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| **Radiocommunication Study Groups** |  |
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| draft CPM text for WRC-19 Agenda Item 1.16 | |
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CHAPTER 2

Broadband applications in the mobile service

(Agenda items 1.13, 1.16, 9.1 (issues 9.1.1, 9.1.5, 9.1.8))

Agenda item 1.16

(**WP 5A** / **WP 4A**, **WP 4C**, **WP 5B**, **WP 5C**, **WP 7C**,   
(WP 1B), (WP 3J), (WP 3K), (WP 3M), (WP 5D))

*1.16 to consider issues related to wireless access systems, including radio local area networks (WAS/RLAN), in the frequency bands between 5 150 MHz and 5 925 MHz, and take the appropriate regulatory actions, including additional spectrum allocations to the mobile service, in accordance with Resolution* ***239 (WRC-15)****;*

Resolution **239 (WRC‑15)** – *Studies concerning Wireless Access Systems including radio local area networks in the frequency bands between 5 150 MHz and 5 925 MHz*

# 2/1.16/1 Executive summary

Section 2/1.16/2 provides background information about the development of WAS/RLAN usage and work at previous WRCs related to WAS/RLAN.

Section 2/1.16/3 describes:

– the results of ITU-R studies for the technical and operational requirements for RLANs taking into account that previous studies indicated the minimum spectrum requirement for RLANs using the 5 GHz frequency range in the year 2018 is estimated to be 880 MHz;

– the sharing and compatibility studies conducted by the ITU-R in accordance with Resolution **239 (WRC-15)** for various frequency ranges;

– analyses of the results of studies for various frequency ranges;

– a list of frequency bands studied: 5 150-5 250 MHz, 5 250-5 350 MHz, 5 350‑5 470 MHz, 5 725‑5 850 MHz, and 5 850‑5 925 MHz.

Methods to satisfy the agenda item are included in section 2/1.16/4.

The frequency bands investigated under this agenda item, i.e. 5 150-5 250 MHz, 5 250-5 350 MHz, 5 350-5 470 MHz, 5 725-5 850 MHz and 5 850-5 925 MHz, are denoted by the letters **A**, **B**, **C**, **D**, and **E**, respectively. When multiple methods are proposed for a particular frequency band, the methods are expressed by the associated letter and a numerical suffix (**Method A1**, **Method A2**, etc.); when only one method is proposed for a particular frequency band, the method is expressed by the associated letter (**B**, **C**, etc.).

For the 5 150-5 250 MHz band, 4 methods (incl. NOC) are proposed (**A1**, **A2**, **A3** and **A4**); for the 5 250-5 350 MHz and 5 350-5 470 MHz bands, only 1 method (NOC) is proposed (**B** and **C** respectively); for the 5 725-5 850 MHz band, 3 methods (incl. NOC) are proposed (**D1**, **D2** and **D3**); for the 5 850-5 925 MHz band only 1 method (NOC) is proposed (**E**).

Also, the regulatory and procedural considerations can be found in section 2/1.16/5.

# 2/1.16/2 Background

RLANs have proven to be a success in conjunction with other fixed and mobile networks at providing affordable and ubiquitous broadband wireless access to the Internet. Introduced by some administrations in the 2.4 GHz band and subsequently expanded into some of the 5 GHz frequency bands, RLANs, specifically Wi-Fi devices, now carry approximately half of all global Internet Protocol (IP) traffic[[1]](#footnote-1). In fact, mobile carriers have increased their reliance on Wi-Fi offload, voice‑over-Wi-Fi (VoWiFi), and similar technologies[[2]](#footnote-2). As technology evolves to meet increasing performance demands and traffic on broadband WAS increases, the use of wider bandwidth channels in order to support high data rates creates a need for additional spectrum.

RR No. **5.446A** specifies that the use of the bands 5 150-5 350 MHz and 5 470-5 725 MHz by the stations in the mobile, except aeronautical mobile, service shall be in accordance with Resolution **229 (Rev.WRC-12)**.

Since WRC-03, the demand for mobile broadband applications especially for WAS/RLANs has been growing rapidly. Resolution **239 (WRC-15)** states “that the results of ITU-R studies indicate that the minimum spectrum need for WAS/RLAN in the 5 GHz frequency range in the year 2018 is estimated at 880 MHz; this figure includes 455-580 MHz already utilized by non-IMT mobile broadband applications operating within the 5 GHz range resulting in 300-425 MHz additional spectrum being required”.

One issue WRC-15 examined was the possibility of additional global allocations to the mobile service for terrestrial mobile broadband applications, including in the 5 GHz range, to facilitate contiguous spectrum for WAS/RLAN. This is to enable the use of wider channel bandwidths to support higher data throughput. The studies performed by ITU-R in preparation for WRC-15 indicated that if the WAS/RLAN mitigation measures were limited to the regulatory provisions of Resolution **229 (Rev.WRC-12)**, sharing between WAS/RLAN and the EESS (active) systems in the frequency band 5 350 to 5 470 MHz may not be feasible, as well as being insufficient to ensure protection of certain radar types in this frequency band. For these cases, sharing may only be feasible if additional WAS/RLAN mitigation measures are implemented. However, no agreement was reached on the applicability of any additional WAS/RLAN mitigation techniques (cf. Section 1/1.1/3.2.11 of the CPM Report to WRC-15).

No agreement was reached on the conclusions of the studies for the frequency band 5 725‑5 850 MHz (cf. Section 1/1.1/3.2.12 of the CPM Report to WRC-15). As such, WRC-15 concluded no change (NOC) for these frequency bands and established a WRC-19 agenda item to continue the work.

Resolution **239 (WRC‑15)**, calls for ITU-R to:

– study WAS/RLAN technical characteristics and operational requirements in the 5 GHz frequency range;

– performsharing and compatibility studies between WAS/RLAN applications and incumbent services in the frequency bands 5 150-5 350 MHz, 5 350-5 470 MHz, 5 725‑5 850 MHz and 5 850-5 925 MHz while ensuring the protection of incumbent services including their current and planned use;

– consider enabling outdoor WAS/RLAN operations in the frequency range 5 150-5 350 MHz;

– consider potential mobile service allocations to accommodate WAS/RLAN operations in the 5 350‑5 470 MHz and 5 725‑5 850 MHz frequency bands; and

– identify potential WAS/RLAN use in 5 850‑5 925 MHz frequency band.

# 2/1.16/3 Summary and analysis of the results of ITU-R studies

## 2/1.16/3.1 Technical and operational requirements for WAS/RLANs

Further information on technical and operational requirements for WAS/RLANs considered in sharing and compatibility studies other than those referred in Resolution **229 (Rev.WRC-12)** can be found in the WDPDN Report ITU-R M.[RLAN REQ-PAR].

## 2/1.16/3.2 Sharing and compatibility studies

### 2/1.16/3.2.1 Frequency range 5 150-5 250 MHz

The band 5 150-5 250 MHz is allocated to various services as contained in the RR Table of Frequency Allocations including associated footnotes thereto.

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 5 150-5 250 FIXED-SATELLITE (Earth-to-space) 5.447A  MOBILE except aeronautical mobile 5.446A 5.446B  AERONAUTICAL RADIONAVIGATION  5.446 5.446C 5.447 5.447B 5.447C | | |

The studies described in the sub-sections below for the 5 150-5 250 MHz band did not address the impact of out-of-band emissions.

#### 2/1.16/3.2.1.1 FSS for NGSO MSS feeder uplinks and the mobile service/RLAN

The studies described in this section assumed a WAS/RLAN e.i.r.p. distribution as contained in the WDPDN Report ITU-R M.[RLAN REQ-PAR].

