditional cellular networks.

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Advanced applications such as cellular offload, voice/video over RLAN, audio/video streaming, mobile hotspot, real-time gaming, AR/VR require improvement in performance characteristics of RLAN such as throughput and latencyAdvanced applications such as cellular offload, voice/video over RLAN, audio/video streaming, mobile hotspot, real-time gaming, AR/VR require improvement in performance characteristics of RLAN such as throughput and latency. Speeds of notebook computers and hand-held computing devices continue to increase. Many of these devices are able to provide interactive communications between users on a wired network but sacrifice portability when connected. Multimedia applications and services require broadband communications facilities not only for wired terminals but also for portable and personal communications devices. Wired local area network standards, i.e. IEEE 802.3ab 1000BASE-T, are able to transport high rate, multimedia applications. To maintain portability, future wireless LANs will need to transport higher data rates. Broadband RLANs are generally interpreted as those that can provide data throughput greater than 10 Mbit/s.

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2 Mobility

[Editor's note: Description of portable RLAN should be updated as it's more and more popular used today.]

Commented [E9]: IEEE 802: IEEE 802.11, in its contribution (#547) addressed this issue and proposes to delete this Editor Note. Portability is covered in the following paragraph.

IEEE 802 would like to add that the standard itself does not place restrictions on use cases that customers and users of the technology can enable using 802.11 technology. Deployed use cases include establishment of data communication networks at portability speeds.

Broadband RLANs may be either pseudo fixed as in the case of a desktop computer that may be transported from place to place or portable as in the case of a battery operated notebooks, tablets, smartphones and wearable deviceslaptop or palmtop devices working on batteries or cellular telephones with integrated wireless LAN connectivity. In some RLAN technologies, the rRelative velocity between these devices and an RLAN wireless access point remains low. In warehousing applications, RLANs may be used to maintain contact with lift trucks at speeds of up to 6 m/s. RLAN devices are generally not designed to be used at automotive or higher speeds.

[The latest WAS/RLAN technology is capable to support not only the fixed stations, but also portable, and even moving stations. It is very common to see the use of portable WAS/RLAN devices especially at the tourist hotspots.]*(#546)*

Commented [E10]: Proposed deletion in 546 (#546): IEEE: Portability is already covered in the above paragraph and there is no need to add this text.

[Editor's Note – the meeting discussed but did not agree to add the below or other use cases to this standards document revision.]

[Some RLAN RLAN technologies devices are also capable to operate in a mobile outdoor environment, possible use cases are:

- Vehicle Area Networks (Cranes, forklifts & top loaders, heavy farm & construction equipment, crew transport vehicles, utility trucks)
- Vehicle-to-Vehicle Mesh Networks
- Backhaul Networks and Data Offloads (Railcar/ locomotive data, vehicle telemetry data, public transport & police cars security DVR data, ambulance diagnostic data)]

Commented [E11]: IEEE 802: Following use-cases are from some 6GHz regulatory activity that is not adopted by any regulatory body. IEEE 802.11 propose to remove the Editor Note and the proposed bullet point additions to the section below.

3 Operational environment and considerations of interface

Broadband RLANs are predominantly deployed inside buildings, in offices, factories, warehouses, etc. For RLAN devices deployed inside buildings, emissions are attenuated by the structure. In order to better support the outdoor operations, WAS/RLAN has developed various features including longer Orthogonal Frequency Division Multiple (OFDM) symbol, preamble includes repeated Legacy Signal field (L-SIG), extended range preamble includes repeated High Efficiency Signal A field(HE-SIG-A), dual carrier modulation improves robustness in Data field. The use of WAS/RLAN operating in some frequencies in the outdoor environment shouldhall be carefully

Commented [E12]: IEEE 802: "Careful consideration of outdoor environment" or "studies" are clearly out of scope of this section and entire document. IEEE 802 propose removing the highlighted in the paragraph.

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considered. For example, Resolution **229 (Rev.WRC-19)** defines the use conditions for 5 GHz WAS/RLAN. [Implementing broadband RLAN standards in any frequency bands not studied by ITU-R are not allowed and shall not cause harmful interference to, and shall not claim protection from harmful interference caused by a station operating in accordance with the provisions of the Regulation.]

[Editor's Note – some administrations prefer to retain the above bracketed text as it pertains to the structure of the document and its annexes; other administrations note that the application of RLANs in bands allocated to the appropriate service do not require studies].

RLANs utilize low power levels because of the short distances inside buildings. Power spectral density requirements are based on the basic service area of a single RLAN. defined by a circle with a radius from 10 to 50 m. When larger networks are required, RLANS may be logically concatenated via bridge or router function to form larger networks without increasing their composite power spectral density.

One of the most useful RLAN features is the connection of mobile computer users to a wireless LAN network. In other words, a mobile user can be connected to his own LAN subnetwork anywhere within the RLAN service area. The service area may expand to other locations under different LAN subnetworks, enhancing the mobile user's convenience.

There are several remote access network techniques to enable the RLAN service area to extend to other RLANs under different subnetworks. International The Internet Engineering Task Force (IETF) has developed a number of the protocol standards on this subject.

To achieve the coverage areas specified above, it is assumed that RLANs require a peak power spectral density of e.g. approximately 10 mW/MHz in the 5 GHz operating frequency range (see Table 23). For data transmission, some standards use higher power spectral density for initialization and control the transmit power according to evaluation of the RF link quality. This technique is referred to as transmit power control (TPC). The required power spectral density is proportional to the square of the operating frequency. The large scale, average power spectral density will be substantially lower than the peak value. RLAN devices share the frequency spectrum on a time basis. Activity ratio Factor will vary depending on the usage, in terms of application and period of the day.

