Radiocommunication Study Groups

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Annex 3 to Joint Task Group 4-5-6-7 Chairman's Report

DRAFT CPM TEXT FOR WRC-15 AGENDA ITEM 1.1

CHAPTER 1

Mobile and Amateur issues

(Agenda items 1.1, 1.2, 1.3 and 1.4)

AGENDA ITEM 1.1

(**JTG 4-5-6-7** / **WP 4A, WP 4B, WP 4C, WP 5A, WP 5B, WP 5C, WP 5D, WP 6A, WP 7B, WP 7C, WP 7D**, (WP 1A), (WP 3K), (WP 3M))[1]

*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*

1/1.1/1 Executive summary

Mobile communications including mobile broadband communications contribute positively to the economic and social developments of both developed and developing countries.

Section 1/1.1/2 provides the background to agenda item 1.1.

[1] See the CPM15-1 Decision on the Establishment and Terms of Reference of Joint Task Group 4-5-6-7, Annex 10 to Administrative Circular CA/201.

Section 1/1.1/3 describes:

- the results of studies which estimate the global spectrum requirements for International Mobile Telecommunications (IMT) to be in the range of 1 340-1 960 MHz for the year 2020, for lower user density settings and higher density settings, respectively;
- the results of ITU-R studies, which indicate that the minimum spectrum requirement for radio local area networks (RLAN) using the 5 GHz frequency range in the year 2018 is estimated at 880 MHz;
- the sharing and compatibility studies conducted by the ITU-R for various frequency ranges.

Section 1/1.1/4 includes:

- analyses of results of studies for various frequency ranges;
- a list of potential candidate frequency bands: 470-694/698 MHz, 1 350-1 400 MHz, 1 427-1 452 MHz, 1 452-1 492 MHz, 1 492–1 518 MHz, 1 518–1 525MHz, 1 695-1 710 MHz, 2 700-2 900 MHz, 3 300-3 400 MHz, 3 400-3 600 MHz, 3 600-3 700 MHz, 3 700-3 800 MHz, 3 800-4 200 MHz, 4 400-4 500 MHz, 4 500-4 800 MHz, 4 800-4 990 MHz, 5 350-5 470 MHz, 5 725-5 850 MHz, and 5 925-6 425 MHz.

Methods to satisfy the agenda item are included in section 1/1.1/5. Also, the regulatory and procedural considerations can be found in section 1/1.1/6.

1/1.1/2 Background

Mobile communications including mobile broadband communications contribute positively to the economic and social developments of both developed and developing countries. Many administrations are investigating a wide range of applications and systems to bridge the digital divide using, inter alia, IMT and other terrestrial mobile broadband applications.

Since WRC-07, the demand for mobile broadband applications has been growing rapidly. Report ITU-R M.2243[2] provides detailed information on the global mobile broadband deployments and forecasts for IMT.

According to Resolution **233 (WRC-12)**, adequate and timely availability of spectrum with appropriate regulatory provisions, as well as improved technologies, are essential to support the future growth of IMT and other mobile broadband systems. Harmonized worldwide frequency bands and harmonized frequency arrangements for these systems are highly desirable in order to facilitate global roaming and the benefits of economies of scale.

Resolution **233 (WRC-12)** is also calling in particular for studies on future spectrum requirements and potential candidate frequency bands for IMT and other terrestrial mobile broadband applications. When considering potential candidate frequency bands, sharing and compatibility studies with services already having allocations in these frequency bands and in adjacent bands are necessary, taking into account the current and planned use of these frequency bands by existing services and their necessary protection.

[2] Report ITU-R M.2243 - “Assessment of the global mobile broadband deployments and forecasts for International Mobile Telecommunications”.

1/1.1/3 Summary of technical and operational studies, including a list of relevant ITU-R Recommendations and/or Reports

1/1.1/3.1 Spectrum requirements

1/1.1/3.1.1 IMT

ITU figures[3] released in October 2013 and again in May 2014 show that the number of mobile-broadband subscriptions will reach 2.3 billion globally by the end of 2014, with fifty-five percent of these subscriptions in the developing world. Mobile cellular subscriptions will reach almost 7 billion by end 2014 and 3.6 billion of these will be in the Asia-Pacific region. Mobile broadband (delivered) over smartphones and tablets has become the fastest growing segment of the global ICT market and is now more affordable than fixed broadband.

Report ITU-R M.2290[4] provides the results of studies which estimate the global spectrum requirements for IMT in the range of 1 340-1 960 MHz for the year 2020, for lower and higher user density settings, respectively (See also relevant parts of Report ITU-R M.2243[5]).

Since there are large differences between market developments and timing of network deployments around the world, the lower and higher user density settings of the estimate are meant to reflect the variation of the mobile data growth in different countries.

Report ITU-R M.2290 provides a global perspective on the future spectrum requirement estimate for terrestrial IMT. The input parameters in this Report are not country specific. In some countries, the spectrum requirements can be lower than the low estimate and in some other countries, the spectrum requirements can be higher than the high estimate (See Annex 4 of Report ITU-R M.2290: Summary of national spectrum requirements in some countries). The methodology utilised in the Report can be used to estimate the total IMT spectrum requirements of a given country only if all the current input parameter values used in this report are replaced by the values which apply to that specific country (as described in the methodology itself). The introductory part of Report ITU-R M.2290 indicates that there is no information in ITU on the use of the spectrum already identified for terrestrial IMT by a previous WRC.

The above mentioned global estimate is based on assumed traffic density figures intended to represent demand in the year 2020, taking into account the traffic off-loading from IMT networks to RLANs. However, if real traffic trends in 2020 differ from the assumptions (e.g., high density of users, high data rate applications), then the resulting spectrum estimates would differ from those provided.

Table 1/1.1/3-1 shows the “additional” spectrum requirements for IMT by the year 2020 per ITU Region based on the estimates from Report ITU-R M.2290.

When identifying additional frequency bands for IMT, the amount of spectrum already identified and currently used for IMT in each Region should be taken into account with a view to optimizing the use of these bands to increase spectrum efficiency.

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[3] ITU Press Release, 5 May 2014, ITU Releases 2014 ICT Figures http://www.itu.int/net/pressoffice/press_releases/2014/23.aspx.

[4] Report ITU-R M.2290 - “Future spectrum requirements estimate for terrestrial IMT”.

[5] Report ITU-R M.2243 - “Assessment of the global mobile broadband deployments and forecasts for International Mobile Telecommunications”.

The demand for high bit rates, especially in densely populated areas could be accommodated in higher frequency bands (e.g. above 6 GHz) than those currently being considered in studies, however the technical information required for compatibility studies has yet to be developed and these studies and proposals are being explored for future work, beyond WRC-15.

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TABLE 1/1.1/3-1

Estimated additional spectrum requirements for IMT by the year 2020

User density settings	Total spectrum requirements (MHz)	Region 1**		Region 2		Region 3	
		Already identified (MHz)*	Additional spectrum requirements (MHz)*, ***	Already identified (MHz)	Additional spectrum requirements (MHz)***	Already identified (MHz)*	Additional spectrum requirements (MHz)*, ***
Low	1 340	981-1 181	**159-359**	951	**389**	885-1 177	**163-455**
High	1 960	981-1 181	**779-979**	951	**1 009**	885-1 177	**783-1 075**

Note *: The values in these columns have ranges since some of the frequency bands are identified for IMT only in some countries in Regions 1 and 3 as per RR Nos. **5.317A**, **5.430A**, **5.432A**, **5.432B**, and **5.433A**.

Note **: The values for Region 1 are based on the assumption that the lower edge of the frequency band identified in RR No **5.312A** remains at 694 MHz.

Note ***: The values in these columns do not necessarily represent additional spectrum requirements for some countries.

The ITU-R has indicated the following frequency ranges as suitable for possible future deployment of IMT: 410-430 MHz, 470-790 MHz[6], 1 000-1 700 MHz, 2 025-2 110 MHz, 2 200-2 290 MHz, 2 700-5 000 MHz, 5 350-5 470 MHz and 5 850-6 425 MHz.

It should be noted that these suitable frequency ranges are indicated only from the view point of suitability for future development of IMT systems and not from the view point of: compatibility with the other services and applications in these bands; the current allocations in the Radio Regulations and the associated footnotes; the status of the use of the frequency band by the services to which they are allocated; or the planned use of these services.

It is noted that no single frequency range satisfies all the criteria required to deploy IMT systems, particularly in countries with diverse geography and population density; therefore, to meet the capacity and coverage requirements of IMT systems multiple frequency ranges would be needed.

1/1.1/3.1.2 Radio local area networks (RLAN)

The results of ITU-R studies indicate that the minimum spectrum requirement for RLAN using the 5 GHz frequency range in the year 2018 is estimated at 880 MHz. This figure includes spectrum of 455-580 MHz already utilised by non-IMT mobile broadband applications operating in the 5 GHz band range resulting in 300-425 MHz additional spectrum being required. The ranges above are due to some of the frequency bands being identified for RLAN only in some countries.