One study showed that RLANs could protect the NGSO MSS feeder links by operating up to 1 Watt conducted power and a power spectral density (PSD) of 17 dBm/MHz with an allowance for a 6 dBi antenna gain (i.e. a total 36 dBm e.i.r.p), 2% of RLANs outdoors, using directional and omnidirectional antennas to minimize the likelihood of harmful interference to the operating MSS system. The study analysed RLAN aggregate interference into satellites in the system over a continuous six-day period. The time-variant CDMA channel capacity or radiofrequency power loss never exceeds 1%. Accordingly, the study found no impact to the satellite constellation capacity or satellite RF power and hence no harmful interference to the single MSS system using the 5 150‑5 250 MHz band for FSS feeder links. Considering the results of this study RLANs could potentially operate outdoors and at higher powers in the 5 150-5 250 MHz band. For outdoor Access Point (AP) antennas, 70% are assumed to employ antennas that are omnidirectional in the azimuth plane and facing with the main beam generally downward for the vertical place; 16% employ a 6 dBi directional antenna with 50 degrees of down tilt; 6% a 12 dBi directional antenna with 30 degrees of down tilt; 8% employ directional point-to-point antennas. This study represents a typical deployment for the country in which this study was carried out, where outdoor deployments need to comply with emissions constrained in elevation higher than 30 degrees to be less than 125 mW e.i.r.p.

A separate comparison showed that higher power and outdoor operation of any RLAN described above, could potentially result in up to 30 dB more e.i.r.p. for RLAN emission elevation angles ≤30 degrees and up to 15 dB more e.i.r.p. for elevation angles >30 degrees, compared with that prescribed by Resolution **229 (Rev.WRC-12)**. It should also be noted that RLAN operations include a wide distribution of devices operating at a range of e.i.r.p. values.

Another sharing study is focused on evaluation of conditions that enable sharing and compatibility between RLAN and MSS. In this study, as mitigation measures, limitation of the number of outdoor access points and the maximum e.i.r.p. dependent on antenna elevation angles are considered. The conditions of the maximum e.i.r.p. are assumed to be the same as described in *resolves* 4 in Resolution **229 (Rev.WRC-12)** for the 5 250-5 350 MHz band. The results of the study show that if the number of outdoor RLANs is limited, the total interference level from RLANs is lower than the threshold for MSS feeder links. Since the 5 250-5 350 band is adjacent to the 5 150-5 250 MHz band, the conditions of these sub-bands are preferred to be equivalent.

Another study examined the impact to another NGSO MSS system sharing the spectrum, which is the COMPASS-MSS system over Asia. The study shows that the COMPASS-MSS system feeder link would suffer interference from RLAN access points for more than 90% of the time if the RLAN devices are 5.3% outdoor used. This study assumed the RLAN density per inhabitants which uses the transmission density factors for RLANs in Europe proposed in WDPDN Report ITU-R M.[RLAN REQ-PAR].

Another study conducted when considering RLAN deployment over Europe, North Africa and part of Asia and Middle East, concluded that RLAN outdoor relaxation (up to 5.3 %) would cause harmful interference to the MSS feeder link. This study considered the 48 HIBLEO-X satellites and an e.i.r.p. of 1W and even 4W. The proposal for outdoor use with a limitation of e.i.r.p. to 125 mW for antenna elevation angles in excess of 30 degrees from the horizon by applying a constant discrimination, was also studied but did not solve the interference problem. This study also assessed low e.i.r.p. RLAN devices (up to 40 mW) restricted to in-vehicle usage. Simulations have shown that the same level of protection offered by the indoor usage is achieved for MSS when combining a low e.i.r.p. up to 40 mW and restricted to in-vehicle use. Low e.i.r.p. (up to 40 mW) associated with an in-vehicle usage restriction is an effective measure to mitigate the level of interference into the MSS feeder link.

No agreement was reached on the results of all these studies as outlined above.

#### 2/1.16/3.2.1.2 Aeronautical radionavigation service and mobile service/RLAN

This frequency band is used for sense and avoid systems and the typical technical characteristics are given in Recommendation ITU-R M.2007 *“Characteristics of and protection criteria for radars operating in the aeronautical radionavigation service in the frequency band 5 150-5 250 MHz”*. These systems were characterised after the initial introduction of the WAS/RLANs under Resolution **229 (WRC-03)**. It should also be noted that the sharing studies carried out when allocating the band to WAS/RLAN use assumed 1% accidental outdoor usage at 200 mW e.i.r.p.

In one deterministic, single entry case example compatibility study, the results showed that the effective measures for reducing interference for airborne sense and avoid systems operation are to be developed to enable the usage of outdoor WAS/RLAN in the frequency band 5 150-5 250 MHz. One approach based on the worst case results may be the reduction of e.i.r.p. values of WAS/RLAN transmitters approximately by 20 dB while increasing the receiver sensitivity can be considered as the effective method for reducing interference. Such method allows to compensate the absence of additional fading in the walls which provided sharing of WAS/RLAN systems with the ARNS systems operating in the considered frequency band.

Without development of such measures for reducing the interference the decision of possible outdoor WAS/RLAN systems usage in the considered frequency band cannot be made.

Consideration of statistical analysis looking at multi-source interference could result in different protection distances. Further studies using an aggregate interference are needed for realistic results.

Another study is submitted that is focused on evaluation of conditions that enable sharing and compatibility. In this study, as mitigation measures, limitation of the number of outdoor RLANs, restriction of the location of outdoor RLANs and the maximum e.i.r.p. dependent on antenna elevation angles are considered. The conditions of maximum e.i.r.p. are assumed to be the same as described in *resolves* 4 in Resolution **229 (Rev.WRC-12)** for the 5 250-5 350 MHz band. Since the 5 250-5 350 band is adjacent to the 5 150-5 250 MHz band, the conditions of these sub-bands are preferred to be equivalent. The results of the study show that if the number of outdoor RLANs is limited, and the distance between RLANs and ARNS systems is larger than a specific protection distance, the total interference level from RLANs is lower than the threshold for ARNS systems with an adequate probability.

Another Minimum Coupling Loss (MCL) coexistence study, showed that indeed an outdoor RLAN relaxation without any mitigation technique would cause harmful interference to the ARNS, but it was shown that the same level of protection offered by the indoor usage is achieved when combining a low e.i.r.p. of 40 mW and a restricted in-vehicle use for the outdoor case. Low e.i.r.p. (up to 40 mW) associated with an in-vehicle usage restriction is an effective measure to mitigate the level of interference into the ARNS.

#### 2/1.16/3.2.1.3 Aeronautical mobile telemetry and mobile service/RLAN

Pursuant to RR No. **5.446C**, “in Region 1 (except in Algeria, Saudi Arabia, Bahrain, Egypt, United Arab Emirates, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Syrian Arab Republic, Sudan, South Sudan and Tunisia) and in Brazil, the band 5 150-5 250 MHz is also allocated to the aeronautical mobile service on a primary basis, limited to aeronautical telemetry transmissions from aircraft stations (see No. **1.83**), in accordance with Resolution **418 (Rev.WRC-12)**\*. These stations shall not claim protection from other stations operating in accordance with Article **5**. No. **5.43A** does not apply.”

One study indicated that MCL calculations showed that outdoor usage with the e.i.r.p. values recognized in Resolution **229 (Rev.WRC-12)** cannot ensure the coexistence of outdoor RLANs and the aeronautical mobile telemetry (AMT). However, this study showed that AMT systems can have the same level of protection established by Resolution **229 (Rev.WRC-12)**, when combining a low e.i.r.p. (up to 40 mW) with in-vehicle use.