Broadband RLAN devices are normally deployed in high-density configurations and may use an etiquette such as listen before talk and dynamic channel selection (referred to here as dynamic frequency selection, DFS) or, TPC to facilitate spectrum sharing between devices.

4 System architecture including fixed applications

Broadband RLANs are often point-to-multipoint architecture. Point-to-multipoint applications commonly use omnidirectional, down-looking antennas. The multipoint architecture employs several system configurations:

– point-to-multipoint centralized system (multiple devices connecting to a central device or access point via a radio interface);

– point-to-multipoint non-centralized system (multiple devices communicating in a small area on an ad hoc basis);

– RLAN technology is sometimes used to implement fixed applications, which provide point-to-multipoint (P-MP) or point-to-point (P-P) links, e.g. between buildings in a campus environment. P-MP systems usually adopt cellular deployment using frequency reuse schemes similar to mobile applications. Technical examples of such schemes are

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given in Report ITU-R F.2086 (see § 6.6). Point-to-point systems commonly use directional antennas that allow greater distance between devices with a narrow lobe angle. This allows band sharing via channel and spatial reuse with a minimum of interference with other applications;

[Editor's Note – some administrations invite additional information on point-to-point systems.]

– RLAN technology is sometimes used for multipoint-to-multipoint (fixed and/or mobile mesh network topology, in which multiple nodes relay a message to its destination). Omnidirectional and/or directional antennas are used for links between the nodes of the mesh network. These links may use one or multiple RF channels. The mesh topology enhances the overall reliability of the network by enabling multiple redundant communications paths throughout the network. If one link fails for any reason (including the introduction of strong RF interference), the network automatically routes messages through alternate paths.

[Editor's Note – there was a proposal to delete references to fixed applications of RLAN in this section but that was not accepted.]

5 Interference mitigation techniques under frequency sharing environments

[Editor's note: Invite administrations to provide information on mitigation techniques to ensure coexistence under frequency sharing environments.]

RLANs are generally intended to operate in unlicensed or license-exempt spectrum and must allow adjacent uncoordinated networks to coexist whilst providing high service quality to users. In the 5 GHz bands, sharing with primary services must also be possible. Whilst multiple access techniques might allow a single frequency channel to be used by several nodes, support of many users with high service quality requires that enough channels are available to ensure access to the radio resource is not limited through queuing, etc. One technique that achieves a flexible sharing of the radio resource is DFS.

Dynamic frequency selection (DFS) is defined as an interference mitigation technique under frequency sharing environment, that dynamically detects presence of signals from other systems and avoids co-channel operation with these systems in particular radar systems. In DFS all radio resources are available at all RLAN nodes. A node (usually a controller node or access point (AP)) can temporarily allocate a channel and the selection of a suitable channel is performed based on interference detected or certain quality criteria, e.g. received signal strength, *C*/*I*. To obtain relevant quality criteria both the mobile terminals and the access point make measurements at regular intervals and report this to the entity making the selection.

In the 5 250-5 350 MHz and 5 470-5 725 MHz bands, DFS must be implemented to ensure compatible operation with systems in the co-primary services, i.e. the radiolocation service.

DFS can also be implemented to ensure that all available frequency channels are utilized with equal probability. This maximizes the availability of a channel to node when it is ready to transmit, and it also ensures that the RF energy is spread uniformly over all channels when integrated over a large number of users. The latter effect facilitates sharing with other services that may be sensitive to the aggregated interference in any particular channel, such as satellite-borne receivers.

TPC is intended to reduce unnecessary device power consumption, but also aids in spectrum reuse by reducing the interference range of RLAN nodes, improve the RF link quality and/or extend the battery life.

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Dynamic frequency selection (DFS) is defined as an interference mitigation technique under frequency sharing environment, which is based on avoiding a channel on which a predefined signal is detected. Transmit power control (TPC) is defined as a technique to control the transmit power to improve the RF link quality, to avoid interference into other devices and/or extend the battery life.]

Automated Frequency Coordination (AFC) is a geolocation aware spectrum use coordination system that uses databases of registered terrestrial incumbent services/links to determine frequency/channel availability and maximum permissible power level for RLAN Access Points based on their reported 3D locations. AFC System is intended to protect incumbent Fixed Services from harmful interference from RLAN license exempt operation. AFC Systems may be used to enforce exclusion zones around radio observatories for protection of Radio Astronomy Services. AFC System is used for Wi-Fi Standard Power mode at 6 GHz band.

Contention-Based Protocol (CBP) is a protocol that allows multiple wireless communication devices to use the same frequency/channel, without pre-coordination, by specifying the events that must occur when two or more transmitters attempt to simultaneously access the same channel and establishing rules by which various devices will have reasonable transmit opportunities to use the spectrum. Listen Before Talk protocol in IEEE 802.11 is one example of CBP.

Antenna Pointing Restriction is in form of a more stringent limit on maximum EiRP at angles above a specified elevation in degrees, relative to near horizon direction, for outdoor devices to protect satellite operations in the band.

Other restrictions such as indoor only, operation at lower transmit power, prohibition on RLAN operations on specific platforms such as oil platforms and abroad ships may be selectively required on specific frequency range and regions as other interference mitigation techniques.

Option 1

[ManySome administrations have authorized broadband RLANs across 5 925-7 125 MHz to respond to increased demand for low-cost wireless Internet connectivity. The decisions allowed RLANs to share this spectrum with incumbent services under rules that are carefully crafted to protect the licensed services and to enable both RLANs and incumbent licensed operations to thrive throughout the band. To protect licensed incumbents in the 6 GHz band, some administrations may require some of the following RLAN mitigation techniques: operating on a no protection, no harmful interference basis, requiring RLANs to implement contention-based protocol, limiting RLAN e.i.r.p., adopting exclusion zones around specific sites, restricting operation to indoor locations only, prohibiting access points on oil platforms and aboard ships, and allowing higher power RLAN access points to operate subject to an antenna pointing restriction and an Automatic Frequency Coordination (AFC) system.]