Currently, within the 5 GHz range, RLAN devices utilize the following frequency bands:
5 150-5 250 MHz, 5 250-5 350 MHz, 5 470-5 725 MHz and 5 725-5 850 MHz (in some countries).

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6 Note: The frequency band 694-790 MHz is under consideration for Region 1 in WRC-15 agenda item 1.2.

Pursuant to Resolution **229 (Rev.WRC-12)**, operation in the 5 150-5 250 MHz band is limited to indoor use while dynamic frequency selection rules apply in the 5 250-5 350 MHz and 5 470-5 725 MHz bands.

The ITU-R has indicated that the 5 350-5 470 MHz and 5 725-5 850 MHz frequency ranges would provide contiguous spectrum with the existing spectrum allocations for RLANs. It should be noted that these frequency ranges will not fully address estimated spectrum requirements for RLANs.

It should be noted that these frequency ranges are not indicated from the view point of: compatibility with the other services and applications in these bands; the current allocations in the Radio Regulations and the associated footnotes; the status of the use of the frequency band by the services to which they are allocated; or the planned use of these services.

1/1.1/3.2 Sharing and compatibility studies

In accordance with *resolves to invite ITU-R* 2 of Resolution **233 (WRC-12)**, administrations proposed to study the frequency bands: 470-694/698 MHz, 1 300-1 525 MHz, 1 695-1 710 MHz, 2 025-2 110 MHz and 2 200-2 290 MHz, 2 700-2 900 MHz, 2 900-3 100 MHz, 3 300-3 400 MHz, 3 400-3 600 MHz, 3 600-4 200 MHz, 4 400-4 900 MHz, 4 800-5 000 MHz, 5 350-5 470 MHz, 5 725-5 850 MHz, 5 925-6 425 MHz.

As stated in *further resolves* 1 of Resolution **233 (WRC-12)** those studies were to:

> *"include sharing and compatibility studies with services already having allocations in the frequency bands and in adjacent bands, as appropriate, taking into account the current and planned use of these bands by the existing services, as well as the applicable studies already performed in ITU-R."*

The following sub-sections briefly summarise the sharing and compatibility studies for each frequency band. The conclusions of these studies and the analysis on the results are contained in section 1/1.1/4.1 below.

A list of relevant Recommendations and Reports can be found in Annex 2 of the Chairman's Report of the final meeting of JTG 4-5-6-7 (Document 4-5-6-7/715).

1/1.1/3.2.1 Frequency range 470 to 694/698 MHz

The frequency range 470-694/698 MHz, or parts thereof, is allocated to BS, FS, MS, MSS, RAS ARNS and RNS. The frequency bands adjacent to this frequency range are allocated to FS, MS, MetSat and BS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

In Region 1 use of the frequency band 470-694 MHz for digital terrestrial broadcasting is governed by the *Regional Agreement relating to the planning of the digital terrestrial broadcasting service in Region 1 (parts of Region 1 situated to the west of meridian 170° E and to the north of parallel 40° S, except the territory of Mongolia) and in the Islamic Republic of Iran, in the frequency bands 174-230 MHz and 470-862 MHz (Geneva, 2006)* ("GE06 Agreement"), to which all Region 1 administrations except Mongolia as well as that of the Islamic Republic of Iran are party.

1/1.1/3.2.1.1 Broadcasting service and mobile service/IMT

1/1.1/3.2.1.1.1 Broadcasting service in the GE06 planning area

Draft new Report ITU-R BT.[MBB_DTTB_470_694] contains the sharing and compatibility studies between digital terrestrial television broadcasting and terrestrial mobile broadband applications, including IMT, for BS in the GE06 planning area (see Section 1 of the Report), in the frequency band 470-694/698 MHz (see Annex 5 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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Some administrations are of the view that information on the use of the frequency band 470-862 MHz for terrestrial broadcasting in Region 1 summarized in Report ITU-R BT.2302 is inappropriate for inclusion in to the CPM Report for WRC-15 agenda item 1.1. The information summarized in ~~Report ITU-R BT.2302 was collected in response to the Circular Letter~~ 6/LCCE/78, questionnaire on spectrum requirements for terrestrial television broadcasting in connection with agenda item 1.2 and does not pertain to agenda item 1.1. Moreover, these administrations are particularly concerned that with the inclusion of information on only terrestrial broadcasting and only in Region 1, the text of the CPM Report under agenda item 1.1 is significantly unbalanced because it fails to provide the same information for spectrum requirements for other incumbent services (e.g., EESS, FS, FSS, Radiolocation) or to consider spectrum requirements of other Regions.

Some other administrations are of the view that the spectrum requirements for terrestrial television are covered by decides 3 of the Terms of Reference of JTG 4-5-6-7 as decided by CPM15-1 in Annex 10 to CA/201, which states that JTG 4-5-6-7 is to consider, in accordance with Resolutions **232 (WRC-12)** and **233 (WRC-12)**, other specific requirements as well as results of studies from any concerned Working Parties on technical and operational characteristics, spectrum requirements and performance objectives or protection requirements of other services. Therefore, these administrations are of the view that the information below is also relevant for WRC-15 agenda item 1.1 and should be included in the CPM Report for WRC-15 agenda item 1.1 as reflected below.

Report ITU-R BT.2302 provides the results of a questionnaire on the spectrum requirements for terrestrial television broadcasting in the UHF frequency band in Region 1 and the Islamic Republic of Iran. Based on this report it is concluded that at least the 28 channels of 8 MHz bandwidth in the range 470-694 MHz are required to satisfy spectrum requirements for the BS for the majority of administrations who responded. This has been confirmed by a recent re-planning exercise[7] in the African Broadcasting Area.

It should be emphasised that, in many countries which are party to the GE06 Agreement the need for broadcasting in the 470-694 MHz frequency band is critical, in particular with regard to those countries which intend to implement the MS in the 700 MHz band, due to the need to provide the required certainty for the investment in broadcasting and facilitate the migration outside 694-790 MHz.

1/1.1/3.2.1.1.2 Broadcasting service outside the GE06 planning area

Draft new Report ITU-R BT.[MBB_DTTB_470_694] contains the sharing and compatibility studies between digital terrestrial television broadcasting and terrestrial mobile broadband applications, including IMT, for BS outside the GE06 planning area (see Section 2 of the Report), in the frequency band 470-694/698 MHz (see Annex 5 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

1/1.1/3.2.1.2 Applications ancillary to broadcasting (SAB/SAP) and mobile service/IMT in Region 1

Draft new Report ITU-R BT.[SAB_SAP] contains SAB/SAP spectrum use in Region 1 and the implication of a co-primary allocation for the MS in the frequency band 694-790 MHz (see Annex 8 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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7 http://www.itu.int/ITU-R/terrestrial/broadcast/ATU/index.html.

1/1.1/3.2.1.3 Fixed service and mobile service/IMT

Draft new Report ITU-R F.[IMT-FS 470-694/698 MHz SHARING] addresses sharing and compatibility between IMT systems and FS systems in the 470-694/698 MHz frequency range (see Annex 6 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.1.4 Radio astronomy service and mobile service/IMT

Draft new Report ITU-R RA.[RAS-IMT] contains compatibility and sharing studies between RAS and IMT systems in the frequency band 608-614 MHz (see Annex 7 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.2 Frequency range 1 300 MHz to 1 525 MHz

The frequency range 1 300-1 525 MHz, or parts thereof, is allocated to RLS, ARNS, RNSS, FS, MS, EESS, RAS, SRS, SOS, BS, BSS, MSS and AMS. The frequency bands adjacent to this frequency range are allocated to EESS, RLS, RNSS, SRS, ARS, FS, MS, ARNS, SOS, MSS and AMS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

1/1.1/3.2.2.1 Broadcasting service and mobile service/IMT

Draft new Report ITU-R BS.[BS_IMT] addresses sharing between MS and BS in the 1 452-1 492 MHz frequency band (see Annex 13 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.2.2 Radiodetermination and mobile service/IMT

Working document toward a PDN Report ITU-R M.[RADAR1300] contains studies on the impact of IMT use on radar systems in the frequency range 1 300-1 400 MHz (see Annex 25 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.2.3 Aeronautical mobile telemetry systems and the mobile service/IMT

Draft new Report ITU-R M.[AMT-IMT.SHARING.L-BAND] contains sharing studies between IMT systems and aeronautical mobile telemetry systems in the frequency band 1 429-1 535 MHz (see Annex 12 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.2.4 Broadcasting-satellite service in the frequency band 1 452-1 492 MHz

Working document toward PDN Report ITU-R M.[BSS-MS] addresses sharing and compatibility studies between IMT systems and BSS systems in the frequency band 1 452-1 492 MHz (see Annex 27 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.2.5 Radio astronomy service and mobile service/IMT

Draft new Report ITU-R RA.[RAS-IMT] contains compatibility and sharing studies between RAS and IMT systems in the frequency band 1 330-1 400 MHz (see Annex 7 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.2.6 Unwanted emissions in the frequency band 1 400-1 427 MHz

Draft new Report ITU-R RS.[EESS-IMT 1.4 GHz] contains consideration of the frequency bands 1 375-1 400 MHz and 1 427-1 452 MHz for MS - compatibility with systems of EESS within the 1 400-1 427 MHz frequency band (see Annex 11 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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Draft new Report ITU-R RA.[RAS-IMT] contains compatibility and sharing studies between RAS and IMT systems in the frequency band 1 400-1 427 MHz (see Annex 7 of the Chairman's Report of the final meeting of JTG 4-5-6-7– Document 4-5-6-7/715).

