|  |  |
| --- | --- |
| **Radiocommunication Study Groups** |  |
|  |  |
|  |  |
| Source: Document 5A/TEMP/184(Rev.1) | **Annex 20 to Document 5A/491-E** |
| **26 November 2021** |
| **English only** |
| Annex 20 to Working Party 5A Chairman’s Report | |
| WORKING DOCUMENT TOWARDS A DRAFT REPORT FOR SHARING  AND COMPATIBILITY STUDIES IN COMPLIANCE WITH  RESOLUTION 246 (WRC‑19) IN RELATION WITH WRC-23 AGENDA ITEM 1.3 | |
|  | |

[Editor’s Note: This document has not yet been fully reviewed and agreed by WP 5A]

NOTE: During the discussion of WRC-23 agenda item 1.3 and associated Resolution **246 (WRC-19)** two views were expressed in relation with whether sharing and compatibility studies should take into account in-band only or the adjacent band as well. Resolution **246 (WRC-19)** *resolves* to “invite the ITU-R sector refer to conducting sharing and compatibility studies for in-band and adjacent band as appropriate”

View 1:

Some administrations are of the view that there should be no sharing studies to be conducted for the adjacent band since there was no agreement in the conference to conduct sharing and compatibility studies for adjacent band by adding the term, “as appropriate”.

View 2:

The above-mentioned view was not shared by some other administrations due to the fact that sharing and compatibility studies to be done for both in-band and adjacent band, since conducting sharing and compatibility studies in adjacent band is clearly and specifically mentioned in the resolves part of Resolution **246 (WRC-19).**

# 1 Introduction

WRC-19 approved WRC-23 agenda item 1.3 calling upon WRC-23 *to consider primary allocation of the frequency band 3 600-3 800 MHz to the mobile service in Region 1 and take appropriate regulatory actions, in accordance with* ***Resolution 246 (WRC-19)****;*

Resolution **246 (WRC-19)** on “*Studies to consider possible allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis within Region* 1”

*– invites the ITU Radiocommunication Sector* to conduct sharing and compatibility studies in time for WRC-23 between the mobile service and other services allocated on a primary basis within the frequency band 3 600-3 800 MHz and adjacent frequency bands in Region 1, as appropriate, to ensure protection of those services to which the frequency band is allocated on a primary basis and not impose undue constraints on the existing services and their future development,

*– invites the 2023 World Radiocommunication Conference,* based on the results of studies in resolves to invite the ITU Radiocommunication Sector, to consider possible upgrade of the allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis within Region 1, and to take appropriate regulatory actions,

This Report contains studies of technical and regulatory conditions for coexistence of the Mobile service with existing primary services in 3 600-3 800 MHz and in adjacent bands, as appropriate, as well as other information that can be valuable in making a decision on the upgrade to primary of the Mobile allocation in the band.

# 2 Allocation information in the 3 600-3 800 MHz frequency band and in adjacent bands

[Editor’s note: This section provides the service allocation information from the Radio Regulations in the frequency band and in adjacent bands.]

| Allocation to services | | | | |
| --- | --- | --- | --- | --- |
| Region 1 | | Region 2 | | Region 3 |
| 3 600-4 200  FIXED  FIXED-SATELLITE (space-to-Earth)  Mobile | 3 600-3 700  FIXED  FIXED-SATELLITE (space-to-Earth)  MOBILE except aeronautical mobile 5.434  Radiolocation 5.433 | | 3 600-3 700  FIXED  FIXED-SATELLITE (space-to-Earth)  MOBILE except aeronautical mobile  Radiolocation  5.435 | |
| 3 700-4 200  FIXED  FIXED-SATELLITE (space-to-Earth)  MOBILE except aeronautical mobile | | | |

# 3 Review of existing ITU-R Recommendations and Reports

[Editor’s note: This section contains a review of existing ITU deliverables addressing coexistence of Mobile services with FSS or FS in the band and in adjacent bands]

## 3.1 The review of study history in ITU

The frequency band 3 400-4 200MHz has been studied in several WRC agenda items previously in ITU-R for possible mobile service allocation and/or IMT identification. The Table 1 below summarized the review of study history in ITU.