### 2/1.16/3.2.2 Frequency range 5 250-5 350 MHz

The band 5 250-5 350 MHz is allocated to various services as contained in the RR Table of Frequency Allocations including associated footnotes thereto.

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 5 250-5 255 EARTH EXPLORATION-SATELLITE (active)  MOBILE except aeronautical mobile 5.446A 5.447F  RADIOLOCATION  SPACE RESEARCH 5.447D  5.447E 5.448 5.448A | | |
| 5 255-5 350 EARTH EXPLORATION-SATELLITE (active)  MOBILE except aeronautical mobile 5.446A 5.447F  RADIOLOCATION  SPACE RESEARCH (active)  5.447E 5.448 5.448A | | |

#### 2/1.16/3.2.2.1 Earth exploration-satellite service (active) and the mobile service/RLAN and Radar systems and the mobile service/RLANs

The current WAS/RLAN operating parameters are specified in Resolution **229 (Rev.WRC-12)**.

Since the adoption of Resolution **229** at WRC-03**,** millions of WAS/RLAN (e.g., Wi-Fi) devices have been deployed in the band 5 250-5 350 MHz.

In preparation to WRC-19, studies in response to *invites ITU-R c)* of Resolution **239 (WRC-15)** have shown that changing the WAS/RLAN operating conditions in 5 250-5 350 MHz as given in Resolution **229 (Rev.WRC-12)**, would not ensure protection of the radiodetermination service and EESS (active) sensors. Furthermore, it was confirmed that the current WAS/RLAN operating conditions in 5 250‑5 350 MHz band are sufficient for the operating needs of WAS/RLAN users.

### 2/1.16/3.2.3 Frequency range 5 350-5 470 MHz

The frequency band 5 350-5 470 MHz, or parts thereof, is allocated to the EESS, RLS, ARNS, SRS and RNS. The details of these allocations can be found in RR Article **5**.

#### 2/1.16/3.2.3.1 Earth exploration-satellite service (active) and the mobile service/RLAN

Previous ITU-R sharing studies show that sharing between RLAN and the EESS (active) systems in the 5 350-5 470 MHz frequency band would not be feasible unless additional RLAN mitigation measures are implemented. After further study of currently available mitigation measures, study results show that there are no feasible mitigation techniques to facilitate sharing between RLAN and EESS (active) in this band.

#### 2/1.16/3.2.3.2 Radar systems and the mobile service/RLANs

The regulatory provisions in the 5 150-5 250 MHz, 5 250-5 350 MHz and 5 470-5 725 MHz frequency ranges contained in Resolution **229 (Rev.WRC-12)** are insufficient to ensure protection of certain radar types in the 5 350-5 470 MHz frequency band. After further study of currently available mitigation measures, study results show that there are no feasible mitigation techniques to facilitate sharing between RLAN and the different radar systems in the 5 350-5 470 MHz frequency band.

### 2/1.16/3.2.4 Frequency range 5 725-5 850 MHz

The band 5 725-5 850 MHz is allocated to various services as contained in the RR Table of Frequency Allocations including associated footnotes thereto.

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 5 725-5 830  FIXED-SATELLITE (Earth-to-space)  RADIOLOCATION  Amateur | 5 725-5 830  RADIOLOCATION  Amateur | |
| 5.150 5.451 5.453 5.455 | 5.150 5.453 5.455 | |
| 5 830-5 850  FIXED-SATELLITE (Earth-to-space)  RADIOLOCATION  Amateur  Amateur-satellite (space-to-Earth) | 5 830-5 850  RADIOLOCATION  Amateur  Amateur-satellite (space-to-Earth) | |
| 5.150 5.451 5.453 5.455 | 5.150 5.453 5.455 | |

The studies described in the sub-sections below for the 5 725-5 850 MHz band did not address the impact of out-of-band emissions.

In this band a number of systems/applications operate in several countries in Region 1 including RTTT, WIA, BFWA and SRDs in addition to the designation of this band worldwide as ISM band. Some of these applications use WAS/RLAN technologies, operate at various power levels and use mitigation techniques (including DFS) to enable sharing with the incumbent services operating in this band. Appropriate mitigation measures may be required to be applied to WAS/RLAN in these countries, in order to achieve coexistence between WAS/RLAN and these systems/applications, if WRC-19 decides to allocate the frequency band 5 725-5 850 MHz to the mobile service in Region 1, with the purpose to accommodate WAS/RLAN use. One administration has regulations allowing generic WAS/RLAN use in the 5 725-5 850 MHz that requires the same DFS implementation as BFWA and WIA to enable sharing with their incumbent services.

In Region 2, the 5 725-5 825 MHz frequency range is also used by WAS including RLANs. The FSS allocation in 5 725‑5 850 MHz is in Region 1 only, therefore wireless WAS/RLAN and FSS sharing issues are not relevant in Regions 2 and 3.

In addition, RR No. **5.453** includes over 40 countries from Regions 1 and 3 which have allocated the 5 650-5 850 MHz frequency range to the fixed and mobile services on a primary basis for which the provisions of Resolution **229 (Rev.WRC-12)** do not apply. Some of these countries operate WAS/RLANs technology under this footnote and one country in Region 3 operates ITS under the mobile allocation of this footnote.

#### 2/1.16/3.2.4.1 Radar systems and the mobile service/RLANs

In one study of a single interferer to the ground-based radiolocation radars, the protection distances range from several tens km for outdoor WAS/RLAN and indoor WAS/RLAN as well. Consideration of multi-source interference result in additional increase of the required protection distance defined by the WAS/RLAN transmitter density and directivity characteristics of the considered radar. Thus based on this one study providing compatibility of WAS/RLAN with the radars operating in this frequency band will be difficult.

It should be noted that the current DFS techniques are not sufficient to protect the new frequency hopping radars modes operating in some countries in the 5 725-5 850 MHz band. No new elements have been presented on any additional mitigation techniques that could be used to provide protection to these new frequency hopping radars operating modes.

#### 2/1.16/3.2.4.2 Fixed-satellite service (allocated only in Region 1) and mobile service/RLANs

One study has been conducted with a variety of assumptions and interference environment. The initial conclusion was that sharing would be difficult without implementation of mitigation techniques.

Another study showed that by limiting the WAS/ RLANs to indoor only operations and a maximum e.i.r.p. of 200mW sharing, including associated mitigation techniques, can be achieved between WAS/RLANs and the FSS operating in Region 1 only in the 5 725-5 850 MHz band.

### 2/1.16/3.2.5 Frequency range 5 850-5 925 MHz

The band 5 850-5 925 MHz is allocated to various services as contained in the RR Table of Frequency Allocations including associated footnotes thereto.

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 5 850-5 925  FIXED  FIXED-SATELLITE (Earth-to-space)  MOBILE | 5 850-5 925  FIXED  FIXED-SATELLITE (Earth-to-space)  MOBILE  Amateur  Radiolocation | 5 850-5 925  FIXED  FIXED-SATELLITE  (Earth-to-space)  MOBILE  Radiolocation |
| 5.150 | 5.150 | 5.150 |

The mobile service is co-primary in the 5 850-5 925 MHz band. Applications under the mobile service have already been implemented in various countries throughout the world. Therefore any sharing analysis carried out under this agenda should not prejudice usages of the mobile service while not imposing any additional constraints on other services to which the band is allocated.

