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| **Radiocommunication Study Groups** |  |
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| Annex 20 to Working Party 5A Chairman’s Report | |
| WORKING DOCUMENT TOWARDS DRAFT NEW REVISION OF RECOMMENDATION ITU-R F.1401-1[[1]](#footnote-1)\* | |
| Considerations for the identification of possible frequency bands for fixed wireless access and related sharing studies | |

(Question ITU-R 215/5)

(1999-2004-202X)

*{Editor’s note: An Administration expressed a serious objection at the November 2022 meeting to include the mobile service in this document.}*

Scope

This Recommendation provides a methodology for identification of suitable frequency spectrum for fixed wireless access (FWA) systems and a list of items to be addressed in identifying candidate bands. These take into account the results of ITU-R studies on compatible operations with systems in other radio services sharing the same bands, characteristics and operational requirements, spectrum requirements, and interference mitigation technologies. Bands identified using the methodology mentioned in § 5.1 could support traditional telephony wireless access applications or new and emerging FWA, including broadband and International Mobile Telecommunications (IMT) technologies.

The scope of this Recommendation covers only FWA systems. These fixed applications can operate in both the FS and MS allocations, however FWA stations are Fixed and therefore should be consistent with the definition of the fixed service in the Radio Regulations (RRs).

*{Editor’s note: After reviewing the document, the scope may need to be revised and adjusted, if necessary, and consider to include that this Recommendation would also address the potential use of IMT technology in the FWA.}*

{Editor’s note: Format of this Recommendation may need to be reviewed and revised.}

# 1 Introduction

## 1.1 Purpose

The objective of this Recommendation is to provide guidance for the identification of suitable frequency spectrum for terrestrial fixed wireless access (FWA) applications, taking due account of sharing issues. [Traditional wireless telephony applications as well as] emerging FWA applications, which include broadband IMT technologies, are considered.

The potential for FWA to enhance availability of telecommunications services in both developing and developed countries is important.

## 1.2 Background

Wireless access has been defined (see Recommendation ITU-R F.1399 as “end-user radio connection(s) to core networks”, where core networks include, for example, PSTN, ISDN, PLMN, PSDN, Internet, WAN/LAN, CATV, etc. Wireless access applications can be provided within the definitions of the radio services FS, MS, FSS and MSS contained in the Radio Regulations (RR) (see § 4 for list of acronyms). FWA is an example of thesewireless access applications in which the location of the end-user termination and the network access point to be connected to the end‑user are fixed.

Technologies in use today for implementing wireless access include cellular systems, cordless phone and cordless telecommunication systems, satellite systems, and specialized point-to-point (P‑P) and point-to-multipoint (P-MP) fixed wireless systems, wireless broadband ISDN, and wireless ATM, etc. New technologies such as IMT, RLAN and WiGig , also form part of wireless access if their application satisfies the basic criteria of end-user radio connection(s) to core networks (see § 4 for list of acronyms) and requirements contained in the Radio Regulations and corresponding information in ITU-R Recommendations.

## 1.3 Traditional telephony wireless access applications

Advances in technology and competitive access are driving the revolution towards wireless access infrastructure for the provision of basic telephone service. Traditionally the most difficult component of the network to build and the least cost-effective to maintain has proven to be the LAN, regardless of a developing or a developed economy. The sheer scope of investment and engineering efforts required to build and maintain copper-based networks has made high penetration rates for basic telephone service available only to industrialized nations of the world. Even the relatively low target subscriber density (teledensity) rate of 20 lines per 100 population set by the ITU, has been far beyond the capability of many nations until recently.

Wireless access is an application of radio technology and personal communication systems experiencing tremendous growth, especially in developing economies.

Generally, a wide range of radio system designs could be used for FWA and the suitability is a function of a number of factors. The most suitable system for a particular application will tend in general to depend on the requirements of the end-user, the cost of deployment (which will depend on the density of the subscriber population and the type of system being considered) and the availability of the appropriate radio-frequency spectrum for that system. The requirement for mobility or portability would tend to drive the deployment of systems derived from cellular technologies. Alternatively, the requirement for wireline quality and services (such as G3 FAX and voiceband data or even ISDN) would tend to be drivers towards special-purpose designed systems.