Option 2

[Many administrations have authorized broadband RLANs in the band 5 925-7 125 MHz (or portions thereof) to respond to increased demand for wireless connectivity. The authorizations are intended to allow RLANs to share this spectrum with incumbent services under rules that are crafted to protect the licensed services and to enable both unlicensed and incumbent licensed operations to continue to thrive throughout the band.

To protect the Fixed Satellite Service, one administration allowed fixed outdoor access points to operate at e.i.r.p. levels up to 36 dBm subject to an antenna pointing restriction and an Automatic Frequency Coordination (AFC) system, with limited RLAN e.i.r.p. in 6 875-7 125 MHz. To protect the radio astronomy service in 6 650-6 675.2 MHz, one administration adopted exclusion zones for certain RLAN access points in that band around specific radio astronomy sites. To protect

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Commented [E21]: IEEE 802: IEEE 802 proposes to remove all 4 options and different administrations add details such as utilizing any of the specified mitigation techniques and sub-bands or power levels, etc. to Table 2. With IEEE 802 proposed changes to Section 5, all such utilization of techniques can be easily covered in Table 2 with reference to Section 5 general/generic descriptions of techniques. IEEE 802 believes that this proposal preserve all the intended contents proposed by various administrations while maintaining the document organization.

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electronic news gathering (ENG) in the mobile service, one administration limited RLAN e.i.r.p. in 6 425-6 525 and restricted operation to indoor locations only. One administration also prohibited low power indoor and standard power access points on oil platforms and aboard ships to protect EESS. Some enterprise grade RLAN access points may have the capability of blocking off certain sub-bands to prevent interference to incumbent licensed operations, including nearby ENG receivers.]

Option 3

[Editor's Note – Option 3 is no new text akin to the above – some participants consider such text not to be useful but rather to expand the purpose and scope of this Section which currently is focused on equipment mitigation techniques. Table 2 has national regulatory mitigation techniques, like those described in Options 1 and 2. Other participants find the new text useful. Some participants prefer any new text to be added in Section 5 to be more general.]

Option 4

[Editor's Note – Option 4 is text that points to the use conditions in Table 2*: Additional information on interference mitigation techniques under frequency sharing environments in administrations that have allowed RLANs can be found in the column of other use conditions in Table 2.]*

6 General technical characteristics

[Editor's Note - A proposal was contributed to delete Section 6 and instead create a new Annex 3 with a new Table 2 to include RLANs identified in the Radio Regulations (and ISM in 2.4 GHz) and a new Table 3 to reflect additional national deployments. This proposal has not been agreed. Some administrations do not support deleting Section 6 and replacing it with a new Annex 3, stating that there is no agreed justification for this change and that the current structure and content in Section 6 support the purpose already. There is concern that initiation of a new Annex 3 will cause unnecessary confusion between Table 1, "Characteristics including technical parameters associated with broadband RLAN standards" and Table 2 "General technical requirements applicable in certain administrations and/or regions".]

[Editor's note: Some texts around Table 3 (based on WRC-12) should be updated based on the results of WRC-19.]

Table 3 summarizes technical characteristics applicable to operation of RLANs in certain frequency bands and in certain geographic areas. Operation in the 5 150-5 250 MHz, 5 250-5 350 MHz and 5 470-5 725 MHz frequency bands are in accordance with Resolution **229 (Rev.WRC-1~~2~~9)**.

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TABLE 23

General technical requirements applicable in certain administrations and/or regions

[Editor's Note: It has been proposed to add to the table the new column "Other use conditions", to replace the footnotes below the table]

General band designation	Administration or region	Specific frequency band (MHz)	Transmitter output power (mW) (except as noted)	Antenna gain (dBi)	Other use conditions
2.4 GHz band	USA	2 400-2 483.5	1 000	0-6 dBi(1) (Omni)	
	Canada	2 400-2 483.5	4 W e.i.r.p.(2)	N/A	
	EuropeCEPT	2 400-2 483.5	100 mW (e.i.r.p.)(3)	N/A	
	China	2 400-2 483.5	20 dBm (e.i.r.p. for integrated antenna gain < 10 dBi) 10 dBm/MHz (e.i.r.p. for Integrated antenna gain < 10 dBi) 27 dBm (e.i.r.p. for antenna gain >= 10 dBi) 17 dBm/MHz (e.i.r.p. for Integrated antenna gain >= 10 dBi)		Interference Avoidance mechanism is mandatory Additional out of band emission limit applies in order to protect the service in the adjacent band and in specific bands.
	Japan(4)	2 471-2 497 2 400-2 483.5	10 mW/MHz(4) 10 mW/MHz(4)	0-6 dBi (Omni) 0-6 dBi (Omni)	
	Republic of Korea	2 400-2 483.5	10 mW/MHz @ OBW 0.5-26 MHz 5 mW/MHz @ OBW 26-40 MHz 2.5 mW/MHz @ OBW 60-80 MHz	6 dBi max (21) 6 dBi max (21) 6 dBi max (21)	
	Brazil	2 400-2 483.5	1 000	0-6 dBi (Omni)	For antenna gains greater than 6 dBi, some reduction in output power is required.
5 GHz band(5), (6) (8)	USA	5 150-5 250(7) 5 250-5 350 5 470-5 725 5 725-5 850 5 850-5 895	50 2.5 mW/MHz 250 12.5 mW/MHz 250 12.5 mW/MHz 1 000 50.1 mW/MHz	0-6 dBi(1) (Omni) 0-6 dBi(1) (Omni) 0-6 dBi(1) (Omni) 0-6 dBi(8) (Omni)	
	Canada	5 150-5 250(7)	200 mW e.i.r.p. 10 dBm/MHz e.i.r.p.		