Concerns were raised about different applications operating under the primary mobile service in this band. Some sharing studies carried out so far on a national or regional basis looking at WAS (RLAN) as an interferer into ITS showed the need for appropriate separation distances, in cases of co-channel operation. As a result, work by some administrations and regional groups on possible mitigation techniques was initiated to help improve the compatibility between individual RLAN devices and ITS applications. Based upon the results of these studies so far, conclusions could not be reached.

This band is also allocated to the FSS for uplink operations in all three ITU regions supporting a variety of FSS applications including broadband service and studies should take account the protection of the current and planned FSS use.

# 2/1.16/4 Methods to satisfy the agenda item

Regulatory procedures associated with some of the methods as described below are provided by the proponents of the methods in question, reflect the view of that proponents, and were presented and discussed by ITU-R.

[NOTE: In case that reference is made to a specific country or regional situation in regard to the use of certain frequency bands under agenda item 1.16, since this may reflect the situation in that country thus it should not be generalized to give the impression that these conditions would be applicable to other countries or regions.]

[NOTE: Moreover, specific language is used in certain methods or its associated regulatory procedures which may not be consistent with past practices used by previous WRCs dealing with similar issues. CPM19-2 is invited to carefully consider these cases with a view to properly address them as needed.]

The frequency bands investigated under this agenda item, i.e. 5 150-5 250 MHz, 5 250-5 350 MHz, 5 350-5 470 MHz, 5 725-5 850 MHz and 5 850-5 925 MHz, are denoted by the letters **A**, **B**, **C**, **D**, and **E**, respectively. The following convention has been used for method numbering.

– If multiple methods are proposed for a particular frequency band, the methods are expressed by the associated letter and a numerical suffix. For example, the four methods proposed for the band 5 150-5 250 MHz are denoted by **Method A1**, **Method A2**, **Method A3** and **Method A4**.

– If only one method is proposed for a particular frequency band, the method is expressed by the associated letter. For instance, the only method proposed for the band 5 250‑5 350 MHz is denoted by **Method B**.

## 2/1.16/4.1 Frequency band A, 5 150-5 250 MHz

### 2/1.16/4.1.1 Method A1: No Change to the RR

No changes are proposed to the RR, with the exception of the suppression of Resolution **239 (WRC-15)**. The provisions of Resolution **229 (Rev.WRC-12)** applied to RLAN in this band should be retained to protect incumbents as supported by some ITU-R studies.

### 2/1.16/4.1.2 Method A2: Revision to Resolution 229 (Rev.WRC-12) to enable outdoor RLAN operations including possible associated conditions for new e.i.r.p. limits

Revisions to Resolution **229 (Rev.WRC-12)** are proposed in order to enable outdoor RLAN operations including possible associated conditions for new e.i.r.p. limits while addressing the protection of incumbent services.

### 2/1.16/4.1.3 Method A3: Revision to Resolution 229 (Rev.WRC-12) to enable outdoor RLAN operations by applying the same conditions of use as defined for the 5 250‑5 350 MHz band in *resolves* 4 of Resolution 229 (Rev.WRC-12)

Revisions to Resolution **229 (Rev.WRC-12)** are proposed to align the technical and regulatory conditions for the 5 150-5 250 MHz frequency band with those defined for the adjacent frequency band 5 250-5 350 MHz in *resolves* 4 of Resolution **229 (Rev.WRC-12)** to protect incumbent services.

### 2/1.16/4.1.4 Method A4: Revisions to Resolution 229 (Rev.WRC-12) to enable in-vehicle use of RLAN operation with e.i.r.p. up to 40 mW

Revisions to Resolution **229 (Rev.WRC-12)** are proposed to enable RLAN in-vehicle use associated with e.i.r.p. levels up to 40 mW, to provide the same level of protection established by Resolution **229 (Rev.WRC-12)** to incumbent services.

## 2/1.16/4.2 Frequency band B, 5 250-5 350 MHz

### 2/1.16/4.2.1 Method B: No Change to the RR

Only one method is proposed, with no change to RR, except suppression of Resolution **239 (WRC‑15)**. The provisions of Resolution **229 (Rev.WRC-12)** continue to be applied to RLAN in this band to protect incumbents.

## 2/1.16/4.3 Frequency band C, 5 350-5 470 MHz

### 2/1.16/4.3.1 Method C: No Change to the RR

Only one method is proposed, with no change to RR, except suppression of Resolution **239 (WRC‑15**).

## 2/1.16/4.4 Frequency band D, 5 725-5 850 MHz

### 2/1.16/4.4.1 Method D1: No Change to the RR

No changes are proposed to the RR, with the exception of the suppression of Resolution **239 (WRC-15)**.

### 2/1.16/4.4.2 Method D2: A new worldwide or Regional primary MS allocation

Allocate the 5 725-5 850 MHz band to the mobile service on primary basis worldwide or in Region 1 to accommodate WAS/RLAN use restricted to indoor operation with e.i.r.p. limits up to 200 mW including associated mitigation techniques and together with the revision of Resolution **229 (Rev.WRC-12)**.

### 2/1.16/4.4.3 Method D3: Accommodate WAS/RLAN in an existing or new footnote

This method accommodates WAS/RLAN in an existing footnote having mobile primary allocation or in a new footnote having mobile primary allocation.

## 2/1.16/4.5 Frequency band E, 5 850-5 925 MHz

### 2/1.16/4.5.1 Method E: No Change to the RR

Only one method is proposed, with no change to RR, except suppression of Resolution **239 (WRC‑15**).

# 2/1.16/5 Regulatory and procedural considerations

## 2/1.16/5.1 Frequency band A, 5 150-5 250 MHz

2/1.16/5.1.1 For Method A1

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations  
(See No. 2.1)

NOC

4 800-5 250 MHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 5 150-5 250 FIXED-SATELLITE (Earth-to-space) 5.447A  MOBILE except aeronautical mobile 5.446A 5.446B  AERONAUTICAL RADIONAVIGATION  5.446 5.446C 5.447 5.447B 5.447C | | |

2/1.16/5.1.2 For Method A2

MOD

RESOLUTION 229 (Rev.WRC‑19)

Use of the bands 5 150-5 250 MHz, 5 250-5 350 MHz and 5 470-5 725 MHz   
by the mobile service for the implementation of wireless access systems   
including radio local area networks

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

*a)* that WRC‑03 allocated the bands 5 150-5 350 MHz and 5 470-5 725 MHz on a primary basis to the mobile service for the implementation of wireless access systems (WAS), including radio local area networks (RLANs);

*b)* that WRC‑03 decided to make an additional primary allocation for the Earth exploration-satellite service (EESS) (active) in the band 5 460-5 570 MHz and space research service (SRS) (active) in the band 5 350-5 570 MHz;

*c)* that WRC‑03 decided to upgrade the radiolocation service to a primary status in the 5 350‑5 650 MHz band;

*d)* that the band 5 150-5 250 MHz is allocated worldwide on a primary basis to the fixed-satellite service (FSS) (Earth-to-space), this allocation being limited to feeder links of non‑geostationary-satellite systems in the mobile-satellite service (No. **5.447A**);

*e)* that the band 5 150-5 250 MHz is also allocated to the mobile service, on a primary basis, in some countries (No. **5.447**) subject to agreement obtained under No. **9.21**;

*f)* that the band 5 250-5 460 MHz is allocated to the EESS (active) and the band 5 250‑5 350 MHz to the SRS (active) on a primary basis;

*g)* that the band 5 250-5 725 MHz is allocated on a primary basis to the radiodetermination service;

*h)* that there is a need to protect the existing primary services in the 5 150-5 350 MHz and 5 470-5 725 MHz bands;

*i)* that results of studies in ITU‑R indicate that sharing in the band 5 150-5 250 MHz between WAS, including RLANs, and the FSS is feasible under specified conditions;