Understanding the drivers for the deployment of each technology is a key factor in minimizing the cost and maximizing the effectiveness of the solution. In some cases wireless access may offer potential for evolution and synergy with mobile services. An infrastructure supporting a fixed wireless system using an air interface developed for mobile services, (e.g. Recommendations ITU‑R F.757, ITU‑R M.622, ITU‑R M.687, ITU‑R M.819, ITU‑R M.1033, and ITU‑R M.1073) might be readily extended to support mobile users. Alternatively, special-purpose systems can be designed to meet the quality requirements in an optimal manner. Volume 1 of the ITU-R Land Mobile (including Wireless Access) Handbook, Second Edition, 2001, provides further information on the basic principles and descriptions of wireless access systems.

## 1.4 Fixed wireless access and broadband fixed wireless access

{Editor’s note: Text below is from the elements for a working document towards a preliminary draft new [report/recommendation] ITU-R F.[IMT-FWB](Annex 18 to the doc. 5A/221) and was aligned with the proposal on common terminology – see Attachment 1 to Doc. 5A/321.}

The term “broadband fixed wireless access” (BFWA) is a term based on the definition of “fixed wireless system” in Recommendation [ITU-R F.592](https://www.itu.int/rec/R-REC-F.592/en): *“Telecommunication systems operating in the fixed service including, for example, radio-relay systems, HF systems, and systems using high altitude platform stations (HAPS), and which support a range of applications such as access and core transport”*, which includes “Fixed wireless access” (FWA),which is defined as: *“Fixed wireless system application in which the location of the end-user termination and the network access point to be connected to the end-user are fixed”*. Together with the *”support capability higher than the primary rate”* used synonymous with broadband the full term further used in this Recommendation is defined (See also Recommendation [ITU-R F.1399](https://www.itu.int/rec/R-REC-F.1399/en).)

Local access and other high density fixed wireless wireless systems have been widely deployed on a worldwide basis.. This development is due in large part to the trend towards increased demand and competition in the provision of high bit-rate local telecommunications, video and broadband data distribution services. Because of cost and speed of deployment considerations, these developments have placed a major focus on the provision of services directly to end-users via FWA systems.

{Editor’s note: Data rates below should be replaced with values that represent current technology. Recommendation ITU-R F.758 is being updated regularly however, an update of the Recommendation ITU-R F.1499 (last updated 2000) might be necessary as well.}

In the past, current broadband wireless access data rates over individual circuit paths have ranged from about 1.5 Mbit/s to about 51 Mbit/s, and were expected to reach at least 310 Mbit/s at one point, as radios utilizing higher order modulation schemes become available (see Recommendations ITU-R F.758 and ITU-R F.1499). For IMT-2020, the user experienced data rate in the downlink direction is to be 100 Mbit/s, and in the uplink it is 50 Mbit/s, while the peak data rate in the downlink is 20 Gbit/s, and 10 Gbit/s for the uplink.

{Editor’s note: The IMT-2020 data rate requirements added above are from Report ITU-R M.2410, Minimum requirements related to technical performance for IMT-2020 radio interface(s) § 4.1 and § 4.3.}

Various use cases can be considered as FWA applications for access, instead of fibre optics, as flexible access in last mile (wireless home broadband). The implementation of different use cases can be achieved by a variety of possible BFWA network configurations including: conventional P-P, conventional P-MP, and combinations thereof, e.g. P-P systems deployed in multisectored P-MP configurations. High density deployment of independent P-P links similarly results in clusters that assume the essential characteristics of P-MP deployment. An emerging system architecture is that of MP-MP, similar to mesh systems used at, for example, HF. In addition, access connectivity from hub stations to fixed terminals (e.g. CPE - Customer Premise Equipment) provides for additional, adaptive and/or virtual network configurations.

# 2 References

This list of references includes general references relevant to the topic of FWA.