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General band designation	Administration or region	Specific frequency band (MHz)	Transmitter output power (mW) (except as noted)	Antenna gain (dBi)	Other use conditions
		5 250-5 350 5 470-5 725 5 725-5 850	250 12.5 mW/MHz (11 dBm/MHz) 1 000 mW e.i.r.p.[9] 250 12.5 mW/MHz (11 dBm/MHz) 1 000 mW e.i.r.p.[9] 1 000 50.1 mW/MHz[9]		
	CEPT[16]	5 150-5 250[7] 5 250-5 350[10] 5 470-5 725 5 945-6 425	200 mW (e.i.r.p.) 10 mW/MHz (e.i.r.p.) 200 mW (e.i.r.p.) 10 mW/MHz (e.i.r.p.) 1 000 mW (e.i.r.p.) 50 mW/MHz (e.i.r.p.) 200 mW (e.i.r.p.)[17] 25mW (e.i.r.p.)[18]	N/A	Operation in the 5 250-5 350 MHz band is limited to indoor use
5 GHz band[5], [6]	China	5 150-5 350	23 dBm (e.i.r.p.) 10 dBm/MHz (e.i.r.p.)		Indoor use only (use within vehicle is prohibited). 5 250-5 350 MHz, TPC and DFS are mandatory. Interference Avoidance mechanism is mandatory Additional out of band emission limit applies in order to protect the service in the adjacent band and in specific bands
		5 725-5 850	33 dBm (e.i.r.p.) 19 dBm/MHz (e.i.r.p)		Interference Avoidance mechanism is mandatory Additional out of band emission limit applies in order to protect the service in the adjacent band and in specific bands

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General band designation	Administration or region	Specific frequency band (MHz)	Transmitter output power (mW) (except as noted)	Antenna gain (dBi)	Other use conditions
	Japan[4]	4 900-5 000[11] 5 150-5 250[7] 5 250-5 350[10] 5 470-~~5 725~~5 730	250 mW 50 mW/MHz ~~10 mW/MHz~~1 W (e.i.r.p.) ~~10 mW/MHz~~200 mW (e.i.r.p.) ~~50 mW/MHz~~1 W (e.i.r.p.)	13 N/A N/A N/A	4 900-5 000 MHz is for fixed wireless access, registered. For 5 150-5 250 MHz, registration is required for RLAN access points with a maximum e.i.r.p. greater than 200 mW, and operations inside automobiles are allowed with a maximum e.i.r.p. of 40 mW. Operation in the 5 250-5 350 MHz band is limited to indoor use
	Republic of Korea	5 150-5 350 [22] & 5 470-5 850	10 mW/MHz @ OBW 0.5-20 MHz 5 mW/MHz @ OBW 20-40 MHz 2.5 mW/MHz @ OBW 40-80 MHz 1.25 mW/MHz @ OBW 80-160 MHz	7 dBi max [23] 7 dBi max [23] 7 dBi max [23] 7 dBi max [23]	
	Brazil	5 150-5 250 5 250-5 350 5 470-5 725 5.725-5.850	1 000 250 1 000 (e.i.r.p.) 1 000	6 6 N/A N/A	For 5 150-5 350, limited to indoor use only.
6 GHz band*	CEPT	5 945-6 425 MHz	Low Power Indoor(LPI)~~(13)~~ 23 dBm (e.i.r.p.) 10 dBm /MHz (e.i.r.p.) Very Low Power (VLP) ~~(14)~~ 14 dBm (e.i.r.p.) 1 dBm/MHz (e.i.r.p) ~~(15)~~	N/A	LPI equipment use is limited to indoor only use. No fixed outdoor use is allowed by VLP equipment. Narrowband VLP devices that operate in channels bandwidths below 20 MHz can operate at a higher e.i.r.p. density up to 10 dBm/MHz if they implement a frequency

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General band designation	Administration or region	Specific frequency band (MHz)	Transmitter output power (mW) (except as noted)	Antenna gain (dBi)	Other use conditions
					hopping mechanism based on at least 15 hop channels
	Republic of Korea	5 925-6 425 MHz [24] 5 925-7 125 MHz [25] 5 925-6 425 MHz [26]	14 dBm (e.i.r.p) & 1 dBm/MHz (VLP) 2 dBm/MHz (LPI) 2 dBm/MHz (only for subway train)	N/A	
	USA	5 925-7 125 MHz (20) 5 925-6 425 MHz 6 525-6 875 MHz	TBD Low Power Indoor (LPI): 30 dBm (max. e.i.r.p.); 5 dBm/MHz and Client Connected to Low Power Access Point (AP): 24 dBm (max e.i.r.p.); –1 dBm/MHz Standard Power (SP) AP (AFC Controlled): 36 dBm (max. e.i.r.p.); 23 dBm/MHz and Client Connected to SP AP: 30 dBm (max e.i.r.p); 17 dBm/MHz SP AP (AFC Controlled): 36 dBm (max. e.i.r.p.); 23 dBm/MHz and Client Connected to SP AP: 30 dBm (max. e.i.r.p.); 17 dBm/MHz	N/A	
	Brazil	5 925-7 125	Indoor access point and subordinate access point 30 dBm (e.i.r.p.) 5 dBm/MHz (e.i.r.p.) Client equipment under control of indoor access point 24 dBm (e.i.r.p.) –1 dBm/MHz (e.i.r.p.) Very Low Power 17 dBm (e.i.r.p.) –5 dBm/MHz (e.i.r.p.)	N/A	Indoor access point and subordinate access point must be directly connected to the power grid
	Japan	5 925-6 425	Low Power Indoor (LPI): 200 mW (e.i.r.p.) Very Low Power (VLP): 25 mW (e.i.r.p.)	N/A	LPI equipment use is limited to indoor only use.
57-66-71[60] GHz	Europe[19]	57-66-71 GHz (C1)	40 dBm (e.i.r.p.)[12] 13 dBm/MHz (e.i.r.p)	N/A	