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1/1.1/3.2.2.7 Fixed service and the mobile service/IMT

Working document toward PDN Report ITU-R F.[IMT 1 350-1 530 MHz ADJACENT CHANNEL SHARING] addresses adjacent channel / adjacent band coexistence between IMT systems and FS point-to-point links currently operating in 1 350-1 527 MHz (see Annex 26 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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Draft new Report ITU-R F.[FS-IMT 1 350-1 530 MHz CO-CHANNEL SHARING] addresses co-channel compatibility/sharing between IMT systems and FS point-to-point links currently operating in the frequency band 1 350-1 527 MHz (see Annex 10 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.2.8 Mobile-satellite service and mobile service/IMT

Annex 29 of the Chairman's Report of the final meeting of JTG 4-5-6-7 (Document 4-5-6-7/715) contains sharing studies of IMT-Advanced systems in MS with respect to systems in MSS in the frequency bands 1 518-1 559 MHz, 1 626.5-1 660.5 MHz and 1 668-1 675 MHz.

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Annex 28 of the Chairman's Report of the final meeting of JTG 4-5-6-7 (Document 4-5-6-7/715) addresses adjacent band compatibility studies of IMT-Advanced systems in MS in the band below 1 518 MHz with respect to systems in MSS in the frequency bands 1 518-1 559 MHz.

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1/1.1/3.2.3 Frequency range 1 695-1 710 MHz

The frequency range 1 695-1 710 MHz, or parts thereof, is allocated to MetAids, MetSat, FS and MS. The frequency bands adjacent to this are allocated to MetAids, MetSat, FS, MS and SRS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

Draft new Report ITU-R SA.[METSAT-IMT 1.7 GHz] contains a sharing assessment between MetSat and IMT stations in the 1 695-1 710 MHz frequency band (see Annex 14 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.4 Frequency ranges 2 025-2 110 MHz and 2 200-2 290 MHz

The frequency range 2 025-2 110 MHz, or parts thereof, is allocated to SOS, EESS, FS, MS and SRS. The frequency bands adjacent to this frequency range are allocated to FS, MS, MSS and SRS. The frequency range 2 200-2 290 MHz, or parts thereof, is allocated to SOS, EESS, FS, MS and SRS. The frequency bands adjacent to this frequency range are allocated to FS, MS, MSS and SRS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

Draft new Report ITU-R SA.[EESS-IMT 2 025-2 290 MHz] addresses sharing between space-to-space links in SRS, SOS and EESS and IMT systems in the frequency bands 2 025-2 110 MHz and 2 200-2 290 MHz (see Annex 15 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.5 Frequency range 2 700-2 900 MHz

The frequency range 2 700-2 900 MHz, or parts thereof, is allocated to ARNS, RLS and MRNS. The frequency bands adjacent to this frequency range are allocated to EESS, RAS, SRS, FS, MS, RLS and RNS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

Working document toward PDN Report ITU-R M.[RADAR2700] contains studies on the impact of IMT use on radar systems in the frequency range 2 700-2 900 MHz (see Annex 30 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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Draft new Report ITU-R RA.[RAS-IMT] contains compatibility and sharing studies between RAS and IMT systems in the frequency band 2 690-2 700 MHz (see Annex 7 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.6 Frequency range 2 900-3 100 MHz

The frequency range 2 900-3 100 MHz, or parts thereof, is allocated to RLS and ARNS. The frequency bands adjacent to this frequency range are allocated to ARNS, RLS, MRNS, EESS, SRS and RNS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

Working document toward PDN Report ITU-R M.[RADAR2900] contains studies on the impact of IMT use on radar systems in the frequency range 2 900-3 100 MHz (see Annex 31 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.7 Frequency range 3 300-3 400 MHz

The frequency range 3 300-3 400 MHz, or parts thereof, is allocated to RLS, ARS, FS, MS and RNS. The frequency bands adjacent to this frequency range are allocated to RLS, EESS, SRS, RNS, FS, FSS, ARS and MS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

PDN Report ITU-R M.[RADAR3300] addresses sharing between indoor IMT systems and radar systems in the frequency band 3 300-3 400 MHz (see Annex 32 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.8 Frequency range 3 400-4 200 MHz

The frequency range 3 400-4 200 MHz, or parts thereof, is allocated to FS, FSS, ARS, MS and RLS. The frequency bands adjacent to this frequency range are allocated to RLS, ARS, FS, MS, RNS and ARNS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

1/1.1/3.2.8.1 Fixed service and the mobile service/IMT

Draft new Report ITU-R F.[IMT-FS 3 400-4 200 MHz SHARING] studies sharing and compatibility between IMT systems and FS systems in the 3 400-4 200 MHz frequency range (see Annex 16 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.8.2 Fixed-satellite service and mobile service/IMT

Draft new Report ITU-R [FSS-IMT C-BAND DOWNLINK] contains sharing studies between IMT-Advanced systems and geostationary satellite networks in FSS in the 3 400-4 200 MHz and 4 500-4 800 MHz frequency bands (see Annex 17 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.9 Frequency range 4 400-4 900 MHz

The frequency range 4 400-4 900 MHz, or parts thereof, is allocated to FS, MS, FSS and RAS. The frequency bands adjacent to this frequency range are allocated to ARNS, FS, MS, RAS, SRS and EESS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

1/1.1/3.2.9.1 Radio astronomy service and mobile service/IMT

Draft new Report ITU-R RA.[RAS-IMT] contains compatibility and sharing studies between RAS and IMT systems in the frequency band 4 800-4 990 MHz (see Annex 7 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

1/1.1/3.2.9.2 Aeronautical mobile systems and the mobile service/IMT

PDN Report ITU-R M.[AERO-IMT.SHARING.C-BAND] contains sharing and compatibility studies between aeronautical mobile/ground mobile applications and potential IMT systems in the 4 400-4 990 MHz band (see Annex 33 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

1/1.1/3.2.9.3 Fixed service and the mobile service/IMT

Draft new Report ITU-R F.[FS-IMT 4 400-4 990 MHz SHARING AND COMPATIBILITY] contains a sharing and compatibility study between IMT systems and point-to-point fixed wireless systems in the frequency bands 4 400-4 500 MHz and 4 800-4 990 MHz (see Annex 18 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

1/1.1/3.2.9.4 Fixed-satellite service and the mobile service/IMT

Draft new Report ITU-R [FSS-IMT C-BAND DOWNLINK] contains sharing studies between IMT-Advanced systems and geostationary satellite networks in the FSS in the 3 400-4 200 MHz and 4 500-4 800 MHz frequency bands (see Annex 17 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

1/1.1/3.2.10 Frequency range 4 800-5 000 MHz

The frequency range 4 800-5 000 MHz, or parts thereof, is allocated to FS, MS, RAS, SRS and EESS. The frequency bands adjacent to this frequency range are allocated to FS, FSS, MS, AMS(R)S, ARNS and RNSS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

1/1.1/3.2.10.1 Aeronautical mobile systems and mobile service/IMT

PDN Report ITU-R M.[AERO IMT.SHARING.C-BAND] contains sharing and compatibility studies between aeronautical mobile/ground mobile applications and potential IMT systems in the 4 400-4 990 MHz band (see Annex 33 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

1/1.1/3.2.10.2 Fixed service and mobile service (IMT)

Draft new Report ITU-R F.[FS-IMT 4 400-4 990 MHz SHARING AND COMPATIBILITY] contains a sharing and compatibility study between IMT systems and point-to-point fixed wireless systems in the frequency bands 4 400-4 500 MHz and 4 800-4 990 MHz (see Annex 18 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

1/1.1/3.2.10.3 Radio astronomy service and the mobile service/IMT

Draft new Report ITU-R RA.[RAS-IMT] contains compatibility and sharing studies between RAS and IMT systems in the frequency bands 4 800-4 990 MHz and 4 990-5 000 MHz (see Annex 7 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

1/1.1/3.2.11 Frequency range 5 350-5 470 MHz

The frequency range 5 350-5 470 MHz, or parts thereof, is allocated to EESS, RLS, ARNS, SRS and RNS. The frequency bands adjacent to this frequency range are allocated to EESS, MS, RLS,

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SRS, FS, RNS, MRNS, ARNS and LMS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