– Recommendation ITU-R F.746: Radio-frequency channel arrangements for fixed service systems

– Recommendation ITU‑R F.748: Radio-frequency arrangements for systems of the fixed service operating in the 25, 26 and 28 GHz bands

– Recommendation ITU‑R F.749: Radio-frequency arrangements for systems of the fixed service operating in the 38 GHz band

– Recommendation ITU-R F.755: Point-to-multipoint systems used in the fixed service

– Recommendation ITU-R F.757: Basic system requirements and performance objectives for fixed wireless access using mobile-derived technol­ogies using telephony and data communication services

– Recommendation ITU-R F.758: Considerations in the development of criteria for sharing between the terrestrial fixed service and other services

– Recommendation ITU-R F.1191: Necessary and occupied bandwidths and unwanted emissions of digital FS systems

– Recommendation ITU-R F.1249: Maximum equivalent isotropically radiated power of transmitting stations in the fixed service operating in the frequency band 25.25-27.5 GHz shared with the inter-satellite service

– Recommendation ITU-R F.1399: Vocabulary of terms for wireless access

– Recommendation ITU-R F.1400: Performance and availability requirements and objectives for fixed wireless access to public switched telephone network

– Recommendation ITU-R F.1402: Frequency sharing criteria between a land mobile wireless access system and a fixed wireless access system using the same equipment type as the mobile wireless access system

– Recommendation ITU-R F.1488: Frequency block arrangements for fixed wireless access systems in the range 3 400-3 800 MHz

– Recommendation ITU-R F.1489: A methodology for assessing the level of operational compatibility between fixed wireless access and radio­location systems when sharing the band 3.4-3.7 GHz

– Recommendation ITU-R F.1498: Deployment characteristics of fixed service systems in the band 37-40 GHz for use in sharing studies

– Recommendation ITU-R F.1499: Radio transmission systems for fixed broadband wireless access based on cable modem standards

– Recommendation ITU‑R F.1509: Technical and operational requirements that facilitate sharing between point-to-multipoint systems in the fixed service and the inter-satellite service in the band 25.25-27.5 GHz

– Recommendation ITU-R F.1518: Spectrum requirement methodology for fixed wireless access and mobile wireless access networks using the same type of equipment, when coexisting in the same frequency band

– Recommendation ITU-R M.478: Technical characteristics of equipment and principles governing the allocation of frequency channels between 25 and 3 000 MHz for the FM land mobile service

– 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.1073: Digital cellular land mobile telecommunication systems

– Recommendation ITU-R M.1390: Methodology for the calculation of IMT-2000 terrestrial spectrum requirements

– Recommendation ITU-R M.1450: Characteristics of broadband radio local area networks

– Recommendation ITU-R M.1454: e.i.r.p. density limit and operational restrictions for RLANs or other wireless access transmitters in order to ensure the protection of feeder links of non-geostationary systems in the mobile-satellite service in the frequency band 5 150-5 250 MHz

– Recommendation ITU-R M.1801: Radio interface standards for broadband wireless access systems, including mobile and nomadic applications, in the mobile service operating below 6 GHz

– Recommendation ITU-R M.2003: Multiple gigabit wireless systems in frequencies around 60 GHz

– Recommendation ITU-R M.2012: Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications Advanced (IMT-Advanced)

– Recommendation ITU-R M.2134: Receiver characteristics and protection criteria for systems in the mobile service in the frequency range 27.5-29.5 GHz for use in sharing and compatibility studies

– Recommendation ITU-R SF.1484: Maximum allowable values of power flux-density at the surface of the Earth produced by non-geostationary satellites in the fixed-satellite service operating in the 37.5-42.5 GHz band to protect the fixed service

– Recommendation ITU-R SF.1486: Sharing methodology between fixed wireless access systems in the fixed service and very small aperture terminals in the fixed-satellite service in the 3 400-3 700 MHz band

– Recommendation ITU-R SF.1573: Maximum allowable values of power flux-density at the surface of the Earth by geostationary satellites in the fixed-satellite service operating in the 37.5-42.5 GHz band to protect the fixed service

– RR Number **5.547**

– Volume 1 of the ITU-R Handbook on Land Mobile (including Wireless Access): Fixed Wireless Access, 2nd edition, 2001.