*j)* that studies have shown that sharing between the radiodetermination and mobile services in the bands 5 250-5 350 MHz and 5 470-5 725 MHz is only possible with the application of mitigation techniques such as dynamic frequency selection;

*k)* that there is a need to specify an appropriate e.i.r.p. limit and, where necessary, operational restrictions for WAS, including RLANs, in the mobile service in the bands 5 250‑5 350 MHz and 5 470-5 570 MHz in order to protect systems in the EESS (active) and SRS (active);

*l)* that the deployment density of WAS, including RLANs, will depend on a number of factors including intrasystem interference and the availability of other competing technologies and services;

*m)* that the means to measure or calculate the aggregate pfd level at FSS satellite receivers specified in Recommendation ITU‑R S.1426 are currently under study;

*n)* that certain parameters contained in Recommendation ITU‑R M.1454 related to the calculation of the number of RLANs tolerable by FSS satellite receivers operating in the band 5 150-5 250 MHz require further study;

*o)* that an aggregate pfd level has been developed in Recommendation ITU‑R S.1426 for the protection of FSS satellite receivers in the 5 150-5 250 MHz band,

further considering

*a)* that the interference from a single WAS, including RLANs, complying with the operational restrictions under *resolves*2 will not on its own cause any unacceptable interference to FSS receivers on board satellites in the band 5 150-5 250 MHz;

*b)* that such FSS satellite receivers may experience an unacceptable effect due to the aggregate interference from these WAS, including RLANs, especially in the case of a prolific growth in the number of these systems;

*c)* that the aggregate effect on FSS satellite receivers will be due to the global deployment of WAS, including RLANs, and it may not be possible for administrations to determine the location of the source of the interference and the number of WAS, including RLANs, in operation simultaneously,

noting

*a)* that, prior to WRC‑03, a number of administrations have developed regulations to permit indoor and outdoor WAS, including RLANs, to operate in the various bands under consideration in this Resolution;

*b)* that, in response to Resolution **229 (WRC‑03)[[3]](#footnote-3)\***, ITU‑R developed Report ITU‑R M.2115, which provides testing procedures for implementation of dynamic frequency selection,

recognizing

*a)* that in the band 5 600-5 650 MHz, ground-based meteorological radars are extensively deployed and support critical national weather services, according to footnote No. **5.452**;

*b)* that the performance and interference criteria of spaceborne active sensors in the EESS (active) are given in Recommendation ITU‑R RS.1166;

*c)* that a mitigation technique to protect radiodetermination systems is given in Recommendation ITU‑R M.1652;

*d)* that Recommendation ITU‑R RS.1632 identifies a suitable set of constraints for WAS, including RLANs, in order to protect the EESS (active) in the 5 250-5 350 MHz band;

*e)* that Recommendation ITU‑R M.1653 identifies the conditions for sharing between WAS, including RLANs, and the EESS (active) in the 5 470-5 570 MHz band;

*f)* that the stations in the mobile service should also be designed to provide, on average, a near-uniform spread of the loading of the spectrum used by stations across the band or bands in use to improve sharing with satellite services;

*g)* that WAS, including RLANs, provide effective broadband solutions, the future demand has increased since the frequency range was first identified for this application;

*h)* that there is a need for administrations to ensure that WAS, including RLANs, meet the required mitigation techniques, for example, through equipment or standards compliance procedures,

resolves

1 that the use of these bands by the mobile service is for the implementation of WAS, including RLANs, as described in the most recent version of Recommendation ITU‑R M.1450;

2 that in the band 5 150-5 250 MHz, stations in the mobile service shall be restricted to a maximum conducted output of 1 W provided the maximum antenna gain does not exceed 6 dBi (i.e., a total maximum mean e.i.r.p. of 36 dBm)[[4]](#footnote-4)1, and, in addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band, and, for the outdoor operation of stations in the mobile service the maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon shall not exceed 125 mW (21 dBm), and finally, for WAS/RLAN transmitters operating in the 5 150-5 250 MHz band, all unwanted emissions outside of the 5 150-5 350 MHz band shall not exceed an e.i.r.p. of –27 dBm/MHz;

3 that in the 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. Administrations are requested to take appropriate measures that will result in the predominant number of stations in the mobile service being operated in an indoor environment. Furthermore, stations in the mobile service that are permitted to be used either indoors or outdoors may operate up to 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, and, when operating above a mean e.i.r.p. of 200 mW, these stations shall comply with the following e.i.r.p. elevation angle mask where θ is the angle above the local horizontal plane (of the Earth):

−13 dB(W/MHz) for 0° ≤ θ < 8°

−13 − 0.716(θ − 8) dB(W/MHz) for 8° ≤ θ < 40°

−35.9 − 1.22(θ − 40) dB(W/MHz) for 40° ≤ θ ≤ 45°

−42 dB(W/MHz) for 45° < θ;

4 that administrations may exercise some flexibility in adopting other mitigation techniques, provided that they develop national regulations to meet their obligations to achieve an equivalent level of protection to the EESS (active) and the SRS (active) based on their system characteristics and interference criteria as stated in Recommendation ITU‑R RS.1632;

5 that in the band 5 470-5 725 MHz, stations in the mobile service shall be restricted to a maximum transmitter power of 250 mW[[5]](#footnote-6)2 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;

6 that in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, systems in the mobile service shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB;

7 that, in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, the mitigation measures found in Annex 1 to Recommendation ITU‑R M.1652‑1 shall be implemented by systems in the mobile service to ensure compatible operation with radiodetermination systems,

invites administrations

to consider appropriate measures when allowing the operation of stations in the mobile service using the e.i.r.p. elevation angle mask referred in *resolves*3 above, to ensure the equipment is operated in compliance with this mask,

invites ITU‑R

1 to continue studies on mitigation techniques to provide protection of EESS from stations in the mobile service;

2 to continue studies on suitable test methods and procedures for the implementation of dynamic frequency selection, taking into account practical experience.

2/1.16/5.1.3 For Method A3

MOD

RESOLUTION 229 (Rev.WRC‑19)

Use of the bands 5 150-5 250 MHz, 5 250-5 350 MHz and 5 470-5 725 MHz   
by the mobile service for the implementation of wireless access systems   
including radio local area networks

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

*a)* that WRC‑03 allocated the bands 5 150-5 350 MHz and 5 470-5 725 MHz on a primary basis to the mobile service for the implementation of wireless access systems (WAS), including radio local area networks (RLANs);

*b)* that WRC‑03 decided to make an additional primary allocation for the Earth exploration-satellite service (EESS) (active) in the band 5 460-5 570 MHz and space research service (SRS) (active) in the band 5 350-5 570 MHz;

*c)* that WRC‑03 decided to upgrade the radiolocation service to a primary status in the 5 350‑5 650 MHz band;

*d)* that the band 5 150-5 250 MHz is allocated worldwide on a primary basis to the fixed-satellite service (FSS) (Earth-to-space), this allocation being limited to feeder links of non‑geostationary-satellite systems in the mobile-satellite service (No. **5.447A**);

*e)* that the band 5 150-5 250 MHz is also allocated to the mobile service, on a primary basis, in some countries (No. **5.447**) subject to agreement obtained under No. **9.21**;

*f)* that the band 5 250-5 460 MHz is allocated to the EESS (active) and the band 5 250‑5 350 MHz to the SRS (active) on a primary basis;

*g)* that the band 5 250-5 725 MHz is allocated on a primary basis to the radiodetermination service;

*h)* that there is a need to protect the existing primary services in the 5 150-5 350 MHz and 5 470-5 725 MHz bands;