1/1.1/3.2.11.1 Earth exploration-satellite service (active) and the mobile service/RLAN

PDN Report ITU-R RS.[EESS RLAN 5 GHz] contains sharing studies between RLAN and EESS (active) systems in the frequency range 5 350-5 470 MHz (see Annex 35 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.11.2 Radar systems and the mobile service/RLANs

PDN Report ITU-R M.[5 350 MHz AERO] contains compatibility studies between RLAN and aeronautical airborne radar systems in the 5 350-5 470 MHz frequency band (see Annex 36 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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Working document toward PDN Report ITU-R M.[RLAN5GHz.SHAR] contains compatibility studies between RLAN and radiolocation systems in the 5 350-5 470 MHz frequency band (see Annex 34 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.12 Frequency range 5 725-5 850 MHz

The frequency range 5 725-5 850 MHz, or parts thereof, is allocated to FSS, RLS, ARS, ARSS, LMS, FS and MS. The frequency bands adjacent to this frequency range are allocated to MS, RLS, ARS, SRS, LMS, FS and FSS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

Some administrations submitted contributions indicating that the study results for the 5 350-5 470 MHz frequency range are applicable to the 5 725-5 850 MHz frequency range to ensure protection of certain radars that operate across or in portions of the 5 250-5 850 MHz frequency range. Some other administrations raised concerns regarding these results because no RLAN characteristics were previously agreed for the 5 725-5 850 MHz frequency range and that RLAN characteristics utilized for the 5 350-5 470 MHz frequency range cannot be applied similarly to the 5 725-5 850 MHz frequency range. Some administrations also highlighted that the sharing environment is significantly different between the two bands due to the ISM designation of the 5 725-5 875 MHz frequency band. There are current deployments of RLAN in the 5 725-5 850 MHz band in some countries in all three ITU Regions. Therefore, agreement was not reached on the conclusions in these documents.

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No other sharing/compatibility studies were provided for this frequency band.

1/1.1/3.2.13 Frequency range 5 925-6 425 MHz

The frequency range 5 925-6 425 MHz, or parts thereof, is allocated to FS, FSS and MS. The frequency bands adjacent to this frequency range are allocated to FS, FSS, MS, ARS and RLS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

1/1.1/3.2.13.1 Fixed service and the mobile service/IMT

Draft new Report ITU-R F.[IMT-FS 5 925-6 425 MHz SHARING] contains a sharing and compatibility study between indoor IMT small cells and FS stations in the 5 925-6 425 MHz frequency band (see Annex 20 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.13.2 Fixed-satellite service and mobile service/IMT

Draft new Report ITU-R [FSS-IMT C-BAND UPLINK] addresses sharing and compatibility between IMT systems and FSS networks in 5 850-6 425 MHz frequency range (see Annex 19 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715).

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1/1.1/3.2.14 Overview of studies for the potential candidate bands listed in section 1/1.1/4.2

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The following two overview tables are provided for convenience and information only to indicate which studies were carried out in ITU-R during the preparation of WRC-15 for agenda item 1.1. Studies were also carried out for other bands than those listed in the tables below and these are included in the respective sub-section of section 1/1.1/3.2 above.

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Studies related to services having allocations within the candidate bands

Potential Candidate Band	Allocations within band	Studies	Status
470–694/698 MHz (224/228 MHz)	BS	BT.[MBB_DTTB_470_694]	DNR
	MS	BT.[SAB_SAP]	DNR
	RNS (ARNS)	-	-
	FS	F.[IMT-FS 470-694/698 MHz]	DNR
	RAS	RA.[RAS-IMT]	DNR
	MSS, except aeronautical	-	-
	RLS	-	-
	SOS (s-E)	-	-
1 350-1 400 MHz (50 MHz)	RAS	RA.[RAS-IMT]	DNR
	RLS	M.[RADAR1300]	WD
	FS	F.[FS-IMT 1 350-1 530 CO-CHANNEL SHARING]	DNR
	SRS(passive)	-	-
	EESS (passive)	-	-
1 427-1 452 MHz (25 MHz)	FS	F.[FS-IMT 1 350-1 530 CO-CHANNEL SHARING]	DNR
	AMS (telemetry)	M.[AMT-IMT.SHARING.L-BAND]	DNR
	SOS (E-s)	-	-
1 452-1 492 MHz (40 MHz)	BS	BS.[BS-IMT]	DNR
	FS	F.[FS-IMT 1 350-1 530 CO-CHANNEL SHARING]	DNR
	AMS (telemetry)	M.[AMT-IMT.SHARING.L-BAND]	DNR
	BSS	M.[BSS-MS]	WD
1 492-1 518 MHz (26 MHz)	FS	F.[FS-IMT 1 350-1 530 CO-CHANNEL SHARING]	DNR
	AMS (telemetry)	M.[AMT-IMT.SHARING.L-BAND]	DNR
1 518-1 525 MHz (7 MHz)	FS	F.[FS-IMT 1 350-1 530 CO-CHANNEL SHARING]	DNR
	AMS (telemetry)	M.[AMT-IMT.SHARING.L-BAND]	DNR
	MSS	Attachment to Chairman's Report	WD
1 695-1 710 MHz (15 MHz)	FS	-	
	EESS (s-E) other than MetSat No. **5.289**	-	-
	METSAT (s-E)	SA.[METSAT-IMT 1.7 GHz]	DNR
	METAID	-	-
	SRS (s-E)	-	-
2 025-2 110 MHz and 2 200-2 290 MHz (175 MHz)	SOS	SA.[EESS-IMT 2 025-2 290 MHz]	DNR
	EESS	SA.[EESS-IMT 2 025-2 290 MHz]	DNR
	FS		
	MS		
	SRS	SA.[EESS-IMT 2 025-2 290 MHz]	DNR
2 700-2 900 MHz (200 MHz)	RLS, ARNS, MRNS	M.[RADAR2700]	WD
3 300-3 400 MHz (100 MHz)	RLS	M.[RADAR3300]	PDNR
	FS	-	-
	Amateur	-	-
	RNS	-	-
3 400-3 600 MHz (200 MHz)	FS	F.[IMT-FS 3 400-4 200 MHz SHARING]	DNR
	RLS		
	FSS (s-E)	[FSS-IMT C-BAND DOWNLINK]	DNR
	Amateur-satellite No.**5.282**	-	
	Amateur	-	-
3 600-3 800 MHz (200 MHz)	FS	F.[IMT-FS 3 400-4 200 MHz SHARING]	DNR
	FSS (s-E)	[FSS-IMT C-BAND DOWNLINK]	DNR
	RLS		
3 800-4 200 MHz (400 MHz)	FS	F.[IMT-FS 3 400-4 200 MHz SHARING]	DNR
	FSS (s-E)	[FSS-IMT C-BAND DOWNLINK]	DNR
4 400-4 500 MHz (100 MHz)	AMS	M.[AERO-IMT.SHARING.C-BAND]	PDNR
	FS	F.[FS-IMT 4 400-4 990 SHARING AND COMPATIBILITY]	DNR

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Potential Candidate Band	Allocations within band	Studies	Status
4 500-4 800 MHz (300 MHz)	FSS (s-E)	[FSS-IMT C-BAND DOWNLINK]	DNR
	FS	F.[FS-IMT4400-4990 SHARING AND COMPATIBILITY]	DNR
	AMS	M.[AERO-IMT.SHARING.C-BAND]	PDNR
4 800-5 000 MHz (200 MHz)	AMS	M.[AERO-IMT.SHARING.C-BAND]	PDNR
	RAS	RA.[RAS-IMT]	DNR
	EESS (passive) No.**5.339**	-	-
	SRS (passive) No.**5.339**	-	-
	FS	F.[FS-IMT4400-4990 SHARING AND COMPATIBILITY]	DNR
5 350-5 470 MHz (120 MHz)	RNS	M.[5 350 MHz AERO]	PDNR
	RLS	M.[RLAN5GHz.SHAR]	WD
	SRS(active)	-	-
	EESS (active)	RS.[EESS RLAN 5 GHz]	PDNR
5 725-5 850 MHz (125 MHz)	RLS		-
	FS Nos. **5.453**, **5.455**, **5.456**	-	-
	Amateur	-	-
	Amateur-satellite (s-E)	-	-
	FSS (s-E)	-	-
5 925-6 425 MHz (500 MHz)	FS	F.[IMT-FS 5 925-6 425 MHz SHARING]	DNR
	Standard frequency and time signal-satellite (E-s)	-	-
	FSS (s-E)	[FSS-IMT C-BAND UPLINK]	DNR

Studies relating to services having allocations in adjacent bands (or adjacent channel studies)