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General band designation	Administration or region	Specific frequency band (MHz)	Transmitter output power (mW) (except as noted)	Antenna gain (dBi)	Other use conditions
		57-71 GHz (C2)	40 dBm (e.i.r.p.) 13 dBm/MHz (e.i.r.p)	Max conducted power 27 dBm	
	Brazil	57-71 GHz	40 dBm (e.i.r.p.) average 43 dBm (e.i.r.p.) peak 13 dBm/MHz (e.i.r.p.)	N/A	Point-to-area indoor and outdoor

[Editor's Note: Some of the Notes to Table 3 below have been moved to the new column "Other use conditions"]

Notes to Table 3

(1) In the United States of America, for RLANs operating in the 5 GHz band, for antenna gains greater than 6 dBi, some reduction in output power required. See sections 15.407 and 15.247 of the FCC's rules for details.

(2) Canada permits point-to-point systems in this band with e.i.r.p. > 4 W provided that the higher e.i.r.p. is achieved by employing higher gain antenna, but not higher transmitter output power.

(3) This requirement refers to ETSI EN 300 328.

(4) See Japan MIC ordinance for Regulating Radio Equipment, Articles 49-20, 49-20-2 and 49-21 for details.

(5) Resolution **229 (Rev.WRC-192)** establishes the conditions under which WAS, including RLANs, may use the 5 150-5 250 MHz, 5 250-5 350 MHz and 5 470-5 725 MHz.

(6) DFS rules apply in the 5 250-5 350 MHz and 5 470-5 725 MHz bands in regions and administrations and must be consulted.

(7) Pursuant to Resolution **229 (Rev.WRC-12)**, operation in the 5 150-5 250 MHz band is limited to indoor use. In Japan, registration is required for RLAN access points with a maximum e.i.r.p. greater than 200 mW, and operations inside automobiles are allowed with a maximum e.i.r.p. of 40 mW. [EDITOR'S NOTE: TO BE UPDATED PER WRC-19] [Editor's note: Texts for USA, Canada and Europe may be added] In the U.S., providers deploying more than 1,000 outdoor access points in the 5 150-5 250 MHz band must notify the FCC and ensure that the maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon shall not exceed 125 mW.

(8) In the United States of America, for RLANs operating in the 5 GHz band, for antenna gains greater than 6 dBi, some reduction in output power required, except for systems solely used for point-to-point. See sections 15.407 and 15.247 of the FCC's rules for details.

(9) See RSS-210, Annex 9 for the detailed rules on devices with maximum e.i.r.p. greater than 200 mW: http://strategis.ic.gc.ca/epic/site/smt-gst.nsf/en/sf01320e.html.

(10) In Europe and Japan, operation in the 5 250-5 350 MHz band is also limited to indoor use.

(11) For fixed wireless access, registered.

(12) This refers to the highest power level of the transmitter power control range during the transmission burst if transmitter power control is implemented. Fixed outdoor installations are not allowed.

(13) LPI equipment use is limited to indoor only use.

(14) No fixed outdoor use is allowed by VLP equipment.

(15) Narrowband VLP devices that operate in channels bandwidths below 20 MHz can operate at a higher e.i.r.p. density up to 10dBm/MHz if they implement a frequency hopping mechanism based on at least 15 hop channels.

(16) See ECC Decision (04)08 https://docdb.cept.org/download/3450 and ECC Decision (20)01 https://docdb.cept.org/download/1448.

(17) Limited to indoor usage.

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(18) No fixed outdoor usage.

(19) See ERC Recommendation 70-03 Annex 3 (Table 3) entries c1 and c2 https://docdb.cept.org/download/25c41779-cd6e/Rec7003e.pdf.

(20) The above technical requirements are as of October 2021 and are under review.

(21) In the Republic of Korea, for RLANs operating in the 2.4 GHz band, for antenna gains greater than 6 dBi, some reduction in output power required.

(22) In the Republic Korea, for the device using OBW 40 MHz in 5 230-5 250 MHz, power density is limited to 2.5mW/MHz or less.

(23) In the Republic of Korea, for RLANs operating in 5 150-5 350 MHz, 5 470-5 850 MHz, for antenna gains greater than 7 dBi, some reduction in output power required. And in this case OBW can use maximum 160 MHz, power density is limited to 1.25 mW/MHz or less.

(24) In the Republic of Korea, this band is not allowed for using in drone. And for device built in vehicle, only 6 085- 6 425 MHz band is allowed. And it is applicable for both indoor and outdoor usage.

(25) In the Republic of Korea, this band is only applicable for indoor usage. This band is not allowed for using in moving objects, such as vehicle, aircraft, railway, ship and drone.

(26) In the Republic of Korea, this band is only applicable for inside subway train.

(*) Pursuant to Resolution 229 (Rev.WRC-19) and subject to not causing interference to existing services.

(*) Some administrations have further RLAN use cases under review.

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[Editor's Note : The meeting discussed whether the specific deployment parameters below were more appropriately included in a sharing report than a standards document.]

