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SPECTRUM ASPECTS AND
WRC-23 PREPARATIONS

ITU-APT Foundation of India (IAFI)

PROPOSAL FOR A NEW/ADDITIONAL RECOMMENDATION IN MM WAVE BANDS TO COMPLEMENT RECOMMENDATION ITU-R M.1036-6

Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the Frequency bands above 10 GHz bands identified for IMT in the Radio Regulations

Introduction

World Radio Conference in 2019 (WRC-19), ITU-R identified additional spectrum for operation of the terrestrial component of IMT in the following frequency bands -

24.25 – 27.5 GHz

37 – 43.5 GHz

45.5 – 47 GHz

47.2 – 48.2 GHz

66 – 71 GHz

Discussion

Globally harmonized spectrum and harmonized frequency arrangements for IMT are desirable to reduce the overall cost of IMT networks and terminals by providing economies of scale and facilitating deployment and cross-border coordination. With identification of spectrum bands as mentioned above for IMT by many administrations, harmonized frequency plans in the current Recommendation ITU-R M.1036-6 for these bands will be very helpful for administrations to carry out spectrum planning. Recommendation ITU R M.1036 provides various alternatives for deployments in various frequency bands depending on local/regional conditions in order to provide flexibility for different conditions. Access to more harmonized spectrum is expected to have a significant impact on the cost of providing mobile broadband with high-capacity bandwidth which will not only have economic benefits such as jobs and growth, but it could also enhance connectivity for social benefits like e-Health, M-Governance and education services. It is therefore essential that Recommendation ITU R M.1036-6 be updated with frequency arrangements for spectrum bands identified at WRC-19 for implementation of IMT.

It was agreed at the 34th meeting of WP 5D in February 2020 to limit the changes in Recommendation ITU-R M.1036-6 to only adding the frequency arrangements for the bands identified at WRC-19 for implementation of IMT. It was further agreed to implement purely the consequential updates to align the text with the decisions adopted at WRC-19 in Article 5 of the RR and related Resolutions, as well as reflecting Recommendation ITU-R M. [IMT-2020.SPECS]. However, when reviewing the working document, concerns were expressed during the 35th and 37th meetings about the revision and therefore agreement could not be reached on these concerns and therefore, the draft revision was not agreed

IAFI submitted its proposal to WP 5D#37 (input contributions [5D/472](#)) and had proposed that in case an agreement on revision of draft working document on revision of ITU-R M.1036 can't be reached at WP 5D#37 meeting, then a separate recommendation on the new mm wave bands approved at the WRC-19 be developed, while leaving the existing Recommendation [ITU-R M.1036-6](#) as it was, except for any editorial changes.

Proposal

It is noted that there has not been much progress on this important Recommendation in the last three meetings of WP 5D. It is also noted that there are many divergent views on the modifications, even on the text which has been there in M.1036 for many years. During the discussions it was also noted that many arguments are getting repeated, and the convergence of views seems difficult, particular in this virtual format of meetings.

Further it is also noted that the frequency arrangements in the mm wave bands are only TDD while in bands below 10 GHz, there are both FDD and TDD options.

In view of the it is proposed that WP5D should consider developing a separate/additional recommendation on the new mm wave bands approved at the WRC-19, while leaving the existing Recommendation ITU-R M.1036-6 as it was, except for any editorial changes as another option to progress this work.

A draft of the proposed working document towards a preliminary draft new recommendation for Frequency bands above 10 GHz, based on the format of M.1036 and content from the working document of the last WP 5D meeting, is enclosed for consideration and further development.

Attachment: 1

ATTACHEMENT

WORKING DOCUMENTS TOWARDS A PRELIMINARY DRAFT NEW RECOMMENDATION ITU-R [M.MM-WAVE-ARRANGEMENTS]

Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the Frequency bands above 10 GHz bands identified for IMT in the Radio Regulations

(Question ITU-R 229-2/5)

Scope

This Recommendation provides guidance on the selection of transmitting and receiving frequency arrangements for the terrestrial component of IMT¹ systems for the mm wave bands identified at WRC-19 for the implementation of the terrestrial component of IMT systems as well as the arrangements themselves, with a view to assisting administrations on spectrum-related technical issues relevant to the implementation and use of the terrestrial component of IMT in the bands identified in the Radio Regulations (RR)².