# 3 List of acronyms

ATM: Asynchronous transfer mode

BFWA: Broadband fixed wireless access

CATV: Community antenna television

CDMA: Code division multiple access

FDD: Frequency duplex division

FS: Fixed service

FSS: Fixed satellite service

FWA: Fixed wireless access

HAPS: High altitude platform stations

HDFS: High density applications in the fixed service

[IMT-2000: International Mobile Telecommunications-2000]

[IMT-2020: International Mobile Telecommunications-2020]

ISDN: Integrated services digital network

LAN: Local area network

LMCS: Local multipoint communications systems

LMDS: Local multipoint distribution systems

MMDS: Multichannel multipoint distribution systems

MP-MP: Multipoint to multipoint

MS: Mobile service

MSS: Mobile satellite service

MVDS: Multipoint video distribution systems

MWS: Multimedia wireless systems

PCS: Personal communications systems

PLMN: Public land mobile network

P-MP: Point-to-multipoint

P-P: Point-to-point

PSDN: Public switched digital network

PSTN: Public switched telephone network

RLAN: Radio local area network

TDD: Time division duplex

TDMA: Time division multiple access

WAN: Wide area network

# 4 Considerations related to the use of the spectrum for FWA

## 4.1 General

The terms fixed (radio) service and mobile (radio) service are defined by the RR. The radio service definitions form the basis for the allocation of radio spectrum internationally by the ITU as well as domestically by each country. For the most part, the ITU has made joint allocations to the mobile and fixed services in various frequency bands. In some countries a choice has been made to limit use to one of the two services.

Certain evolving wireless access applications do not fit explicitly into the definitions of either the FS or the MS. The appropriate approach is to apply some flexibility in the interpretation of these definitions to be able to embrace these integrated applications under the umbrella of the FS and the MS. A key to the interpretation of the use of these terms is the concept of mobility. If the device is intended to be used in motion or is normally moved from place to place, it is considered as part of the MS. On the other hand it is generally understood that portable systems, which are transportable but operate always in the fixed state, belong to the FS.

Applications are envisaged for fixed radio service systems where the integration of wireless access devices that function as mobile (requiring mobile allocations) radio stations might be required. These situations have resulted from the converging requirements of both mobile and fixed radio services and the use of wireless access devices in integrated radio applications.

In order to facilitate the introduction of FWA systems the following factors should be considered:

– There is a growing trend in certain frequency bands that fixed and mobile applications are converging.

− In circumstances stated in the above, systems can use technologies derived from mobile and fixed systems.

– Frequency reuse becomes increasingly effective at higher (millimetre wave) frequencies.

– Adaptive technologies and other advances are likely to afford greater effective capacity and spectrum efficiency in the future.

– Flexibility is needed in the frequency band structure to provide for multiple technologies and a variety of applications.

– Area-wide and site-by-site frequency assignments are commonly used for FWA.

– Service providers may benefit from economies of scale in bands where there is significant regional or worldwide harmonization.

– In the future the convergence of telecommunications and broadcast applications may prompt the development of hybrid FS/broadcasting service applications.

## 4.2 Spectrum characteristics for FWA

This section points out relevant characteristics of the radio spectrum for FWA implementation. Most of these characteristics are also relevant for other services.

The main characteristics and applications of the frequency bands allocated to FS and MS that may be suitable for FWA are summarized as follows:

### 4.2.1 Below 1 GHz

– telephony and low-speed data;

– good propagation for long reach – beyond horizon (rural systems);

– high-level of coverage reliability;

– limited bandwidth available;

– many bands heavily used for MS, broadcasting and other services;

– difficult to achieve high antenna gains with small antenna structures;

– easy to generate high transmit power at base station;

– components very readily available;

– coordination distances between co-channel systems are quite large;

– frequencies below 50 MHz suffer from propagation anomalies – ducting due to temperature inversion – ionosphere skip.