TABLE 1

Review of study history in ITU

| Frequency bands | WRC agenda item | Content | Related Resolution | Study results in CPM |
| --- | --- | --- | --- | --- |
| 3 400-4 200 MHz | WRC-07 1.4 | to consider frequency-related matters for the future development of IMT-2000 and systems beyond IMT-2000 taking into account the results of ITU-R studies in accordance with Resolution **228 (Rev.WRC-03)** | Resolution **228 (Rev.WRC-03)** – Studies on frequency-related matters for the future development of IMT-2000 and systems beyond IMT-2000 as defined by ITU-R | 1/1.4/4.2 Summary of technical and operational studies and relevant ITU-R Recommendations and Reports |
| 3 400-4 200 MHz | WRC-15 1.1 | to consider additional spectrum allocations to the mobile service on a primary basis and identification of additional frequency bands for International Mobile Telecommunications (IMT) and related regulatory provisions, to facilitate the development of terrestrial mobile broadband applications, in accordance with Resolution **233 (WRC-12)**; | Resolution **233 (WRC-12)** – Studies on frequency-related matters on International Mobile Telecommunications and other terrestrial mobile broadband applications | 1/1.1/4.1.8 Frequency bands within the range 3 400-4 200 MHz |
| 3 600-3 800 MHz | WRC-23 1.3 | to consider primary allocation of the frequency band 3 600-3 800 MHz to the mobile service in Region 1 and take appropriate regulatory actions, in accordance with Resolution **246 (WRC 19)**; | Resolution **246 (WRC-19)** –Studies to consider possible allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis within Region 1 | TBD |

## 3.2 The review of existing ITU-R Reports and/or Recommendations

ITU-R has developed certain ITU-R Reports in different WRC study cycles to address the sharing and compatibility issues in the frequency band 3 400- 4 200 MHz. Table 2 provides the review of existing ITU-R Reports and/or Recommendations related to WRC-23 agenda item 1.3.

TABLE 2

Review of existing ITU-R Reports and/or Recommendations related to WRC-23 agenda item 1.3

|  | Title | Scope and content | Related WRC agenda | Approved Date |
| --- | --- | --- | --- | --- |
| Report ITU-R S.2368 | Sharing studies between International Mobile Telecommunication-Advanced systems and geostationary satellite networks in the fixed-satellite service in the 3 400-4 200 MHz and 4 500‑4 800 MHz frequency bands in the WRC study cycle leading to WRC‑15 | This Report describes sharing studies between IMT-Advanced systems and geostationary satellite networks in the fixed-satellite service in the 3 400-4 200 MHz and 4 500-4 800 MHz frequency bands. | WRC-15 1.1 | 06/2015 |
| Report ITU-R M.2109 | Sharing studies between IMT-Advanced systems and geostationary satellite networks in the fixed-satellite service in the 3 400-4 200 and 4 500-4 800 MHz frequency bands | This Report provides a summary of the sharing studies between IMT-Advanced systems and geostationary satellite networks in the fixed-satellite service (FSS) in the 3 400-4 200 and 4 500‑4 800 MHz frequency bands. | WRC-07 1.4 | 2007 |
| Report ITU-R M.2111 | Sharing studies between IMT-Advanced and the radiolocation service in the 3 400-3 700 MHz bands | This Report provides sharing studies between radar systems and IMT-Advanced systems in the bands 3 400-3 700 MHz, and potential interference mitigation techniques. | WRC-07 1.4 | 2007 |
| Report ITU-R F.2328 | Sharing and compatibility between international mobile telecommunication systems and fixed service systems in the 3 400-4 200 MHz frequency range | This Report examines the compatibility of proposed international mobile telecommunication (IMT) systems and fixed service (FS) systems operating in the 3 400-4 200 MHz frequency range | WRC-15 1.1 | 11/2014 |

The Report ITU-R S.2368 is the latest document developed by ITU-R in 2015 which is related to the frequency band 3 400-4 200 MHz.

TABLE 3

Review of Report ITU-R S.2368

| Annex / Study # | Source | Operating frequency band | | Co-channel and/or  Adjacent channel |
| --- | --- | --- | --- | --- |
| IMT | FSS ES |
| 1 | Japan | 3 400-4 200 MHz 4 500-4 800 MHz | 3 400-4 200 MHz 4 500-4 800 MHz | Co-channel |
| 2 | UMTS Forum | 3 400-4 200 MHz | 3 400-4 200 MHz | Co-channel |
| adjacent channel |
| 3 | Japan | 3 400-4 200 MHz | 3 400-4 200 MHz | Co-channel |
| adjacent channel |
| 4 | NABA | 3 400-4 200 MHz | 3 400-4 200 MHz | Co-channel |
| adjacent channel |
| 5 | USA | 3 400-4 200 MHz 4 500-4 800 MHz | 3 400-4 200 MHz 4 500-4 800 MHz | Co-channel |
| adjacent channel |
| 6 | GSMA | 3 400-4 200 MHz | 3 400-4 200 MHz | Co-channel |
| 7 | China | 3 300-3 400/ 4 400-4 500/ 4 800-4 990 MHz | 3 400-4 200 MHz 4 500-4 800 MHz | adjacent channel |
| 8 | Inmarsat | 3 400-4 200 MHz | 3 400-4 200 MHz | Co-channel |
| 9 | GSMA | 3 400-4 200 MHz | 3 400-4 200 MHz | adjacent channel |
| 10 | Intel | 3 400-4 200 MHz | 3 400-4 200 MHz | Co-channel |
| adjacent channel |
| 11 | Brazil | 3 400-3 600 MHz | 3600-4200 MHz | adjacent channel |