The frequency arrangements are recommended from the point of view of enabling the most effective and efficient use of the spectrum to deliver IMT services – while minimizing the impact on other systems or services in these bands – and facilitating the growth of IMT systems.

This recommendation is complementary to Recommendation ITU-R M.1036 which provides Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications in bands below 10 GHz.

This Recommendation is complemented by other ITU-R Recommendations and Reports on IMT that provide additional details on a number of aspects including unwanted emission characteristics for the bands addressed in this Recommendation and radio interface specifications.

Keywords

IMT, frequency arrangements, terrestrial component of IMT

The ITU Radiocommunication Assembly,

considering

- a)* that the ITU is the internationally recognized organization that has sole responsibility, in conformity with the ITU Constitution, Convention, and the Radio Regulations, to define and to recommend the standards and globally harmonized frequency arrangements for IMT systems, with the collaboration of other relevant organizations;
- b)* that globally harmonized spectrum and globally harmonized frequency arrangements for IMT are desirable to reduce the overall cost of IMT networks and terminals by providing economies of scale, facilitating deployment and cross-border coordination;

¹ International Mobile Telecommunications (IMT) encompasses IMT-2000, IMT-Advanced and IMT-2020, as specified in Resolution ITU-R 56-2.

² See also Attachment 1 to the Annex.

- c) that the use of the bands identified for IMT may not be harmonized globally due to different uses by other services in some countries;
- d) that a common base and/or mobile transmit band would facilitate the development of terminal equipment for global roaming. A common base transmit band, in particular, provides the possibility to broadcast to roaming users all information necessary to establish a call;
- e) that guardbands for IMT systems should be minimized to avoid wasting spectrum taking into account the coexistence with other services and applications;
- f) that individual subscriber traffic and capacity dimensioning in IMT systems is expected to be dynamically asymmetric where the direction of asymmetry can vary rapidly within short (msec) time-frames, while IMT network traffic may vary in asymmetry over the longer term (see Annex);
- g) that a number of ITU-R Reports are available that can assist in determining means to facilitate coexistence and compatibility between systems in other services and the terrestrial components of IMT as shown in Attachment 3 to the Annex;
- h) that the capabilities of IMT systems are being continuously enhanced in line with user needs and technology trends,

considering further

- a) that the IMT-2000 radio interfaces are detailed in Recommendation ITU-R M.1457 and currently include two modes of operation – frequency division duplex (FDD) and time division duplex (TDD);
- b) that the IMT-Advanced radio interfaces are detailed in Recommendation ITU-R M.2012 and include both FDD and TDD modes;
- c) that the IMT-2020 radio interfaces are detailed in Recommendation ITU-R M.2150 and include both FDD and TDD modes;
- d) that IMT technologies could support various applications (e.g. PPDR, MTC/IoT/M2M, ITS). Specific frequency arrangements for those applications may be addressed in other Reports and or Recommendations,

noting

- a) that Attachments 2 and 3 to the Annex provide information on specific vocabulary and terms utilized in this Recommendation and a listing of related Recommendations and Reports;
- b) that consideration should be taken by neighbouring countries that are implementing different services (e.g. IMT system and other services/applications), considering technical and operational measures to facilitate coexistence in such cases.

recognizing

- a) that No. 92 of the ITU Constitution stipulates that “The decisions of a World Radiocommunication Conference, of a Radiocommunication Assembly and of a Regional Radiocommunication Conference shall in all circumstances be in conformity with this Constitution and the Convention. The decisions of a Radiocommunication Assembly or of a Regional Radiocommunication Conference shall also in all circumstances be in conformity with the Radio Regulations”;
- b) that frequency allocation and associated footnotes in force are contained in Article 5 of the RR. See also Attachment 1 to the Annex;

c) that key features of IMT-2000, IMT-Advanced and IMT-2020 are contained in Recommendations ITU-R M.1645, ITU-R M.1822 and ITU-R M.2083;

d) that Resolution **242 (WRC-19)**, amongst other things, in its *encourages administrations 4*, indicates that for the future development of EESS (passive) in the frequency band 23.6-24 GHz, administrations should consider additional mitigation techniques (e.g. guardbands) beyond the limits specified in Resolution **750 (Rev.WRC-19)**, as appropriate.

recommends

that the frequency arrangements and implementations aspects contained in the Annex should be considered for the deployment of IMT in the frequency bands above 10 GHz that are identified for IMT in the Radio Regulations.