[Typical RLAN characteristic and deployment (applied to population density) in 6 425-7 125 MHz

Parameter		Value (mW)	Value dBW	Percentage
VLP e.i.r.p. (mW)		25	–16	6.93
		12.5	–19	45.71
		3.25	–25	47.36
LPI e.i.r.p. (mW)		1000	0	5.00
		501	–3	9.19
		251	–6	3.77
		126	–9	13.14
		32	–15	39.01
		3	–26	5.00
		100	–10	1.23
		50	–13	11.63
		13	–19	12.07
Body loss for body-worn/handheld devices (dB) (only applies to VLP)		4		50
VLP/ LPI ratio		%		93/7
Indoor vs outdoor (VLP)	Indoor	N/A		95
	Outdoor			5
Indoor vs outdoor (LPI)	Indoor			98
	Outdoor			2
Market adoption factor [(1)]	High			95
	Medium			80
	Low			25
Busy Hour factor				62.5

Commented [E23]: IEEE 802: IEEE 802 believes that the characteristics and deployment parameters proposed here, as related to sharing and in general, do not belong to this recommendation as compatibility studies are not within the scope of this recommendation. IEEE 802 proposes to remove the table.

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Parameter	Value (mW)	Value dBW	Percentage
6 GHz factor [(2)]			48.17
Activity factor per person during non-busy hours			TBD
Activity factor per person during busy hours			TBD
Channel bandwidth distribution (MHz)	20		10
	40		10
	80		50
	160		30
[(1)] portion of population equipped by a WIFI 6 GHz terminal [(2)] probability that a terminal 6 GHz enabled (multiband terminal 6/5/2,4 GHz) use one channel in the band 6 GHz			

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[Editor's Note - As noted above, a proposal was contributed to create a new Annex 3 with a new Table [2][3] to include RLANs identified in the Radio Regulations (and ISM in 2.4 GHz) and a new Table [3][4] to reflect additional national deployments. As noted above some administrations do not support deleting Section 6 and Table 3 and replacing it with a new Annex 3, stating that there is no agreed justification for this change and that the current structure and content in Section 6 support the purpose already. There is concern that initiation of a new Annex 3 will cause unnecessary confusion.]

Commented [E24]: IEEE 802: IEEE 802 agrees with the administrations not supporting addition of the new Annex 3 and deleting Section 6 and Table 3.

[ANNEX 3 (#548)

Commented [SD25]: Document 548 (#548) proposes to insert ANNEX 3, and delete section 6 above)

Frequency ranges and use conditions for RLAN

Annex 3 summarizes the frequency ranges and technical characteristics applicable to operation of RLANs in the Radio Regulation in Table 3, and at regional and national level in Table 4.

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TABLE 3

Frequency ranges and use conditions for RLAN in Radio Regulation

General band designation	**Specific frequency band (MHz)**	**Footnote/Resolution in RR**	**Transmitter output power and power density**	**Other use conditions**
2.4 GHz band	2 300-2 450 2 450-2 483.5 2 483.5-2 500	Footnote **5.150** for R1, R2, R3	N/A	The bands are also designated for industrial, scientific and medical (ISM) applications. Radiocommunication services operating within these bands must accept harmful interference which may be caused by these applications. ISM equipment operating in these bands is subject to the provisions of No. **15.13**.
5 GHz band	5 150-5 250 5 250-5 350 5 470-5 725	Resolution **229 (Rev.WRC 19)**	in the frequency band 5 150-5 250 MHz, maximum mean e.i.r.p. 1 of 200 mW and a maximum mean e.i.r.p. density of 10 mW/MHz in any 1 MHz band or equivalently 0.25 mW/25 kHz in any 25 kHz band; in the frequency band 5 250-5 350 MHz, stations in the mobile service shall be limited to a maximum mean e.i.r.p. of 200 mW and a maximum mean e.i.r.p. density of 10 mW/MHz in any 1 MHz band; in the frequency band 5 470-5 725 MHz, stations in the mobile service shall be restricted to a maximum transmitter power of 250 mW3 with a maximum mean e.i.r.p. of 1 W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1 MHz band	in the frequency band 5 150-5 250 MHz, stations in the mobile service shall be restricted to indoor use, including inside trains, mobile stations inside automobiles shall operate with a maximum e.i.r.p. of 40 mW. For outdoor use in 5 150-5 250 MHz, *resolve* 3 of Res. **229 (Rev.WRC-19)** should be referred to. For higher power use in 5 250-5 350 MHz, e.i.r.p elevation angle mask should be complied, see *resolve* 5 of Res. **229 (Rev.WRC-19)** Mitigation measures DFS shall be used in frequency bands 5 250-5 350 MHz and 5 470-5 725 MHz More details can be found in Res. **229 (Rev.WRC-19)**
	5 725-5 830 5 830-5 850 5 850-5 925	Footnote **5.150** for R1, R2, R3	N/A	The bands are also designated for industrial, scientific and medical (ISM) applications. Radiocommunication services operating within these bands must accept harmful interference which may be caused by these applications. ISM equipment operating in these bands is subject to the provisions of No. **15.13**

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TABLE 43

Frequency ranges and use conditions for RLAN at regional and national level General technical requirements applicable in certain administrations and/or regions

[Editor's Note: It has been proposed to add to the table the new column "Other use conditions", to replace the footnotes below the table]