[Editor's note: the text in brackets below is to be corrected in the future meeting in particular the text in italics]

[

Based on the review Report ITU-R S.2368 and corresponding input contributions, when conducting any new sharing studies or reusing the existing studies in ITU-R towards WRC-23 agenda item 1.3, the results are very variable and depend on assumptions. After initial review of the technical studies in Report ITU-R S.2368, the following initial observations can be made:

1. The parameters of IMT system

The studies in Report ITU-R S.2368 were mainly carried out based on non-AAS IMT base stations. *[However, the parameters for IMT system towards WRC-23 agenda item 1.3 are still under discussion in WP5D and they will be liaised to WP5A in the June meeting of WP5D. While, technical studies on non-AAS antenna pattern of IMT-Advanced base stations can be kindly considered, as reference or reused, towards sharing and compatibility studies of WRC-23 agenda item 1.3.]*

2. The FSS characteristics and protection criteria of FSS receiver

The protection criteria of FSS receiver used in Report ITU-R S.2368 was based on the study in WRC-15. *[However, WP4A has restudied the protection criteria issue in the WRC-19 study cycle. Besides, WP4A is currently discussing this protection criteria issue in its CG-7 (FSS and BSS characteristics and protection criteria necessary for WRC-23). The FSS and BSS characteristics and protection criteria will be liaised to WP5A in the July meeting of WP4A.]*

# 3 The propagation model

The propagation model used in the studies of Report ITU-R S.2368 is Recommendation ITU-R P.452-14 (10/2009) or ITU-R P.452-15 (09/2013). *[However, the current version in force of Recommendation ITU-R P.452 is version 16 and it is also considered to be updated in SG3 (CG 3K-3M-18) for the study towards WRC-23 agenda items. The latest status of the propagation matters will be liaised to WP5A when the information is available.*

]

# 4 Existing regulations in the 3 600-3 800 MHz frequency band

*[Editor’s note: This section provides the information about existing regulations in the 3 600-3 800 MHz in Region 1 or outside of Region 1]*

# 5 Usage of the 3 600-3 800 MHz band

*[Editor’s note: This section provides usage survey of 3 600-3 800 MHz in different regional organizations/Administrations [of Region 1].]*

# 6 Technical characteristics for the studies

## 6.1 Technical and operational characteristics of services and systems operating in the 3 600-3 800 MHz frequency band.

[Editor’s note: This section provides the sources of technical and operational characteristics from WP 5A and other services from other expert groups.]

| WP 5A document number | Source | Services/Applications |
| --- | --- | --- |
| 203 | WP 5A | Mobile/ broadband wireless access systems |
| 395 | WP 4A | FSS |
| 088 | WP 5B | RLS |
| 233 | WP 5C | FS |
| 378 | WP 5D | Mobile/IMT |

## 6.2 Deployment scenarios

[Alternative 1:

The following scenarios can be considered for the Mobile systems:

– Macro cells scenario in the suburban,

macro cells scenario in the urban;

– optional macro cell rural\* environments ;

– Outdoor small cells scenario in the urban environment;

– Indoor small cells scenario in the urban environment.

\*Additional optional scenario: as contiguous coverage is not expected in this frequency range in rural areas for certain applications in the Mobile service, and any such base stations that may exist in small numbers will be isolated installations at specific locations, and therefore, the rural deployment environment is only optional

Alternative 2:

Three main scenarios can be considered for the Mobile systems:

– Macro cells scenario in the suburban and urban environments;

– Outdoor small cells scenario in the urban environment;

– Indoor small cells scenario in the urban environment.