*i)* that results of studies in ITU‑R indicate that sharing in the band 5 150-5 250 MHz between WAS, including RLANs, and the FSS is feasible under specified conditions;

*j)* that studies have shown that sharing between the radiodetermination and mobile services in the bands 5 250-5 350 MHz and 5 470-5 725 MHz is only possible with the application of mitigation techniques such as dynamic frequency selection;

*k)* that there is a need to specify an appropriate e.i.r.p. limit and, where necessary, operational restrictions for WAS, including RLANs, in the mobile service in the bands 5 250‑5 350 MHz and 5 470-5 570 MHz in order to protect systems in the EESS (active) and SRS (active);

*l)* that the deployment density of WAS, including RLANs, will depend on a number of factors including intrasystem interference and the availability of other competing technologies and services

*m)* that the means to measure or calculate the aggregate pfd level at FSS satellite receivers specified in Recommendation ITU‑R S.1426 are currently under study;

*n)* that certain parameters contained in Recommendation ITU‑R M.1454 related to the calculation of the number of RLANs tolerable by FSS satellite receivers operating in the band 5 150-5 250 MHz require further study;

*o)* that an aggregate pfd level has been developed in Recommendation ITU‑R S.1426 for the protection of FSS satellite receivers in the 5 150-5 250 MHz band,

further considering

*a)* that the interference from a single WAS, including RLANs, complying with the operational restrictions under *resolves*2 will not on its own cause any unacceptable interference to FSS receivers on board satellites in the band 5 150-5 250 MHz;

*b)* that such FSS satellite receivers may experience an unacceptable effect due to the aggregate interference from these WAS, including RLANs, especially in the case of a prolific growth in the number of these systems;

*c)* that the aggregate effect on FSS satellite receivers will be due to the global deployment of WAS, including RLANs, and it may not be possible for administrations to determine the location of the source of the interference and the number of WAS, including RLANs, in operation simultaneously,

noting

*a)* that, prior to WRC‑03, a number of administrations have developed regulations to permit indoor and outdoor WAS, including RLANs, to operate in the various bands under consideration in this Resolution;

*b)* that, in response to Resolution **229 (WRC‑03)[[6]](#footnote-7)\***, ITU‑R developed Report ITU‑R M.2115, which provides testing procedures for implementation of dynamic frequency selection,

recognizing

*a)* that in the band 5 600-5 650 MHz, ground-based meteorological radars are extensively deployed and support critical national weather services, according to footnote No. **5.452**;

*b)* that the performance and interference criteria of spaceborne active sensors in the EESS (active) are given in Recommendation ITU‑R RS.1166;

*c)* that a mitigation technique to protect radiodetermination systems is given in Recommendation ITU‑R M.1652;

*d)* that Recommendation ITU‑R RS.1632 identifies a suitable set of constraints for WAS, including RLANs, in order to protect the EESS (active) in the 5 250-5 350 MHz band;

*e)* that Recommendation ITU‑R M.1653 identifies the conditions for sharing between WAS, including RLANs, and the EESS (active) in the 5 470-5 570 MHz band;

*f)* that the stations in the mobile service should also be designed to provide, on average, a near-uniform spread of the loading of the spectrum used by stations across the band or bands in use to improve sharing with satellite services;

*g)* that WAS, including RLANs, provide effective broadband solutions, the future demand has increased since the frequency range was first identified for this application;

*h)* that there is a need for administrations to ensure that WAS, including RLANs, meet the required mitigation techniques, for example, through equipment or standards compliance procedures,

resolves

1 that the use of these bands by the mobile service will be for the implementation of WAS, including RLANs, as described in the most recent version of Recommendation ITU‑R M.1450;

2 that in the bands 5 150-5 250 MHz and 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. Administrations are requested to take appropriate measures that will result in the predominant number of stations in the mobile service being operated in an indoor environment. Furthermore, stations in the mobile service that are permitted to be used either indoors or outdoors may operate up to 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, and, when operating above a mean e.i.r.p. of 200 mW, these stations shall comply with the following e.i.r.p. elevation angle mask where θ is the angle above the local horizontal plane (of the Earth):

−13 dB(W/MHz) for 0° ≤ θ < 8°

−13 − 0.716(θ − 8) dB(W/MHz) for 8° ≤ θ < 40°

−35.9 − 1.22(θ − 40) dB(W/MHz) for 40° ≤ θ ≤ 45°

−42 dB(W/MHz) for 45° < θ;

3 that administrations may exercise some flexibility in adopting other mitigation techniques, provided that they develop national regulations to meet their obligations to achieve an equivalent level of protection to the EESS (active) and the SRS (active) based on their system characteristics and interference criteria as stated in Recommendation ITU‑R RS.1632;

4 that in the band 5 470-5 725 MHz, stations in the mobile service shall be restricted to a maximum transmitter power of 250 mW[[7]](#footnote-10)1 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;

5 that in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, systems in the mobile service shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB;

6 that, in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, the mitigation measures found in Annex 1 to Recommendation ITU‑R M.1652‑1 shall be implemented by systems in the mobile service to ensure compatible operation with radiodetermination systems,

invites administrations

to consider appropriate measures when allowing the operation of stations in the mobile service using the e.i.r.p. elevation angle mask referred in *resolves*2 above, to ensure the equipment is operated in compliance with this mask,

invites ITU‑R

1 to continue studies on mitigation techniques to provide protection of EESS from stations in the mobile service;

2 to continue studies on suitable test methods and procedures for the implementation of dynamic frequency selection, taking into account practical experience.

2/1.16/5.1.4 For Method A4

No Change to the preamble (*considering*, *noting* and *recognizing* parts) of Resolution **229 (Rev.WRC-12)**.

MOD

RESOLUTION 229 (Rev.WRC‑19)

Use of the bands 5 150-5 250 MHz, 5 250-5 350 MHz and 5 470-5 725 MHz   
by the mobile service for the implementation of wireless access systems   
including radio local area networks

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

…/…

resolves

1 that the use of these bands by the mobile service is for the implementation of WAS, including RLANs, as described in the most recent version of Recommendation ITU‑R M.1450;

2 that in the band 5 150-5 250 MHz, indoor stations in the mobile service shall operate with a maximum mean e.i.r.p.[[8]](#footnote-11)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, and, moreover, the in-vehicle use shall operate with a maximum e.i.r.p. of 40mW;

…/…

## 2/1.16/5.2 Frequency band B, 5 250-5 350 MHz

2/1.16/5.2.1 For Method B

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations  
(See No. 2.1)

NOC

5 250-5 570 MHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 5 250-5 255 EARTH EXPLORATION-SATELLITE (active)  MOBILE except aeronautical mobile 5.446A 5.447F  RADIOLOCATION  SPACE RESEARCH 5.447D  5.447E 5.448 5.448A | | |
| 5 255-5 350 EARTH EXPLORATION-SATELLITE (active)  MOBILE except aeronautical mobile 5.446A 5.447F  RADIOLOCATION  SPACE RESEARCH (active)  5.447E 5.448 5.448A | | |

## 2/1.16/5.3 Frequency band C, 5 350-5 470 MHz

2/1.16/5.3.1 For Method C

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations  
(See No. 2.1)

NOC

5 250-5 570 MHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 5 350-5 460 EARTH EXPLORATION-SATELLITE (active) 5.448B  RADIOLOCATION 5.448D  AERONAUTICAL RADIONAVIGATION 5.449  SPACE RESEARCH (active) 5.448C | | |
| 5 460-5 470 EARTH EXPLORATION-SATELLITE (active)  RADIOLOCATION 5.448D  RADIONAVIGATION 5.449  SPACE RESEARCH (active)  5.448B | | |