Potential Candidate Band	Allocations in adjacent bands	Studies	Status
470–694/698 MHz (224/228 MHz)	BS	BT.[MBB_DTTB_470_694]	DNR
	FS	F.[IMT-FS 470-694/698 MHz]	DNR
	RAS	RA.[RAS-IMT]	DNR
	METSAT (s-E) (5.290)	-	-
1 350-1 400 MHz (50 MHz)	RLS	M.[RADAR1300]	WD
	FS	F.[IMT 1 350-1 530 MHz ADJACENT CHANNEL SHARING]	WD
	RAS	RA.[RAS-IMT]	DNR
	EESS	RS.[EESS-IMT 1.4 GHz]	DNR
	SRS	RS.[EESS-IMT 1.4 GHz]	DNR
	ARNS	-	-
	RNSS (E-s)	-	-
1 427-1 452 MHz (25 MHz)	FS	F.[IMT 1 350-1 530 MHz ADJACENT CHANNEL SHARING]	WD
	RAS	RA.[RAS-IMT]	DNR
	EESS	RS.[EESS 1.4 GHz]	DNR
	SRS	RS.[EESS 1.4 GHz]	DNR
	AMS (telemetry)	M.[AMT-IMT.SHARING.L-BAND]	DNR
1 452-1 492 MHz (40 MHz)	FS	F.[IMT 1 350-1 530 MHz ADJACENT CHANNEL SHARING]	WD
	AMS (telemetry)	M.[AMT-IMT.SHARING.L-BAND]	DNR
1 492-1 518 MHz (26 MHz)	BS	-	-
	BSS	-	-
	AMS (telemetry)	M.[AMT-IMT.SHARING.L-BAND]	DNR
	FS	F.[IMT 1 350-1 530 MHz ADJACENT CHANNEL SHARING]	WD
	MSS (s-E)	Attachment to Chairman's Report	WD
1 518-1 525 MHz (7 MHz)	MSS (s-E)	Attachment to Chairman's Report	WD
	AMS	M.[AMT-IMT.SHARING.L-BAND]	DNR
	FS	-	-

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Potential Candidate Band	Allocations in adjacent bands	Studies	Status
	EESS	-	-
1 695-1 710 MHz (15 MHz)	-	The band has a guard band at the lower edge taking into account current wider allocation and at the upper edge the band is already identified for IMT	
2 700-2 900 MHz (200 MHz)	RAS	RA.[RAS-IMT]	DNR
	RLS	-	-
	RNS	M.[RADAR2700] M.[RADAR2900]	WD WD
	EESS (passive)	-	-
	SRS (passive)	-	-
	FS	-	-
3 300-3 400 MHz (100 MHz)	RLS	-	-
	RNS	-	-
	EESS (active)	-	-
	SRS (active)	-	-
	FS	F.[IMT-FS 3 400-4 200 MHz SHARING]	DNR
	FSS (s-E)	[FSS-IMT C-BAND DOWNLINK]	DNR
	Amateur	-	-
3 400-3 600 MHz (200 MHz)	FSS (s-E)	[FSS-IMT C-BAND DOWNLINK]	DNR
	FS	F.[IMT-FS 3 400-4 200 MHz SHARING]	DNR
	RLS		
3 600-3 800 MHz (200 MHz)	FSS (s-E)	[FSS-IMT C-BAND DOWNLINK]	DNR
	FS	F.[IMT-FS 3 400-4 200 MHz SHARING]	DNR
	RLS (5.433)		
3 800-4 200 MHz (400 MHz)	FSS (s-E)	[FSS-IMT C-BAND DOWNLINK]	DNR
	FS	F.[IMT-FS 3 400-4 200 MHz SHARING]	DNR
	ARNS (altimeters)	-	-
4 400-4 500 MHz (100 MHz)	FSS (s-E)	[FSS-IMT C-BAND DOWNLINK]	DNR
	FS	F.[FS-IMT 4 400-4 990 SHARING AND COMPATIBILITY]	DNR
	ARNS (altimeters)	-	-
	AMS	M.[AERO-IMT.SHARING.C-BAND] (Note: limited studies on AMT ground receivers)	PDNR
4 500-4 800 MHz (300 MHz)	FS	F.[FS-IMT 4 400-4 990 SHARING AND COMPATIBILITY]	DNR
	RAS	RA.[RAS-IMT]	DNR
	AMS	-	-
4 800-5 000 MHz (200 MHz)	FSS (s-E)	[FSS-IMT C-BAND DOWNLINK]	DNR
	FS	F.[FS-IMT 4 400-4 990 SHARING AND COMPATIBILITY]	DNR
	RAS	RA.[RAS-IMT]	DNR
	AMS	M.[AERO-IMT.SHARING.C-BAND] (Note: limited studies on AMT ground receivers)	PDNR
	AMSS(R)	-	-
	ARNS	-	-
	RNSS	-	-
5 350-5 470 MHz (120 MHz)	-	Both adjacent bands are already used by RLAN	
5 725-5 850 MHz (125 MHz)	FSS (s-E)	-	
	Amateur		
	RLS		
	FS	-	
5 925-6 425 MHz (500 MHz)	FS	F.[IMT-FS 5 925-6 425 MHz SHARING]	DNR
	FSS (s-E)	-	-
	Amateur		
	RLS		

1/1.1/4 Analysis of the results of studies

1/1.1/4.1 Analysis of the results for frequency bands studied

1/1.1/4.1.1 Frequency range 470-694/698 MHz

1/1.1/4.1.1.1 Broadcasting service and mobile service/IMT

Frequency bands below 1 GHz are the only available bands for terrestrial television broadcasting and they are harmonised worldwide leading to consumer benefits in terms of wider choice and competition in TV receiver markets, and thus lower consumer costs. They are primarily used to provide wide area coverage from high power transmitters serving large audiences.

1/1.1/4.1.1.1.1 Broadcasting in the GE06 planning area

1/1.1/4.1.1.1.1.1 Co-channel studies

1/1.1/4.1.1.1.1.1.1 Mobile service base-stations as an interferer into broadcast reception

A generic study showed that the cumulative effect of interference can exceed 20 dB and that a separation distance of more than 200 kilometres is needed to meet the field strength threshold of 23 dB(μV/m) which is equivalent to an I/N of -10 dB (95% locations, 16 dB antenna discrimination) at the lower end of the 694-790 MHz band compared to 61 kilometres for a single base-station of the MS.

The results of another generic study showed that the excess of the cumulative interference from a MS network (from IMT to broadcast) over the single interferer can be up to 21 dB. This causes a corresponding increase of separation distance of up to 274 kilometres on land and up to 1 000 kilometres for land/sea paths (warm), when using the same field strength threshold for cumulative interference as for single entry interference.

A case study showed two particular examples where the excess of the cumulative interference from the MS network over the single interferer can be up to 21 dB, even when using fixed directional receiving antennas.

A generic study showed that even without accumulation of interfering field strength, a single IMT base-station will need to be positioned 53 kilometres (for land path) from the DTTB service edge, i.e. from the border of the affected administration in order not to exceed 23 dB(μV/m). This field strength is equivalent to an I/N of -10 dB (95% locations, 16 dB antenna discrimination) at the input of the DTTB receiver at the lower end of the 694-790 MHz band. Including multiple interfering base-stations would increase the interfering field strength at the DTTB service edge by up to 20 dB which corresponds to a separation distance of up to 200 kilometres based on the parameters used in this particular study, when using the same field strength threshold for cumulative interference as for single entry interference.

A case study showed that IMT base-stations in one country which are not individually subject to coordination, i.e. meeting the trigger threshold of GE06 (25 dB(μV/m)), will not interfere with the DTTB receivers in the neighbouring country, even if the cumulative effect of those base-stations is taken into account. This case study is based on C/N+I protection criteria of the BS.

1/1.1/4.1.1.1.1.1.2 Broadcasting as an interferer into mobile service base-stations

A generic study showed that separation distances up to 427 kilometres and 269 kilometres, for high power (HP) and medium power (MP) DTTB transmitters respectively, would be required to protect the IMT base-station receiver (uplink) for 99% time, a target I/N of -6 dB and with no additional discrimination by cross polarization or receive antenna directivity. The relaxation of the protection

level to 90% time, a target I/N of 0 dB and mitigation by full receive antenna polarization and/or discrimination would reduce the separation distances to 159 kilometres for HP and 76 kilometres for MP.

A case study showed that co-channel sharing between DTTB transmitters and an IMT uplink receiver positioned at 30 meters height, will require separation distances of the order of 200 kilometres on land paths even with antenna cross polarization and a relaxation of the percentage of time for the interfering signal from 1 to 10%.

1/1.1/4.1.1.1.1.2 Adjacent channel studies

1/1.2/4.1.1.1.1.2.1 IMT base-station interference into DTTB

This field trial study indicated that necessary line-of-sight separation distance between transmitting antennas of wireless broadband access system and DTTB receiving antennas ranges from 180 to 995 metres for specified technical parameters in this study (depending from OOBE limit and frequency separation) in frequency range till at least 112 MHz (N-14) offset, taken into account fundamental difficulties with application of such mitigation techniques as additional sideband filters within 470-694 MHz frequency band. During trials, it was no way found for further mitigation improvement while maintaining the basic features of wideband access system available, because one end of radio link is user-controlled.