### 4.2.2 1-3 GHz

– telephony and low/medium speed data;

– good propagation – limited-trans-horizon path (particularly suitable for both fixed and mobile applications);

– good coverage reliability – limited blockage problems;

– many bands already heavily used by existing MS, FS, satellite and radiolocation/ radionavigation services;

– moderate bandwidth available;

– good range for urban and rural applications;

– antenna structures can be quite small (e.g. cellular, cordless);

– easy to generate high transmit power at base station;

– components readily available.

### 4.2.3 3-10 GHz

– telephony and low/medium/high speed data;

– propagation generally limited to near line of sight (LoS);

– propagation through foliage is relatively good;

– path length generally less than 20 km for P-MP, more for P-P;

– more bandwidth available;

– many fixed/mobile bands shared with satellite services:

– sharing constraints more favourable to P-P systems;

– components of reasonable cost and availability;

– more difficult to generate transmit power;

– coverage reliability is moderate-poor due to blockage;

– bands can be suitable for FWA applications employing high-gain antennas at the base station and subscriber station.

### 4.2.4 10-30 GHz

– telephony, low, medium and high data rates, video;

– mature P-P and multipoint technology;

– propagation:

– LoS required;

– rain attenuation is a factor;

– urban/suburban applications;

– employ small antenna structures;

– path lengths generally less than 10 km for P-MP, more for P-P, that utilize directional antennas in both sites of the link;

– substantial contiguous bands of FS spectrum are available;

– support of FWA applications;

– transmit power is more difficult;

– high-level of frequency reuse, especially in the 20-30 GHz range;

– many FS/MS bands shared with satellite services;

– in high-density applications, sharing between FS (including FWA) and FSS/MSS may be difficult.

### 4.2.5 30-50 GHz

– telephony, low-medium and high data rates, video;

– propagation: LoS is essential;

– rain attenuation – a significant factor;

– antenna structures can be very small, and have high levels of gain;

– path lengths generally less than 5 km for P-MP, more for P-P, that utilize directional antennas in both sites of the link;

– large contiguous bands of spectrum available for FWA applications;

– applications are urban/suburban;

– very high level of frequency reuse;

– in high-density applications, sharing between FS (including FWA) and FSS/MSS may be difficult;

– some countries have FWA systems in the 38 GHz band and others have planned FWA systems in the 40 GHz band.

### 4.2.6 50-66 GHz

− high atmospheric losses in the 55-66 GHz range;

– propagation: LoS is essential;

– rain attenuation – a significant factor;

– antenna structures can be very small, and have high levels of gain;

– path lengths generally less than 2 km for P-MP, more for P-P, that utilize high directional antennas in both ends of the link;

– substantial contiguous bands of FS spectrum are available;

– support of FWA applications;

– very high level of frequency reuse;

– in high-density applications, sharing between FS (including BFWA) and FSS/MSS may be difficult;

– some countries have BFWA systems in the 60 GHz band.

### 4.2.7 71-86 GHz

– propagation: LoS is essential;

– rain attenuation – a significant factor;

– antenna structures very small, and have high levels of gain;

– generally the range is up to [X] km;

– substantial contiguous bands of FS spectrum are available;

– support of FWA applications;

– very high level of frequency reuse;

– in high-density applications, sharing between FS (including FWA) and FSS/MSS may be difficult.

### 4.2.8 Above 92 GHz

For bands above 92 GHz the properties and possibilities to make use of bands for FWA and other applications in the fixed service are being further considered in ITU-R, as some of the features will be the same for bands up to 86 GHz.

### 4.2.9 Categorization

[Editor’s note: Service types below (including Table 1) should be checked whether they correctly reflect the current use. An update of the Recommendation ITU-R F.1400 might be necessary as well.]

Table 1 provides a generalized categorization of frequency bands by service and constituency. For the purposes of this Recommendation, the types of services are defined in Recommendation ITU‑R F.1400 – Performance and availability requirements and objectives for fixed wireless access to public switched telephone network.

*Type 1*: Analogue signals such as voice and voiceband data at rates up to 64 kbit/s (minimum 3.1 kHz audio as identified in Recommendation ITU-T G.174).

*Type 2*: Access bearer service from 64 kbit/s to bit rates below the primary rate.