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General band designation	Administration or region	Specific frequency band (MHz)	Transmitter output power (mW) (except as noted)	Antenna gain (dBi)	Other use conditions
2.4 GHz band	USA	2 400-2 483.5	1 000	0-6 dBi(1) (Omni)	
	Canada	2 400-2 483.5	4 W e.i.r.p.(2)	N/A	
	EuropeCEPT	2 400-2 483.5	100 mW (e.i.r.p.)(3)	N/A	
	China	2 400-2 483.5	20 dBm (e.i.r.p. for integrated antenna gain < 10 dBi) 10 dBm/MHz (e.i.r.p. for Integrated antenna gain < 10 dBi) 27 dBm (e.i.r.p. for antenna gain >= 10 dBi) 17 dBm/MHz (e.i.r.p. for Integrated antenna gain >= 10 dBi)		Interference Avoidance mechanism is mandatory Additional out of band emission limit applies in order to protect the service in the adjacent band and in specific bands.
	Japan(4)	2 471-2 497 2 400-2 483.5	10 mW/MHz(4) 10 mW/MHz(4)	0-6 dBi (Omni) 0-6 dBi (Omni)	
	Republic of Korea	2 400-2 483.5	10 mW/MHz @ OBW 0.5-26 MHz 5 mW/MHz @ OBW 26-40 MHz 2.5 mW/MHz @ OBW 60-80 MHz	6 dBi max(21) 6 dBi max(21) 6 dBi max(21)	
5 GHz band(5), (6) (*)	USA	5 150-5 250(7) 5 250-5 350 5 470-5 725 5 725-5 850 5 850 – 5 895	50 2.5 mW/MHz 250 12.5 mW/MHz 250 12.5 mW/MHz 1 000 50.1 mW/MHz	0-6 dBi(1) (Omni) 0-6 dBi(1) (Omni) 0-6 dBi(1) (Omni) 0-6 dBi(8) (Omni)	
	Canada	5 150-5 250(7)	200 mW e.i.r.p.		

General band designation	Administration or region	Specific frequency band (MHz)	Transmitter output power (mW) (except as noted)	Antenna gain (dBi)	Other use conditions
		5 250-5 350 5 470-5 725 5 725-5 850	10 dBm/MHz e.i.r.p. 250 12.5 mW/MHz (11 dBm/MHz) 1 000 mW e.i.r.p.(9) 250 12.5 mW/MHz (11 dBm/MHz) 1 000 mW e.i.r.p.(9) 1 000 50.1 mW/MHz(9)		
	CEPT(16)	5 150-5 250(7) 5 250-5 350(10) 5 470-5 725 5 945-6 425	200 mW (e.i.r.p.) 10 mW/MHz (e.i.r.p.) 200 mW (e.i.r.p.) 10 mW/MHz (e.i.r.p.) 1 000 mW (e.i.r.p.) 50 mW/MHz (e.i.r.p.) 200 mW (e.i.r.p.)(17) 25mW (e.i.r.p.)(18)	N/A	Operation in the 5 250-5 350 MHz band is limited to indoor use
	China	5 150-5 350	23 dBm (e.i.r.p.) 10 dBm/MHz (e.i.r.p.)		Indoor use only (use within vehicle is prohibited). 5 250-5 350 MHz, TPC and DFS are mandatory. Interference Avoidance mechanism is mandatory Additional out of band emission limit applies in order to protect the service in the adjacent band and in specific bands
		5 725-5 850	33 dBm (e.i.r.p.) 19 dBm/MHz (e.i.r.p)		Interference Avoidance mechanism is mandatory Additional out of band emission limit applies in order to protect the service in the adjacent band and in specific bands

Commented [CHN26]: The information was included in the 6 GHz band column. Remove the redundant information here.

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General band designation	**Administration or region**	**Specific frequency band (MHz)**	**Transmitter output power (mW) (except as noted)**	**Antenna gain (dBi)**	**Other use conditions**
	Japan[4]	4 900-5 000[11] 5 150-5 250[7] 5 250-5 350[10] 5 470-~~5 725~~5 730	250 mW 50 mW/MHz ~~10 mW/MHz~~1 W (e.i.r.p.) ~~10 mW/MHz~~200 mW (e.i.r.p.) ~~50 mW/MHz~~1 W (e.i.r.p.)	13 N/A N/A N/A	4 900-5 000 MHz is for fixed wireless access, registered. Operation in the 5 250-5 350 MHz band is limited to indoor use
	Republic of Korea	5 150-5 350[22] & 5 470-5 850	10 mW/MHz @ OBW 0.5-20 MHz 5 mW/MHz @ OBW 20-40 MHz 2.5 mW/MHz @ OBW 40-80 MHz 1.25 mW/MHz @ OBW 80-160 MHz	7 dBi max[23] 7 dBi max[23] 7 dBi max[23] 7 dBi max[23]	
6 GHz band*	CEPT	5 945-6 425 MHz	Low Power Indoor(LPI)[13] 23 dBm (e.i.r.p.) 10 dBm /MHz (e.i.r.p.) Very Low Power (VLP)[14] 14 dBm (e.i.r.p.) 1 dBm/MHz (e.i.r.p)[15]	N/A	LPI equipment use is limited to indoor only use. No fixed outdoor use is allowed by VLP equipment. Narrowband VLP devices that operate in channels bandwidths below 20 MHz can operate at a higher e.i.r.p. density up to 10 dBm/MHz if they implement a frequency hopping mechanism based on at least 15 hop channels
	USA	5 925-7 125 MHz (20) 5 925-6 425 MHz 6 525-6 875 MHz	Low Power Indoor (LPI): 30 dBm (max. e.i.r.p.); 5 dBm/MHz and Client Connected to Low Power Access Point (AP): 24 dBm (max e.i.r.p.); -1 dBm/MHz Standard Power (SP) AP (AFC Controlled): 36 dBm (max. e.i.r.p.); 23 dBm/MHz and Client Connected to SP AP: 30 dBm (max e.i.r.p); 17 dBm/MHz SP AP (AFC Controlled): 36 dBm (max. e.i.r.p.); 23 dBm/MHz and	N/A	