1/1.1/4.1.1.1.1.3 Analysis of co-channel, adjacent channel and spectrum requirement studies

Analysis of the studies summarized above indicated a range of frequency and geographic separation distances required for sharing between DTTB systems and MS (IMT) systems. The ranges in the studies reflect the various assumptions and technical assumptions used in the studies.

The results of the studies summarized above show that, if one country wants to use the band for broadcasting and the other neighbouring country wants to deploy IMT networks, sharing will be very difficult. Based on these large separation distances, the conclusion of these studies emphasized constraints on the planning, implementation, and sharing of the two services regarding the use of the same or overlapping frequencies in neighbouring geographic areas.

The result of the adjacent channel study in section 1/1.2/4.1.1.1.1.2.1 shows that the adjacent channel selectivity of DTTB receivers and out-of-band emissions of user equipment (UE) should be addressed to decrease the interference. Depending on the situation filters may need to be frequency adjustable.

A survey carried out by ITU-R showed that the band 470-694 MHz is the minimum spectrum required for broadcasting for 68 out of 89 administrations that responded to a questionnaire in Region 1 and is currently used or planned to be used for that purpose. 72 administrations have expressed a clear view on the spectrum requirements. Of those, 28 expressed a requirement for more than 224 MHz, 40 require exactly 224 MHz and 4 administrations indicate a requirement for less than 224 MHz.

Some administrations are of the view that information on the use of the frequency band 470-862 MHz for terrestrial broadcasting in Region 1 is inappropriate for inclusion in to the CPM Report for WRC-15 agenda item 1.1 because it was collected in response to the Circular Letter 6/LCCE/78, questionnaire on spectrum requirements for terrestrial television broadcasting in connection with agenda item 1.2 and does not pertain to agenda item 1.1.

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1/1.1/4.1.1.1.2 Broadcasting outside the GE06 planning area

1/1.1/4.1.1.1.2.1 Co-channel and adjacent channel studies

Study 1 showed that for the co-frequency channel case, taking into account a single base-station as interferer, the required separation distance can range from 10-12 for portable indoor BS systems and around 13-19 kilometres for portable outdoor BS systems. The co-channel results for fixed outdoor reception BS systems range from around 28 to 70 kilometres. For the adjacent channel case, the results show that in the worst-case scenarios (BS receive station pointing directly toward a macro suburban or rural deployment of IMT base-stations), a distance separation of around 5 kilometres combined with a frequency separation one channel bandwidth is needed in order to meet the BS protection requirement. However, these pointing scenarios should be avoidable in practice, and for more realistic pointing scenarios, the interference can be mitigated through a combination of geographic separation and frequency separation. For these cases, the interference can be mitigated with a separation distance on the order of one kilometre coupled with a frequency separation of about one channel bandwidth. It is important to note that the frequency separation results reflect channel centre-to-channel centre separations and not guard bands, which are usually expressed as channel edge-to-channel edge. Finally, this study results also show that the interference from the IMT UE is acceptable with a geographic separation as low as one kilometre.

Studies 2 and 3 indicated that either a single IMT base-station or a single IMT UE operating in the vicinity of a fixed DTTB receiving system will exceed the protection requirement for the BS. For the case of co-channel spectrum sharing, in order to remain within the BS protection requirement, a separation distance of 94 kilometres from the IMT base-station and one kilometre from the IMT UE is required. For the case of first adjacent-channel spectrum sharing, a separation distance of 64 kilometres from the IMT base-station and 0.7 kilometres from the IMT UE is required. Spectrum sharing of frequencies beyond the first adjacent-channel may be problematic. Frequency offsets up to 90 MHz were found to require separation distances of 5 kilometres and 70 metres from the IMT base-station and UE, respectively.

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Study 4 indicated that the IMT base-station receiving system is susceptible to interference from single DTTB transmitters even with mitigation measures such as down-tilt of antennas. For the case of co-channel spectrum sharing with typical broadcast transmitters, the separation distance must be greater than 550 kilometres. For the case of first adjacent-channel spectrum sharing, the separation distance must be greater than 125 kilometres. In both cases, the separation distances extend near and beyond the radio horizon. In conclusion, the required separation distances between IMT base-stations and DTTB transmitters are significant in the frequency bands between 470 and 694/698 MHz. It is unlikely that spectrum sharing between DTTB and IMT is possible within a given geographic location.

Study 5 shows that the separation distance needed for different adjacent channels case in order to protect DTTB from IMT base-stations, considering the accumulative effect would vary from 14 to 45 kilometres.

Study 6 shows that the separation distance needed for the co channel case in order to protect DTTB from base-stations, considering the accumulative effect would exceed 200 kilometres.

Study 7 on the adjacent channel case indicated the minimum separation distances between a DTTB System C (ISDB-T) receiver and a mobile broadband (MBB) UE operated in the same room have been presented. A minimum separation distance of 15 metres is required to achieve I/N of -10 dB, even in instances where the MBB transmitter output power of -9 dBm, the OOB emission level of -55 dBm in a 6MHz channel and the receiver ACS of 80 dB.

Considering the actual usage of a DTTB and a MBB UE in the same room, this separation distance seems unrealistic. In addition, to achieve the ACS value of 80 dB requires an insertion of external filters to the receivers concerned. Although it has not been considered in this study, additional measures may need to be taken into account for the effect of direct interference from a MBB UE into a DTTB receiver circuit. The above shows the difficulties of coexistence of both ISDB-T receivers and IMT in the same band in the same geographical area.

Study 8 on Monte Carlo simulations was made in order to evaluate interference from an IMT network into an ISDB-T receiver. In an urban environment, simulations for the IMT downlink show that sharing between both systems is only possible for frequency separations equal to or higher than 8 MHz between both systems. For a separation of 8 MHz, a 45 kilometres distance is required between the DTTB receiver and the central cell of the IMT network. For a separation of 18 MHz, a 20 kilometres distance is required between the DTTB receiver and the central cell of the IMT network.

In a rural environment, the simulations of the IMT downlink show that the sharing between both systems is only possible for frequency separations equal to or higher than 12 MHz between both systems, and with distances exceeding 50 kilometres.

These results demonstrate that co-channel sharing between IMT and ISDB-T is not feasible in the same location within the 470-698 MHz range.

Also a sharing criterion is provided, based on needed spatial and frequency separation, for the adjacent channel case. This criterion highlights the difficulty for both systems to share in this frequency range.

Study 9 calculated aggregate interference from a cluster of 19 IMT base-stations into DTT receivers for ATSC, DVB-T, DVB-T2 and ISDB-T technologies. Initial deterministic calculations with IMT base-station antennas directed towards the DTTB coverage area indicated that separation distances between the edge of the DTT coverage area and the IMT network ranged from 30-43 kilometres (for DVB-T/T2) to 72 kilometres (for ATSC and ISDB-T).

Further analysis was then conducted to examine the potential impact of one possible mitigation technique which may be considered as standard practice when planning IMT networks close to borders. It was calculated that the separation distances were reduced to 14-20 kilometres (for DVB-T/T2) and 33 kilometres (for ATSC and ISDB-T) when it was assumed that the IMT base-station antennas were pointing away from the DTT coverage area.

1/1.1/4.1.1.1.2.2 Analysis of co-channel and adjacent channel studies

Analysis of the studies indicated a range of frequency and geographic separation distances required for sharing between DTTB systems and MS (IMT) systems. The ranges reflect various assumptions and technical assumptions used in the studies.

The studies summarized above produced a range of separation distances for the following scenarios:

For co-channel interference:

From MS (IMT) base-station to DTTB receiver:

- from 10 kilometres to 106 kilometres considering a single interferer;
- from 14 kilometres to over 200 kilometres considering cumulative interference.

From MS (IMT) UE to DTTB receiver:

- 1.2 kilometres considering a single interferer;
- from 1 kilometre to 37 kilometres considering cumulative interference.

For adjacent-channel interference:

From MS (IMT) base-station to DTTB receiver:

- from 5 kilometres to 65 kilometres for frequency offsets of 90 MHz and 8 MHz, respectively, considering a single interferer;
- from 1 kilometre to over 100 kilometres for the first adjacent channel case considering cumulative interference.

From MS (IMT) UE to DTTB receiver:

- from 15 meters to 700 meters for a frequency offset of 8 MHz considering a single interferer;
- from 2 kilometres to 17 kilometres for frequency offsets of 18 MHz and 8 MHz, respectively, for cumulative interference.

For co-channel interference:

From DTTB transmitter to MS (IMT) base-station:

- from 559 kilometres to 621 kilometres considering a single interferer.

For adjacent-channel interference:

From DTTB transmitter to MS (IMT) UE:

- from 129 kilometres to 153 kilometres considering a single interferer.

The co-channel studies above show that separation distances between MS (IMT) base-stations and DTTB receivers/transmitters are several tens of kilometres, which makes sharing difficult.