*Type 3*: Digital services operating at the primary rate or above.

TABLE 1

Frequency bands broadly categorized by service and constituency

|  |  |  |  |
| --- | --- | --- | --- |
| Class of service | Service constituency | | |
| Rural (GHz) | Suburban (GHz) | Urban (GHz) |
| Type 1 | < 4(1) | < 5 | < 5 |
| Type 2 | < 4(1) | 1-11 | 1-11 |
| Type 3 | < 1-4 | 3-70 | 3-70 |
| (1) Frequency bands below 1 GHz may be preferred where typical paths are beyond the radio horizon or subject to terrain blockage. | | | |

# 5 Recommendations

The ITU Radiocommunication Assembly recommends that the following points be taken into consideration in the identification of suitable frequency bands for the implementation of FWA systems.

{Editor’s note: the below section 5.1 had generated in particular much discussion at the November 2022 meeting of WP 5A, namely with regards to the inclusion of MS bands, even though they have been part of this methodology in Recommendation ITU-R F.1401-1 for well over 20 years.}

## 5.1 Methodology to identify possible bands for FWA

*[Step 1*: Identify either or both FS and MS bands taking into account the following considerations:

[– bands already in use for FWA or for which relevant equipment is available;]

– bands allocated to FS on a primary basis in the RR;

– bands allocated to MS on a primary basis in the RR;

– bands with greatest possibility for global harmonization (less sharing constraints);

– FS bands which may be under-utilized by other radioservices (candidates for re-farming).]

*Step 2:* Consider the spectrum implications of the performance and availability requirements for the required telecommunication services.

*Step 3:* Consider cost-effectiveness and equipment availability of the bands under consideration.

*Step 4:* Identify sharing and regulatory constraints for the primary Fixed Service allocation in band being considered:

– List of applicable ITU-R Recommendations (technical);

– Conditions and protection requirements of existing services in the band under consideration and bands adjacent to it;

– Radio Regulations, including footnotes (regulatory).

*Step 5:* Identify complementary sharing studies with other primary radio services in the bands identified in accordance with Step 1.

*Step 6:* If Steps 4 and 5 indicate ITU-R sharing studies are inconclusive or there is potential for interference, perform analysis to determine if sharing between FWA systems and these services is feasible.

*Step 7:* Identify the frequency bands that have passed the tests above.

## 5.2 Information to be compiled for the identification of frequency bands

Based on the above methodology, the following items are necessary for studies to identify possible FS and MS bands eligible for FWA systems covering the range 400 MHz to 134 GHz:

– frequency band,

– bandwidth,

– ITU-R Recommendations on radio-frequency arrangements,

– other ITU-R Recommendations,

– regional Recommendations on radio-frequency arrangements,

– other regional Recommendations,

– ITU-R Recommendations on sharing studies,

– current use,

– other information.

Annex 1 presents examples of frequency bands used in some countries for which RF channel arrangements for FWA systems or results of sharing studies are given in ITU-R Recommendations. Other countries may use other frequency bands for FWA systems.

Annex 1  
  
Information on the sharing studies to identify   
frequency bands for FWA systems

Table 2 provides information on sharing studies in the bands listed below that may be applicable to FWA systems. These bands were selected based upon existing or planned use by some administrations or regional Recommendations (or standards) and equipment availability. The results of these sharing studies should be taken into account as indicated in the methodology given in § 6.1. Additional information on regional Recommendations may be found in Volume 1 of the ITU-R Handbook on land mobile (including wireless access): fixed wireless access, 2nd edition, 2001 (§ 4.3.2, p. 14-17).