Annex

Implementation aspects and frequency arrangements applicable for IMT

SECTION 1

Implementation aspects applicable to the frequency arrangements

The order of the frequency arrangements within each Section does not imply any priority. Administrations may implement any of the recommended frequency arrangements to suit their national conditions taking into account the relevant provisions of the RR. Administrations may implement all or part of each frequency arrangement.

It is noted that Administrations may implement other frequency arrangements to fulfil their requirements. These administrations should consider geographical neighbouring and regional deployments as well as matters related to achieving economies of scale, facilitating roaming, and measures to minimize interference.

Sections 1 to 6 to the Annex are parts of this Recommendation, and they should be considered in their entirety when implementing frequency arrangements as appropriate.

Traffic asymmetry implications

It is recommended that administrations and operators consider asymmetric traffic requirements when assigning spectrum or implementing systems. Applications supported by IMT may have various degrees of asymmetry. Report ITU-R M.2072 describes not only download dominant applications such as e-newspaper, but also upload dominant applications such as observation (network-camera) and upload file transfer. Also, the degree of asymmetry of other applications such as high-quality video telephony, mobile multicasting, and videoconference depends on their requirements.

In this context, asymmetry means that the basic amount of traffic may differ between the uplink and the downlink direction. As a possible consequence, the amount of resources needed for the downlink may differ from that of the uplink. Estimates for a mix of traffic are described in Report ITU-R M.2023, Report ITU-R M.2078 and Recommendation ITU-R M.1822. Suitable techniques to support asymmetric traffic are described in Report ITU-R M.2038.

It is noted that traffic asymmetry can be accommodated by a variety of techniques including flexible timeslot allocation, different modulation formats, and different coding schemes for the uplink and downlink. With equal FDD pairing for uplink and downlink, downlink-only paired with an external FDD uplink, or TDD, varying degrees of traffic asymmetry can be accommodated.

Segmentation of the spectrum

It is recommended that the frequency arrangements not be segmented for different IMT radio interfaces or services except where necessary for technical and regulatory reasons.

Unwanted emission and compatibility with other services

Frequency aspects and unwanted emission parameters are contained in Resolutions **243 (WRC-19)**, **750 (Rev.WRC-19)**, Recommendations ITU-R M.1580, ITU-R M.1581, ITU-R M.2070 and ITU-R M.2071.

Limits on the maximum unwanted emission characteristics according to the relevant WRC Resolutions or ITU-R Recommendations are necessary to protect other radio systems including those in adjacent bands and to help establish the coexistence between different technologies for the bands addressed in this Recommendation.

SECTION 2

Frequency arrangements in the band 24.25-27.5 GHz

The recommended frequency arrangements for implementation of IMT in the band 24.25-27.5 GHz are summarized in Table 1 and in Fig. 1, noting the implementation aspects in Section 1 above.

TABLE 1
Frequency arrangements in the 24.25-27.5 GHz frequency range

Frequency arrangements	Un-paired arrangements (TDD) (GHz)
I1	24.25-27.5

Notes to Table 1:

Note 1: FDD is not envisaged for this band/Administrations should use this band solely for TDD.

Note 2: Bandwidth of channel assigned to the IMT station with active antenna system in the frequency band 24.35-27.5 GHz should be preferably more than 200 MHz.

Note 3: Limits of unwanted emission power in 24.25-27.5 GHz band are as follows -

- a) -33 dBW in any 200 MHz of the EESS (passive) band for IMT base stations. A limit of -39 dB(W/200 MHz) will apply to IMT base stations brought into use after 1 September 2027. This limit will not apply to IMT base stations which have been brought into use prior to this date. For those IMT base stations, the limit of -33 dB(W/200 MHz) will continue to apply after this date.
- b) -29 dBW in any 200 MHz of the EESS (passive) band for IMT mobile stations. A limit of -35 dB(W/200 MHz) will apply to IMT mobile stations brought into use after 1 September 2027. This limit will not apply to IMT mobile stations which have been brought into use prior to this date. For those IMT mobile stations, the limit of -29 dB(W/200 MHz) will continue to apply after this date.

FIGURE 1
Frequency arrangement I1

GHz	24.25	27.5
I1		
	TDD	
	24.25	27.5

SECTION 3

Frequency arrangements in the band 37-43.5 GHz

The recommended frequency arrangements for implementation of IMT in the band 37-43.5 GHz are summarized in Table 2 and in Fig. 2, noting the implementation aspects in Section 1 above.