1/1.1/4.1.1.2 Applications ancillary to broadcasting (SAB/SAP) and mobile service/IMT in Region 1

In Region 1, 72 administrations are using the frequency band 470-790 MHz or parts of it under RR No. **5.296** for applications ancillary to broadcasting (SAB/SAP). Due to the propagation and body absorption characteristics it is the core band for audio SAB/SAP. Parameters have been developed and can be found in the draft new Report ITU-R BT.[SAB_SAP] by ITU-R for sharing studies under WRC-15 agenda item 1.2 and are equally valid for this frequency range. Audio SAB/SAP needs to be operated in accordance with the parameters given in this report including acceptable levels of interference from any source. However, it should be noted that the results of the sharing studies show that a co-channel and co-location operation between SAB/SAP and IMT is not feasible.

1/1.1/4.1.1.3 Fixed service and mobile service/IMT

This study examines the compatibility of proposed IMT systems and FS systems operating in the 470-694/698 MHz frequency range.

The co-frequency channel results show that the required separation distance can range from around 25 kilometres to nearly 220 kilometres, depending on the interference scenario and deployment environment. These results are based on worst-case assumptions including the pointing direction of the IMT base-station and the application of the propagation model. Furthermore, mobile operators can determine which locations are suitable for the deployment of IMT base-stations, which can prove advantageous in terms of meeting any required separation distances.

The adjacent channel results show that in the worst-case scenarios (FS receive station pointing directly toward a macro deployment of IMT base-stations) the separation distance needed to protect the FS station exceeds 30 kilometres. However, these pointing scenarios should be avoidable in

practice, and for more realistic pointing scenarios, the interference can be mitigated through a combination of geographic separation and frequency separation. For these cases, the interference can be mitigated with a separation distance between the FS receive station and the IMT base-station on the order of 10 kilometres coupled with a frequency separation of about one to two channel bandwidths. It is important to note that the frequency separation results reflect channel centre-to-channel centre separations and not guard bands, which are usually expressed as channel edge-to-channel edge.

These results also show that the interference from the IMT UE is acceptable with a geographic separation as low as one kilometre. It should be noted that certain assumptions such as FS receive station placement and direction, use of propagation model, etc. overestimate interference from the IMT network.

1/1.1/4.1.1.4 Radio astronomy service and mobile service/IMT

The results presented in draft new Report ITU-R RA.[RAS-IMT] show that to ensure the protection of the RAS in the frequency band 608-614 MHz for the case of in-band sharing with IMT systems, a separation distance of a thousand kilometres is needed between IMT macro rural base-stations and an RAS antenna, and of 130 kilometres for UE, for an assumed flat terrain profile. This indicates that in-band sharing will be very difficult, if not impossible, to achieve in practice.

1/1.1/4.1.1.4.1 Unwanted emissions in the frequency band 608 - 614 MHz

For the case of IMT systems operating in the range 470-694 MHz but adjacent to the frequency band 608-614 MHz allocated to the RAS, a separation distance between IMT macro rural base-stations and an RAS antenna of 75 kilometres is needed, and of one kilometre for UE, for an assumed unwanted emission level of –50 dBm/MHz and a flat terrain profile.

1/1.1/4.1.1.5 Aeronautical radionavigation service and mobile service/IMT

One compatibility study was presented to ITU-R for the band 645-694 MHz and no new Report was created regarding ARNS and MS issues in the above mentioned frequency band due to the fact that this issue technically covered in the working document toward PDN Report ITU-R.M.[ARNS-MS] (see Annex 23 of the Chairman's Report of the final meeting of JTG 4-5-6-7 – Document 4-5-6-7/715). Other studies for the band 694/698-790 MHz are summarised in the CPM Text for WRC-15 agenda item 1.2.

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1/1.1/4.1.2 Frequency range 1 300-1 525 MHz

1/1.1/4.1.2.1 Radionavigation-satellite service and mobile service/IMT

RNSS systems are operational in the 1 164-1 300 MHz, 1 300-1 350 MHz, 1 559-1 610 MHz, 5 000-5 010 MHz and 5 010-5 030 MHz bands. Certain RNSS signals are used for safety-of-life applications and subject to RR No. **4.10** which states that "*the safety aspects of radionavigation require special measures to ensure their freedom from harmful interference*".

Recommendation ITU-R M.1318 provides a model for evaluating the impact of continuous interference to the RNSS, however no technical studies on compatibility between RNSS in the frequency bands above and IMT-Advanced have been carried out by ITU-R. RNSS signals are very low-power, spread-spectrum signals coming from space that are difficult to detect. It takes special processing by RNSS receivers to extract the signal from the background noise. As shown in studies leading up to WRC-2000, if a higher-power, continuous-in-time signal in the same frequency band, or an adjacent band, is broadcast near an RNSS receiver, it could desensitize the RNSS receiver to the degree that the RNSS receiver is unable to extract the RNSS signal from space. As a result, frequency ranges near those used for RNSS should not be identified for IMT.

1/1.1/4.1.2.2 Fixed service and mobile service/IMT

Co-channel case

The report presents an analysis of the feasibility of co-channel compatibility/sharing between IMT systems and FS point-to-point links currently operating in the frequency band 1 350-1 527 MHz.

Separation distances required for co-channel coexistence between IMT and fixed links will inevitable be larger than those required for adjacent channel / adjacent band coexistence. Separation distances that are calculated for co-channel operation under worst-case assumptions may appear quite large, however these are more like coordination distances than minimum separation distances that will be required to avoid interference in reality, and can give a misleading impression about the potential for coexistence.

The geographic separation required between an IMT transmitter and a co-channel fixed link is highly dependent on the orientation of the fixed link antenna, the transmitter and receiver antenna heights relative to the clutter/terrain, the power transmitted, and fixed link receiver antenna performance. A much greater separation is required for base-station transmitters than for UE, especially where base-stations are located above the local clutter and their emission levels are high in order to provide wide area coverage for UE.

There are likely to be mitigation factors associated with many deployment scenarios that would significantly decrease separation distances. For example, the required separation will decrease where there is additional shielding introduced by local terrain and clutter. This is likely to be the case, for example, if the base-station transmitters are deployed to serve micro/pico cells located in cluttered urban environments. The separation distances calculated in this study range from 6.5 to 21 kilometres for IMT macro base-stations deployed in urban areas. When the urban deployment is restricted to micro cells, the separation distances are reduced to between 2.5 and 11 kilometres.

The above mentioned separation distances were calculated under the assumption of 20 dB additional clutter loss from nearby buildings, this however may not be applicable in the case where a macrocell IMT base-station antenna is located above roof top level and also taking into account that FS station antenna is normally located above rooftop, at least relative to the buildings in the direction of the main lobe.

These calculated separation distances are going to be dependent on a number of local level considerations including deployment and geographical distribution of both IMT and FS stations at national level and may require coordination with neighbouring administrations.

In actual deployment cases where a terrain database is available a more accurate case-specific separation distance may be calculated using a point-to-point propagation model such as Recommendation ITU-R P.452.

In the case of IMT UE the required separation is likely to be much smaller than for base-stations. Interference aggregation through the fixed link receiver main beam is unlikely to be significant since the UE are likely to be located below terrain/clutter and the individual interference paths will be subject to different propagation losses. It is likely that coexistence of fixed links with IMT uplinks will be possible provided that the fixed links are not located close to major population centres or busy transport infrastructures where mobile devices are likely to be used in close proximity.

Adjacent channel case

An interference analysis of the feasibility of adjacent channel /adjacent band co-existence between IMT systems and FS point-to-point links currently operating in 1 350-1 527 MHz has been considered by the ITU-R. The analysis is based on deriving separation distances for different guard

band assumptions. For a given guard band, the effective interfering emission power into the transmitter antenna resulting from the following two mechanisms has been considered:

- the IMT base-station / UE unwanted emissions overlapping the fixed link receiver bandwidth. This is calculated by integrating the transmitter emission mask over the receiver bandwidth;
- the IMT base-station / UE transmitter in-band power overlapping the fixed link receiver selectivity mask. This is calculated by integrating the receiver selectivity mask over the transmitter bandwidth.

With no guard band, separation distances in the range 8.3 to 25.9 kilometres (depending on the assumed IMT base-station emission mask and fixed link receiver antenna pointing and antenna pattern) have been calculated to satisfy the fixed link interference criterion for an IMT base-station. This is reduced to 2.4 to 15.7 kilometres when 2 MHz guard band (which is equal to the fixed link receiver bandwidth) is assumed and 2.4 to 10.6 km when 10 MHz guard band (which is equal to the IMT base-station transmitter bandwidth) is assumed.

Depending on the assumed IMT base-station emission mask and fixed link antenna pointing and antenna pattern, the calculated separation distance is between 0.9 and 14.9 kilometres when the IMT base-station transmitter is assumed to point away from the fixed link receiver. Similarly the separation is between 1.5 and 19.8 kilometres when the fixed link margin loss due to IMT base-station interference is 3 dB. If IMT base-station transmitters are deployed in cluttered urban area the separation is between 0.15 and 6.5 kilometres.