## 2/1.16/5.4 Frequency band D, 5 725-5 850 MHz

2/1.16/5.4.1 For Method D1

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations  
(See No. 2.1)

NOC

5 570-6 700 MHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 5 725-5 830  FIXED-SATELLITE (Earth-to-space)  RADIOLOCATION  Amateur | 5 725-5 830  RADIOLOCATION  Amateur | |
| 5.150 5.451 5.453 5.455 | 5.150 5.453 5.455 | |
| 5 830-5 850  FIXED-SATELLITE (Earth-to-space)  RADIOLOCATION  Amateur  Amateur-satellite (space-to-Earth) | 5 830-5 850  RADIOLOCATION  Amateur  Amateur-satellite (space-to-Earth) | |
| 5.150 5.451 5.453 5.455 | 5.150 5.453 5.455 | |

2/1.16/5.4.2 For Method D2

MOD

5 570-6 700 MHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 5 725-5 830  FIXED-SATELLITE (Earth-to-space)  MOBILE  RADIOLOCATION  Amateur | 5 725-5 830  MOBILE  RADIOLOCATION  Amateur | |
| 5.150 5.451 5.453 5.455 | 5.150 5.453 5.455 | |
| 5 830-5 850  FIXED-SATELLITE (Earth-to-space)  MOBILE  RADIOLOCATION  Amateur  Amateur-satellite (space-to-Earth) | 5 830-5 850  MOBILE  RADIOLOCATION  Amateur  Amateur-satellite (space-to-Earth) | |
| 5.150 5.451 5.453 5.455 | 5.150 5.453 5.455 | |

MOD

RESOLUTION 229 (Rev.WRC‑19)

Use of the bands 5 150-5 250 MHz, 5 250-5 350 MHz, 5 470-5 725 MHz and  
5 725-5 850 MHz by the mobile service for the implementation of   
wireless access systems including radio local area networks

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

*a)* that WRC‑03 allocated the bands 5 150-5 350 MHz and 5 470-5 725 MHz on a primary basis to the mobile service for the implementation of wireless access systems (WAS), including radio local area networks (RLANs);

*b)* that WRC‑03 decided to make an additional primary allocation for the Earth exploration-satellite service (EESS) (active) in the band 5 460-5 570 MHz and space research service (SRS) (active) in the band 5 350-5 570 MHz;

*c)* that WRC‑03 decided to upgrade the radiolocation service to a primary status in the 5 350‑5 650 MHz band;

*d)* that the band 5 150-5 250 MHz is allocated worldwide on a primary basis to the fixed-satellite service (FSS) (Earth-to-space), this allocation being limited to feeder links of non‑geostationary-satellite systems in the mobile-satellite service (No. **5.447A**);

*e)* that the band 5 150-5 250 MHz is also allocated to the mobile service, on a primary basis, in some countries (No. **5.447**) subject to agreement obtained under No. **9.21**;

*f)* that the band 5 250-5 460 MHz is allocated to the EESS (active) and the band 5 250‑5 350 MHz to the SRS (active) on a primary basis;

*g)* that the band 5 250-5 850 MHz is allocated on a primary basis to the radiodetermination service;

*h)* that the band 5 725-5 850 MHz is allocated in Region 1 only, on a primary basis to the fixed‑satellite service (FSS) (Earth-to-space);

*i)* that there is a need to protect the existing primary services in the 5 150-5 350 MHz and 5 470-5 850 MHz bands;

*j)* that results of studies in ITU‑R indicate that sharing in the band 5 150-5 250 MHz and 5 725-5 850 MHz (Region 1 only) between WAS, including RLANs, and the FSS is feasible under specified conditions;

*k)* that studies have shown that sharing between the radiodetermination and mobile services in the bands 5 250-5 350 MHz and 5 470-5 725 MHz is only possible with the application of mitigation techniques such as dynamic frequency selection;

*l)* that there is a need to specify an appropriate e.i.r.p. limit and, where necessary, operational restrictions for WAS, including RLANs, in the mobile service in the bands 5 250‑5 350 MHz and 5 470-5 570 MHz in order to protect systems in the EESS (active) and SRS (active);

*m)* that the deployment density of WAS, including RLANs, will depend on a number of factors including intrasystem interference and the availability of other competing technologies and services;

*n)* that the means to measure or calculate the aggregate pfd level at FSS satellite receivers specified in Recommendation ITU‑R S.1426 are currently under study;

*o)* that certain parameters contained in Recommendation ITU‑R M.1454 related to the calculation of the number of RLANs tolerable by FSS satellite receivers operating in the band 5 150-5 250 MHz require further study;

*p)* that an aggregate pfd level has been developed in Recommendation ITU‑R S.1426 for the protection of FSS satellite receivers in the 5 150-5 250 MHz band,

further considering

*a)* that the interference from a single WAS, including RLANs, complying with the operational restrictions under *resolves*2 will not on its own cause any unacceptable interference to FSS receivers on board satellites in the bands 5 150-5 250 MHz and 5 725-5 850 MHz (Region 1 only);

*b)* that such FSS satellite receivers may experience an unacceptable effect due to the aggregate interference from these WAS, including RLANs, especially in the case of a prolific growth in the number of these systems;

*c)* that the aggregate effect on FSS satellite receivers will be due to the global deployment of WAS, including RLANs, and it may not be possible for administrations to determine the location of the source of the interference and the number of WAS, including RLANs, in operation simultaneously,

noting

*a)* that, prior to WRC‑03, a number of administrations have developed regulations to permit indoor and outdoor WAS, including RLANs, to operate in the various bands under consideration in this Resolution;

*b)* that, in response to Resolution **229 (WRC‑03)[[9]](#footnote-12)\***, ITU‑R developed Report ITU‑R M.2115, which provides testing procedures for implementation of dynamic frequency selection,

recognizing

*a)* that in the band 5 600-5 650 MHz, ground-based meteorological radars are extensively deployed and support critical national weather services, according to footnote No. **5.452**;

*b)* that the performance and interference criteria of spaceborne active sensors in the EESS (active) are given in Recommendation ITU‑R RS.1166;

*c)* that a mitigation technique to protect radiodetermination systems is given in Recommendation ITU‑R M.1652;

*d)* that Recommendation ITU‑R RS.1632 identifies a suitable set of constraints for WAS, including RLANs, in order to protect the EESS (active) in the 5 250-5 350 MHz band;

*e)* that Recommendation ITU‑R M.1653 identifies the conditions for sharing between WAS, including RLANs, and the EESS (active) in the 5 470-5 570 MHz band;

*f)* that the stations in the mobile service should also be designed to provide, on average, a near-uniform spread of the loading of the spectrum used by stations across the band or bands in use to improve sharing with satellite services;

*g)* that WAS, including RLANs, provide effective broadband solutions, the future demand has increased since the frequency range was first identified for this application;

*h)* that there is a need for administrations to ensure that WAS, including RLANs, meet the required mitigation techniques, for example, through equipment or standards compliance procedures,

resolves

1 that the use of these bands by the mobile service is for the implementation of WAS, including RLANs, as described in the most recent version of Recommendation ITU‑R M.1450;

2 that in the band 5 150-5 250 MHz, stations in the mobile service shall be restricted to indoor use with a maximum mean e.i.r.p.[[10]](#footnote-13)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;

3 that administrations may monitor whether the aggregate pfd levels given in Recommendation ITU‑R S.1426[[11]](#footnote-14)2 have been, or will be exceeded in the future, in order to enable a future competent conference to take appropriate action;