TABLE 2
Frequency arrangements in the 37-43.5 GHz frequency range

Frequency arrangements	Un-paired arrangements (TDD) (GHz)
J1	37-43.5

Notes to Table 2:

Note 1: FDD is not envisaged for this band/Administrations should use this band solely for TDD.

Note 2: Bandwidth of channel assigned to the IMT station with active antenna system in the frequency band 37-43.5 GHz should be preferably more than 200 MHz.

FIGURE 2
Frequency arrangement J1

GHz	37	43.5
J1		
	TDD	
	37	43.5

SECTION 4

Frequency arrangements in the band 45.5-47 GHz

The recommended frequency arrangements for implementation of IMT in the band 45.5-47 GHz are summarized in Table 3 and in Fig. 3, noting the implementation aspects in Section 1 above.

TABLE 3
Frequency arrangements in the 45.5-47 GHz frequency range

Frequency arrangements	Un-paired arrangements (TDD) (GHz)
K1	45.5-47

Notes to Table 3:

Note 1: FDD is not envisaged for this band/Administrations should use this band solely for TDD.

Note 2: Bandwidth of channel assigned to the IMT station with active antenna system in the frequency band 45.5-47 GHz should be preferably more than 200 MHz.

FIGURE 3
Frequency arrangement K1

GHz	45.5	47
K1	TDD	
	45.5	47

SECTION 5

Frequency arrangements in the band 47.2-48.2 GHz

The recommended frequency arrangements for implementation of IMT in the band 47.2-48.2 GHz are summarized in Table 4 and in Fig. 4, noting the implementation aspects in Section 1 above.

TABLE 4
Frequency arrangements in the 47.2-48.2 GHz frequency range

Frequency arrangements	Un-paired arrangements (TDD) (GHz)
L1	47.2-48.2

Notes to Table 12:

Note 1: FDD is not envisaged for this band/Administrations should use this band solely for TDD.

Note 2: Bandwidth of channel assigned to the IMT station with active antenna system in the frequency band 47.2-48.2 GHz should be preferably more than 200 MHz.

FIGURE 4
Frequency arrangement L1

GHz	47.2	48.2
L1		
	TDD	
	47.2	48.2

SECTION 6

Frequency arrangements in the band 66-71 GHz

The recommended frequency arrangements for implementation of IMT in the band 66-71 GHz are summarized in Table 5 and in Fig. 5, noting the implementation aspects in Section 1 above.

TABLE 5
Frequency arrangements in the 66-71 GHz frequency range

Frequency arrangements	Un-paired arrangements (TDD) (GHz)
M1	66-71

Notes to Table 5:

Note 1: FDD is not envisaged for this band/Administrations should use this band solely for TDD.

Note 2: Bandwidth of channel assigned to the IMT station with active antenna system in the frequency band 66-71 GHz should be preferably more than 200 MHz.

FIGURE 5
Frequency arrangement M1

GHz	66	71
M1		
	TDD	
	66	71

Attachment 1¹ to Annex

Frequency bands and associated footnotes identifying the frequency bands above 10 GHz for IMT in Table 6 below are extracted from the edition 2020 of the RR, Article 5 for ease of reference.

- 1 Also, administrations may deploy IMT systems in bands allocated to the mobile service other than those identified in the RR, and administrations may deploy IMT systems only in some or parts of the bands identified for IMT in the RR.
- 2 However, it is emphasized that the use of IMT in any band allocated to the mobile service on a primary basis but not identified for IMT should also comply with the objectives of the relevant technical and regulatory provisions of the RR, as well as with the latest version of applicable ITU-R Recommendation(s).

TABLE 6

Band	Footnotes identifying the band for IMT		
	Region 1	Region 2	Region 3
24.25-27.5 GHz	5.532AB		
37-43.5 GHz	5.550B		
45.5-47 GHz	5.553A	5.553A	5.553A
47.2-48.2 GHz	5.553B	5.553B	5.553B
66-71 GHz	5.559AA		

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¹ See also Summary Report of the 6th Plenary Meeting of the Radiocommunication Assembly 2019 (Friday, 25 October 2019).