– In addition to the above mentioned 3 scenarios, macro cell scenario for rural environment could be studied as an option to address certain applications in the Mobile service. ]

## 6.3 Propagation models

### 6.3.1 Propagation model for outdoor deployment scenarios

Recommendation ITU-R P.452, as well as other relevant ITU-R recommendations, is suitable to be used in the sharing studies between mobile service systems and other services systems in the 3 600‑3 800 MHz frequency band.

### 6.3.2 Propagation model for indoor deployment scenarios

Recommendation ITU-R P.1238 or Recommendation ITU-R P.2040 are suitable to be used in the sharing between mobile service systems and other services systems in the 3 600-3 800 MHz frequency band.

### 6.3.3 Clutter loss model

[TBD]

### 6.3.4 Building entry loss model

[TBD]

## 6.4 Probabilistic interference modelling

For realistic interference modelling, interference probability analysis according to the methodology described in Recommendation ITU-R P.2001, as well as other relevant ITU-R recommendations, can be used. This methodology is designed for Monte Carlo simulation in the frequency range 30 MHz–50 GHz, it takes into account the full range of time percentages (0-100 %). This recommendation makes use of terrain profiles, which is more appropriate for interference studies involving low terminals.

### 6.4.1 Power control for IMT UE

IMT UE transmission power control is a typical mechanism implemented to reduce UE power consumption. Therefore, for conducting Monte Carlo sharing studies scenarios involving IMT UE, appropriate power control parameters need to be considered in the sharing studies for the different deployment scenarios in the 3 600-3 800 MHz frequency band.

# 7 Sharing and compatibility studies

*[Editor’s note: This section includes the sharing and compatibility studies carried out in the frequency band]*

The sharing and compatibility studies are contained in the Attachments to this document.

**Attachment 1:** Sharing and compatibility of the [Service type Z] and the mobile service operating in the frequency band 3 600-3 800 MHz.

# 8 Mitigation measures for protection of services

*[Editor’s note: This section includes measures that can be deployed to ensure the protection of existing services]*

Attachment

Sharing and compatibility Studies of [Service Type z] and the Mobile service operating in the frequency band 3 600-3 800 MHz and in adjacent bands, as appropriate

*[Editor’s note: This Attachment contains sharing and compatibility studies of the [Service Type z] and the Mobile service operating in the band. Note the technical characteristics are provided in Section 3 in the main body of the document.]*

# 1 Technical Analysis

## 1.1 Study A

*[Editor’s note: The chapter structure for each study depends on the input contribution of the ITU members. The following chapter structure in each study can be used as a reference.]*

### 1.1.1 Technical characteristics

*[Editor’s note: This section provides the specific parameters used and included in the study/studies, as provided by the contributing groups to WP 5A.]*

#### 1.1.1.1 Technical and operational characteristics of Mobile systems operating in the frequency band 3 600-3 800 MHz

*[Editor’s note: This section provides specific characteristics of Mobile systems provided by WP 5A for sharing/interference analyses used in the study.]*

#### 1.1.1.2 Technical and operational characteristics of [Service type z] operating in the frequency band 3 600-3 800 MHz and in adjacent bands, as appropriate

*[Editor’s note: This section provides specific characteristics of [Service type z] provided by other expert group for sharing/interference analyses used in the study.]*

#### 1.1.1.3 Propagation models for sharing and compatibility studies in the frequency band 3 600-3 800 MHz

*[Editor’s note: This section provides specific propagation models and related parameters for sharing/interference analyses used in the study.]*

### 1.1.2 Methodology

*[Editor’s note: This section provides the methodology used in this study.]*

### 1.1.3 Study results

*[Editor’s note: This section provides the sharing and compatibility study results of this study.]*

### 1.1.4 Summary and analysis of the results of Study A

*[Editor’s note: This section provides the summary and analysis of the results of this study.]*

## 1.2 Study B

### 1.2.1 Technical characteristics

#### 1.2.1.1 Technical and operational characteristics of Mobile systems operating in the frequency band 3 600-3 800 MHz

#### 1.2.1.2 Technical and operational characteristics of [Service type z] operating in the frequency band 3 600-3 800 MHz and in adjacent bands, as appropriate

#### 1.2.1.3 Propagation models for sharing and compatibility studies in the frequency band 3 600-3 800 MHz

### 1.2.2 Methodology

### 1.2.3 Study results

### 1.2.4 Summary and analysis of the results of Study B

# 2 Summary and analysis of the results of studies

[Editor’s note: This section provides the summary and analysis of the results of studies. The text here can be used in the Section 1/1.3/3 “Summary and analysis of the results of ITU-R studies” of Draft CPM Text.]