TABLE 2

Examples of frequency bands used in some countries for FWA systems   
and related sharing studies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Frequency range and reference ITU‑R Rec. for frequency arrangements | | Band | RF carrier spacing | Reference ITU-R Rec. for sharing consideration (with other service) |
| 450 MHz | F.1567 | 413.05-423.05 MHz paired with 440‑450 MHz | 250, 300,  500, 600, 750 kHz, 1, 1.75, 3.5 MHz | These bands are shared with mobile service and partly with amateur service and space research service. SA.1236, SA.1260 |
| 406.1-413.05 MHz paired with 423.05-430 MHz | 50, 100, 150, 200, 250 and 600 kHz |
| 800-900 MHz | M.1073 | 824-849 MHz paired with 869-894 MHz; 890-915 MHz paired with 935‑960 MHz | 10, 30 and 200 kHz | M.478 principles to assigning channels  25-3 000 MHz |
| 1.8/1.9 GHz | F.757, M.1073 | 1 710-1 785 MHz paired with 1 805-1 880 MHz | 200 kHz |  |
| F.757, M.1073 | 1 850-1 910 MHz paired with 1 930-1 990 MHz | 30 kHz | These bands are shared partly with MSS |
| F.757, M.1033 | 1 880-1 900 MHz | 1 728 kHz | F.1518 (mobile service) |
| F.757, M.1033 | 1 893.5-1 919.6 MHz | 300 kHz | F.1402 (mobile service), F.1518 (mobile service) |
| 3.5 GHz | F.1488  (Annex 1) (Annex 2) | 3.4-3.8 GHz | 25 MHz block (250 kHz × *n* blocks) | F.1489 (radiolocation service), SF.1486 (FSS) |

TABLE 2 (*end*)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Frequency range and reference ITU‑R Rec. for frequency arrangements | | Band | RF carrier spacing | Reference ITU-R Rec. for sharing consideration (with other service) |
| 24/29 GHz | F.748  (Annex 3), (§ 1) | 24.25-24.45 GHz paired with 25.05‑25.25 GHz | 40 MHz block | These bands are shared with radionavigation service (RNS) and FSS |
| F.748 | 24.25-27.5 GHz | (2.5 MHz × *n*) (3.5 MHz × *n*) | F.1249 (inter-satellite service (ISS)),  F.1509, SA.1278 (ISS) |
| F.748  (Annex 1) | 24.5-26.5 GHz | 3.5, 7, 14, 28,  56, 112 MHz | F.1249 (ISS), F.1509, SA.1278 (ISS) |
| F.748  (Annex 3), (§ 2) | 25.27-26.98 GHz | 60 MHz block | F.1249 (ISS), F.1509, SA.1278 (ISS) |
| F.748  (Annex 2) | 27.5-29.5 GHz | 3.5, 7, 14, 28,  56, 112 MHz | These bands are shared with FSS and MS |
| 32 GHz | F.1520  (Annex 1), (Annex 2) | 31.8-33.4 GHz | 3.5, 7, 14, 28, 56 MHz 56 MHz block | F.1571 (RNS) SA.1157 |
| 38 GHz | F.749 | 36.0-40.5 GHz | (2.5 MHz × *n*) (3.5 MHz × *n*) | SF.1484 (FSS) SF.1573 (FSS) SA.1396 |
| F.749  (Annex 2) | 36.0-37.0 GHz paired with 39.5-40.5 GHz | 3.5, 7, 14, 28,  56, 112 MHz | SF.1484 (FSS) SF.1573 (FSS) SA.1396 |
| F.749 | 37.0-39.5 GHz | 3.5, 7, 14, 28,  56, 140 MHz | SF.1484 (FSS) SF.1573 (FSS) SA.1396 |
| F.749  (Annex 3), (§ 2) | 38.06-38.48 GHz paired with 39.06‑39.48 GHz | 60 MHz block | SF.1484 (FSS) SF.1573 (FSS) SA.1396 |
| F.749 (Annex 3),  (§ 1) | 38.6-40.0 GHz | 50 MHz block | SF.1484 (FSS) SF.1573 (FSS) |
| 40 GHz | Q.108-1/9 | 40.5-43.5 GHz | Block allocation depending on demand | SF.1484 (FSS) SF.1573 (FSS)(2) |
| (2) Sharing with FSS applies up to 42.5 GHz. | | | | |

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1. \* Radiocommunication Study Group 5 made editorial amendments to this Recommendation in November 2011, in accordance with Resolution ITU-R 1. [↑](#footnote-ref-1)