Attachment 2

Vocabulary of terms

Centre gap – The frequency separation between the upper edge of the lower band and the lower edge of the upper band in an FDD paired frequency arrangement.

Duplex band frequency separation – The frequency separation between a reference point in the lower band and the corresponding point in the upper band of an FDD arrangement.

Duplex channel frequency separation – The frequency separation between a specific channel carrier in the lower band and its paired channel carrier in the upper band of an FDD arrangement.

Conventional duplex arrangement – Duplex arrangement with mobile terminal transmit within the lower band and base station transmit within the upper band.

Reverse duplex arrangement – Duplex arrangement with the mobile terminal transmit within the upper band and base station transmit within the lower band.

Acronyms and abbreviations

DL	Downlink
FDD	Frequency division duplex
IMT	International Mobile Telecommunications
TDD	Time division duplex

Attachment 3

Related Recommendations and Reports

- Recommendation [ITU-R M.687](#): International Mobile Telecommunications-2000 (IMT-2000)
- Recommendation [ITU-R M.816](#): Framework for services supported on International Mobile Telecommunications-2000 (IMT-2000)
- Recommendation [ITU-R M.818](#): Satellite operation within International Mobile Telecommunications-2000 (IMT-2000)
- Recommendation [ITU-R M.819](#): International Mobile Telecommunications-2000 (IMT-2000) for developing countries
- Recommendation [ITU-R M.1033](#): Technical and operational characteristics of cordless telephones and cordless telecommunication systems
- Recommendation [ITU-R M.1034](#): Requirements for the radio interface(s) for International Mobile Telecommunications-2000 (IMT-2000)
- Recommendation [ITU-R M.1035](#): Framework for the radio interface(s) and radio sub-system functionality for International Mobile Telecommunications-2000 (IMT-2000)
- Recommendation [ITU-R M.1036](#): Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications in the bands identified for IMT in the Radio Regulations
- Recommendation [ITU-R M.1073](#): Digital cellular land mobile telecommunication systems
- Recommendation [ITU-R M.1167](#): Framework for the satellite component of International Mobile Telecommunications-2000 (IMT-2000)
- Recommendation [ITU-R M.1224](#): Vocabulary of terms for International Mobile Telecommunications (IMT)
- Recommendation [ITU-R M.1308](#): Evolution of land mobile systems towards IMT-2000
- Recommendation [ITU-R M.1390](#): Methodology for the calculation of IMT-2000 terrestrial spectrum requirements
- Recommendation [ITU-R M.1457](#): Detailed specifications of the radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)
- Recommendation [ITU-R M.1579](#): Global circulation of IMT terrestrial terminals
- Recommendation [ITU-R M.1580](#): Generic unwanted emission characteristics of base stations using the terrestrial radio interfaces of IMT-2000
- Recommendation [ITU-R M.1581](#): Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-2000
- Recommendation [ITU-R M.1645](#): Framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000
- Recommendation [ITU-R M.1768](#): Methodology for calculation of spectrum requirements for the terrestrial component of International Mobile Telecommunications
- Recommendation [ITU-R M.1797](#): Vocabulary of terms for the land mobile service
- Recommendation [ITU-R M.1822](#): Framework for services supported by IMT

- Recommendation [ITU-R M.2012](#): Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications Advanced (IMT-Advanced)
- Recommendation [ITU-R M.2015](#): Frequency arrangements for public protection and disaster relief radiocommunication systems in accordance with Resolution **646 (Rev.WRC-15)**
- Recommendation [ITU-R M.2070](#): Generic unwanted emission characteristics of base stations using the terrestrial radio interfaces of IMT-Advanced
- Recommendation [ITU-R M.2071](#): Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-Advanced
- Recommendation [ITU-R M.2083](#): IMT Vision – “Framework and overall objectives of the future development of IMT for 2020 and beyond”
- Recommendation [ITU-R M.2150](#): Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2020 (IMT-2020)
- Recommendation [ITU-R SM.329](#): Unwanted emissions in the spurious domain
- Report [ITU-R M.2038](#): Technology trends
- Report [ITU-R M.2072](#): World mobile telecommunication market forecast
- Report [ITU-R M.2078](#): Estimated spectrum bandwidth requirements for the future development of IMT-2000 and IMT-Advanced
- Report [ITU-R M.2320](#): Future technology trends of terrestrial IMT systems
- Report [ITU-R M.2375](#): Architecture and topology of IMT networks
-