4 that in the 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. Administrations are requested to take appropriate measures that will result in the predominant number of stations in the mobile service being operated in an indoor environment. Furthermore, stations in the mobile service that are permitted to be used either indoors or outdoors may operate up to 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, and, when operating above a mean e.i.r.p. of 200 mW, these stations shall comply with the following e.i.r.p. elevation angle mask where θ is the angle above the local horizontal plane (of the Earth):

−13 dB(W/MHz) for 0° ≤ θ < 8°

−13 − 0.716(θ − 8) dB(W/MHz) for 8° ≤ θ < 40°

−35.9 − 1.22(θ − 40) dB(W/MHz) for 40° ≤ θ ≤ 45°

−42 dB(W/MHz) for 45° < θ;

5 that administrations may exercise some flexibility in adopting other mitigation techniques, provided that they develop national regulations to meet their obligations to achieve an equivalent level of protection to the EESS (active) and the SRS (active) based on their system characteristics and interference criteria as stated in Recommendation ITU‑R RS.1632;

6 that in the band 5 470-5 725 MHz, stations in the mobile service shall be restricted to a maximum transmitter power of 250 mW[[12]](#footnote-15)3 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;

7*(Alt. A)* that in the band 5 725-5 850 MHz, stations in the mobile service shall be restricted to indoor[[13]](#footnote-16) use with a 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*

7*(Alt. B)* that in Region 1 only in the band 5 725-5 850 MHz, stations in the mobile service shall be restricted to indoor[[14]](#footnote-17) use with a 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;

8 that in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, systems in the mobile service shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB;

9*(Alt. A)* that in the band 5 725-5 850 MHz, stations in the mobile service shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB;

*OR*

9*(Alt. B)* that in Region 1 only in the band 5 725-5 850 MHz, stations in the mobile service shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB;

10 that, in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, the mitigation measures found in Annex 1 to Recommendation ITU‑R M.1652‑1 shall be implemented by systems in the mobile service to ensure compatible operation with radiodetermination systems;

11*(Alt.A)* that in the band 5 725-5 850 MHz, the mitigation measures found in Annex 1 to Recommendation ITU‑R M.1652‑1 shall be implemented by systems in the mobile service to ensure compatible operation with radiodetermination systems,

*OR*

11*(Alt.B)* that in Region 1 only in the band 5 725-5 850 MHz, the mitigation measures found in Annex 1 to Recommendation ITU‑R M.1652‑1 shall be implemented by systems in the mobile service to ensure compatible operation with radiodetermination systems,

invites administrations

to consider appropriate measures when allowing the operation of stations in the mobile service using the e.i.r.p. elevation angle mask referred in *resolves*4 above, to ensure the equipment is operated in compliance with this mask,

invites ITU‑R

1 to continue studies on mitigation techniques to provide protection of EESS from stations in the mobile service;

2 to continue studies on suitable test methods and procedures for the implementation of dynamic frequency selection, taking into account practical experience.

[NOTE: It should be noted that footnote 3 of Resolution **229 (Rev.WRC-12)** (“Administrations with existing regulations prior to WRC-03 may exercise some flexibility in determining transmitter power limits”) may need to be revisited by WRC-19 in particular regarding its duration and scope of applications including reference to the countries or sub-regions that are benefiting from this grand-fathering.]

2/1.16/5.4.3 For Method D3

Example of modified footnote:

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations  
(See No. 2.1)

MOD

5.453 *Additional allocation:* in Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Cameroon, China, Congo (Rep. of the), Korea (Rep. of), Côte d’Ivoire, Djibouti, Egypt, the United Arab Emirates, Gabon, Guinea, Equatorial Guinea, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kenya, Kuwait, Lebanon, Libya, Madagascar, Malaysia, Niger, Nigeria, Oman, Uganda, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, the Dem. People’s Rep. of Korea, Singapore, Sri Lanka, Swaziland, Tanzania, Chad, Thailand, Togo, Viet Nam, [*Country name*] and Yemen, the band 5 650-5 850 MHz is also allocated to the fixed and mobile services on a primary basis. In this case, the provisions of Resolution **229** **(Rev.WRC‑[12/19])** do not apply.    (WRC‑19)

[NOTE: The version of Resolution **229** to be referred to in RR No. **5.453** will depend on the decision of WRC-19 on the matter.]

Example of new footnote.

ADD

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5.A116 *Additional allocation:* In ………………, [*Country name*], the band 5 725-5 850 MHz is also allocated to the mobile service on a primary basis.    (WRC‑19)

## 2/1.16/5.6 For the frequency band 5 850-5 925 MHz

2/1.16/5.6.1 For Method E

NOC

5 570-6 700 MHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 5 850-5 925  FIXED  FIXED-SATELLITE (Earth-to-space)  MOBILE | 5 850-5 925  FIXED  FIXED-SATELLITE (Earth-to-space)  MOBILE  Amateur  Radiolocation | 5 850-5 925  FIXED  FIXED-SATELLITE  (Earth-to-space)  MOBILE  Radiolocation |
| 5.150 | 5.150 | 5.150 |

2/1.16/5.7 For all frequency bands and all Methods

SUP

RESOLUTION 239 (WRC‑15)

Studies concerning Wireless Access Systems including radio local   
area networks in the frequency bands between   
5 150 MHz and 5 925 MHz

1. *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2015-2020*, pp. 24-25 (3 Feb. 2016), available at <http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.pdf>. [↑](#footnote-ref-1)
2. *Id.* at p. 25. [↑](#footnote-ref-2)
3. \* *Note by the Secretariat:* This Resolution was revised by WRC-12. [↑](#footnote-ref-3)
4. 1 In the context of this Resolution, “mean e.i.r.p.” refers to the e.i.r.p. during the transmission burst which corresponds to the highest power, if power control is implemented. [↑](#footnote-ref-4)
5. 2 Administrations with existing regulations prior to WRC‑03 may exercise some flexibility in determining transmitter power limits. [↑](#footnote-ref-6)
6. \* *Note by the Secretariat:* This Resolution was revised by WRC-12. [↑](#footnote-ref-7)
7. 1 Administrations with existing regulations prior to WRC‑03 may exercise some flexibility in determining transmitter power limits. [↑](#footnote-ref-10)
8. 1 In the context of this Resolution, “mean e.i.r.p.” refers to the e.i.r.p. during the transmission burst which corresponds to the highest power, if power control is implemented. [↑](#footnote-ref-11)
9. \* *Note by the Secretariat:* This Resolution was revised by WRC-12. [↑](#footnote-ref-12)
10. 1 In the context of this Resolution, “mean e.i.r.p.” refers to the e.i.r.p. during the transmission burst which corresponds to the highest power, if power control is implemented. [↑](#footnote-ref-13)
11. 2 −124 − 20 log10 (*hSAT*/1 414) dB(W/(m2 · 1 MHz)), or equivalently,

    −140 − 20 log10 (*hSAT*/1 414) dB(W/(m2 · 25 kHz)), at the FSS satellite orbit, where *hSAT* is the altitude of the satellite (km). [↑](#footnote-ref-14)
12. 3 Administrations with existing regulations prior to WRC‑03 may exercise some flexibility in determining transmitter power limits. [↑](#footnote-ref-15)
13. In this context “indoor only” should be considered as “no fixed outdoor usage” to allow for accidental outdoor usage by mobile terminals. [↑](#footnote-ref-16)
14. In this context “indoor only” should be considered as “no fixed outdoor usage” to allow for accidental outdoor usage by mobile terminals. [↑](#footnote-ref-17)