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General band designation	Administration or region	Specific frequency band (MHz)	Transmitter output power (mW) (except as noted)	Antenna gain (dBi)	Other use conditions
			Client Connected to SP AP: 30 dBm (max. e.i.r.p.); 17 dBm/MHz		
	Republic of Korea	5 925- 6 425 MHz (24) 5 925-7 125 MHz (25) 5 925- 6 425 MHz (26)	14 dBm (e.i.r.p) & 1 dBm/MHz (VLP) 2 dBm/MHz (LPI) 2 dBm/MHz (only for subway train)	N/A	
57-66 71 GHz 60 GHz band	CEPT (19)	57-66 71 GHz (C1) 57-71 GHz (C2)	40 dBm (e.i.r.p.)(12) 13 dBm/MHz (e.i.r.p) 40 dBm (e.i.r.p.) 13 dBm/MHz (e.i.r.p)	N/A Max conducted power 27 dBm	

Obtaining additional information on RLAN at regional/national level:

Canada: RSS-210, Annex 9, http://strategis.ic.gc.ca/epic/site/smt-gst.nsf/en/sf01320e.html.

CEPT: ECC Decision (04)08 https://docdb.cept.org/download/3450 and ECC Decision (20)01 https://docdb.cept.org/download/1448. And ERC Recommendation 70-03 Annex 3 (Table 3) entries c1 and c2 https://docdb.cept.org/download/25c41779-cd6e/Rec7003e.pdf.

Japan: Japan MIC ordinance for Regulating Radio Equipment, Articles 49-20, 49-20-2 and 49-21

United States of America: See sections 15.407 and 15.247 of the FCC's rule

[Editor's Note: Some of the Notes to Table 3 below have been moved to the new column "Other use conditions"]

Notes to Table 4

(1) In the United States of America, for RLANs operating in the 5 GHz band, for antenna gains greater than 6 dBi, some reduction in output power required. See sections 15.407 and 15.247 of the FCC's rules for details.

(2) Canada permits point-to-point systems in this band with e.i.r.p. > 4 W provided that the higher e.i.r.p. is achieved by employing higher gain antenna, but not higher transmitter output power.

(3) This requirement refers to ETSI EN 300 328.

(4) See Japan MIC ordinance for Regulating Radio Equipment, Articles 49-20, 49-20-2 and 49-21 for details.

(5) Resolution **229 (Rev.WRC-192)** establishes the conditions under which WAS, including RLANs, may use the 5 150-5 250 MHz, 5 250-5 350 MHz and 5 470-5 725 MHz.

(6) DFS rules apply in the 5 250-5 350 MHz and 5 470-5 725 MHz bands in regions and administrations and must be consulted.

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(7) Pursuant to Resolution 229 (Rev.WRC-12), operation in the 5 150-5 250 MHz band is limited to indoor use. In Japan, registration is required for RLAN access points with maximum e.i.r.p. greater than 200 mW. [EDITOR's NOTE: TO BE UPDATED PER WRC-19] [Editor's note: Texts for USA, Canada and Europe may be added] In the U.S., providers deploying more than 1,000 outdoor access points in the 5 150-5 250 MHz band must notify the FCC and ensure that the maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon shall not exceed 125 mW.

(8) In the United States of America, for antenna gains greater than 6 dBi, some reduction in output power required, except for systems solely used for point-to-point. See sections 15.407 and 15.247 of the FCC's rules for details.

(9) See RSS-210, Annex 9 for the detailed rules on devices with maximum e.i.r.p. greater than 200 mW: http://strategis.ic.gc.ca/epic/site/smt-gst.nsf/en/sf01320e.html.

(10) In Europe and Japan, operation in the 5 250-5 350 MHz band is also limited to indoor use.

(11) For fixed wireless access, registered.

(12) This refers to the highest power level of the transmitter power control range during the transmission burst if transmitter power control is implemented. Fixed outdoor installations are not allowed.

(13) LPI equipment use is limited to indoor only use.

(14) No fixed outdoor use is allowed by VLP equipment.

(15) Narrowband VLP devices that operate in channels bandwidths below 20 MHz can operate at a higher e.i.r.p. density up to 10dBm/MHz if they implement a frequency hopping mechanism based on at least 15 hop channels.

(16) See ECC Decision (04)08 https://docdb.cept.org/download/3450 and ECC Decision (20)01 https://docdb.cept.org/download/1448.

(17) Limited to indoor usage.

(18) No fixed outdoor usage.

(19) See ERC Recommendation 70-03 Annex 3 (Table 3) entries c1 and c2 https://docdb.cept.org/download/25c41779-cd6e/Rec7003e.pdf.

(20) The above technical requirements are as of October 2021 and are under review.

(21) In the Republic of Korea, for RLANs operating in the 2.4 GHz band, for antenna gains greater than 6 dBi, some reduction in output power required.

(22) In the Republic of Korea, for the device using OBW 40 MHz in 5 230-5 250 MHz, power density is limited to 2.5 mW/MHz or less.

(23) In the Republic of Korea, for RLANs operating in 5 150-5 350 MHz, 5 470-5 850 MHz, for antenna gains greater than 7 dBi, some reduction in output power required. And in this case OBW can use maximum 160 MHz, power density is limited to 1.25 mW/MHz or less.

(24) In the Republic of Korea, this band is not allowed for using in drone. And for device built in vehicle, only 6 085- 6 425 MHz band is allowed. And it is applicable for both indoor and outdoor usage.

(25) In the Republic of Korea, this band is only applicable for indoor usage. This band is not allowed for using in moving objects, such as vehicle, aircraft, railway, ship, drone, etc.

(26) In the Republic of Korea, this band is only applicable for inside subway train.

(*) Pursuant to Resolution **229 (Rev.WRC-19)** and subject to not causing interference to existing services.

(*) Some administrations have further RLAN use cases under review.]

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Commented [CHN28]: Remove note 17 and 18 as the content is included in the last column of table 4.