The required separation is less than 2 kilometres when interference from IMT UE transmitters is considered. Depending on the assumed guard band, interference alignment and IMT UE emission mask, the required distance is reduced to a few hundred metres.

1/1.1/4.1.2.3 Broadcasting service and mobile service/IMT 1 452-1 492 MHz

This study provides a sharing study between potential IMT system and the BS in the frequency band 1 452-1 492 MHz conducted as preparatory work for WRC-15 agenda item 1.1. This Report aims at analysing the feasibility of sharing between the BS and the MS through comparison of sharing between digital audio broadcasting networks and IMT networks with the case of sharing between networks within the BS. Only the case of IMT downlink is considered.

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Sharing between BS and MS (IMT) in 1 452-1 492 MHz is not feasible in the same geographical area. Nevertheless, in the case of one administration implementing IMT and a neighbouring administration implementing a broadcast service, the maximum field strength value produced at the border of the neighbouring administration by a single IMT base-station, together with the relevant coordination procedure, could be used in order to avoid interference from the IMT network to the T-DAB network. The concerned administrations could agree to use the above-mentioned value, as for example 41 dBμV/m or 21 dBμV/m at the border at 10 m height, depending on whether aggregated interference from IMT network is to be considered or not.

1/1.1/4.1.2.4 Radiodetermination and mobile service/IMT

All studies carried out were based on the parameters provided by ITU-R and show that within the same geographical area co-frequency operation of mobile broadband systems and radar is not feasible. Furthermore, there is widespread usage of this frequency range in some countries for radar. In addition, harmonized usage of all or a portion of this frequency range by MS for the implementation of IMT may not be feasible, in particular on a global basis.

In some countries the band is not fully used by radiodetermination systems, and there were studies undertaken in ITU-R which showed that sharing may be feasible in those countries subject to

various mitigation measures, and to co-ordination with potentially affected neighbouring countries. However no conclusions as to the applicability, complexity, practicability or achievability of these mitigations could be reached.

1/1.1/4.1.2.5 Aeronautical mobile telemetry systems and mobile service/IMT

In order to provide protection of aeronautical mobile telemetry ground receivers in Region 1 from co-frequency interference caused by IMT base-stations, required separation distances would generally exceed 100 kilometres:

- For interference from a single IMT base-station, separation distances are around 225 kilometres for a land path and up to 415 kilometres for a sea path. For aggregate interference from an IMT network having multiple base-stations, separation distances are up to 450 kilometres for a land path and 500 kilometres for a mixed path (40% of land and 60% of sea).
- For interference from a single IMT base-station, separation distances are around 100-130 kilometres and increasing up to 200 kilometres when assuming the apportionment for urban 40-50% path and less than 10 % in the total path, respectively.

However, when applying mitigation techniques (e.g., sector antenna disabling at IMT base-stations) separation distances may be reduced to few tens of kilometres. This will be addressed during coordination between the concerned administrations.

With respect to Region 1, Report ITU-R M.2286 indicated the operation of telemetry on-board receivers.

However, some administrations not listed in RR No. **5.342** expressed the view that such airborne relay receivers cannot be considered as an assignment in conformity with RR No. **5.342** and such stations cannot be considered as a part of telemetry application and shall not be considered for protection.

Providing protection for such air-borne receiver in Region 1 from co-frequency interference caused by an IMT base-station may require separation distances exceeding line-of-sight (460 kilometres for typical flight altitudes). In case of airborne aeronautical receiver, necessary separation distance is equal to line of sight distance for any cases. In case of ground-based aeronautical receiver, due to finite value of telemetry receiver antenna pattern width, its main lobe may be affected by emissions from several interferers located at different distances from a given aeronautical mobile telemetry receiver. In that case the aggregate effect of interference from IMT base-stations would be defined by density of their deployment and would result in increasing the required protection distances.

In order to provide protection for IMT base-stations from co-frequency interference caused by an air-borne aeronautical mobile telemetry station in Region 1, maximum required separation distances would be around 460 kilometres. It has to be noted that the duration of interference and required separation distance is depending on the visibility of the airborne telemetry transmitter, of the scenario of the flight and of parameters such as the antenna diagram. Thus, such interference would not be permanent.

Taking into account the protection criteria of average long-term throughput loss per cell; in order to protect IMT UE from cross-border co-frequency interference caused by an airborne aeronautical mobile telemetry station in Region 1, separation distances up to 25 kilometres would be required.

In Region 2, co-channel sharing between IMT and AMT in the sub-band 1 435-1 525 MHz has been studied by one administration. Based on that study, it is concluded that such sharing is not practical in the geographic areas located within the exclusion zones required below for all of the possible uplink/downlink combinations:

- For interference from IMT UE to AMT ground stations, typical protection distances are 47 kilometres and more in the absence of extreme (>20 dB) clutter loss.
- For interference from IMT base-stations to AMT ground stations, the distance beyond which an IMT base-station needs to be from an AMT ground station exceeds 100 kilometres, even for “typical” terrain.
- For interference from AMT equipped aircraft to IMT UE and IMT base-stations, the separation distances will be 45 km in the case of interference to IMT UE, and 80 km or more in the case of interference to IMT base-stations.

Adjacent channel co-existence of IMT systems was studied by a different Region 2 administration operating AMT in the band 1 452-1 472 MHz, with IMT operating in adjacent channels. Adjacent channel operation has been determined feasible with a separation distance of one kilometre from the IMT base-station to the AMT receiver. However, this conclusion depends on certain assumptions not characteristic of flight testing as conducted in another administration (such as AMT antenna elevation angle, maximum flight distance from the AMT antenna, and maximum altitude). For this case, there would be a significant protection shortfall using a 1 kilometre separation distance for the adjacent channel case.

1/1.1/4.1.2.6 Broadcasting-satellite service in the frequency band 1 452-1 492 MHz

ITU-R studies concluded that co-frequency sharing between BSS and IMT is not feasible in the same area.

The sharing and compatibility for adjacent frequency bands (in the same and in adjacent service areas) between IMT and BSS was not studied. Some studies considered co-frequency sharing between BSS and IMT in adjacent service areas.

With respect to the interference from IMT to BSS, the results of the preliminary studies are that, in the case of implementation of IMT networks on adjacent territory to the BSS service area, the maximum power flux-density (pfd) values produced by each IMT base-station at the edge of BSS service area to protect BSS earth stations is in the range of –139 to -150 dBW/m²/MHz if aggregated interference is taken into account and is in the range of -119 to -130 dBW/m²/MHz if aggregated interference is not taken into account.

No consensus has been reached with respect to the results of the studies outlined below, in particular the pfd mask concept, assumptions and parameters used in the studies.

Two views were expressed:

One view is that a BSS pfd mask for the protection of IMT may facilitate the coexistence:

- The power flux-density value of BSS satellite to protect receiver terminals of MS, including IMT, in the band 1 452-1 492 MHz is –113 dBW/m²/MHz.
- The pfd value of BSS satellite to protect base-stations of MS, including IMT, in the band 1 452-1 492 MHz is in the range of -122 to -134 dBW/m²/MHz depending on the vertical arrival angle.

Another view is that no additional limitation shall be imposed on the incumbent services in ITU-R studies related to WRC preparations. Therefore, there shall be no pfd mask limiting BSS space station power in the RR. The pfd limits for BSS space station proposed above neither could be met by the current and future satellite systems nor approved by ITU-R.

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1/1.1/4.1.2.7 Radio astronomy service and mobile service/IMT

The results presented in draft new Report ITU-R RA.[RAS-IMT] show that to ensure the protection of the RAS in the frequency band 1 330-1 400 MHz for the case of in-band sharing with IMT systems operating in the frequency band 1 375-1 400 MHz, a separation distance of about 500 kilometres is needed between IMT macro rural base-stations and an RAS antenna, and of 85 kilometres for UE, for an assumed flat terrain profile. This indicates that in-band sharing may be very difficult to achieve in practice.

1/1.1/4.1.2.8 Unwanted emissions in the frequency band 1 400-1 427 MHz

1/1.1/4.1.2.8.1 Earth exploration-satellite service (passive) and mobile service/IMT

Draft new Report ITU-R RS.[EESS-IMT 1.4 GHz] shows that, in order to protect EESS (passive) systems, the unwanted emission level of –60 dBW/27 MHz as currently recommended in Resolution **750 (Rev. WRC-12)** is not sufficient and that the following levels of unwanted emissions in the 1 400-1 427 MHz frequency band are required:

For base-stations:

- -80 dBW/27 MHz in the case both 1 375-1 400 MHz and 1 427-1 452 MHz frequency bands are considered to be used simultaneously by IMT systems;
- -75 dBW/27 MHz in the case only one of the 1 375-1 400 MHz or 1 427-1 452 MHz frequency bands is to be considered for IMT systems.

For user equipment:

- -65 dBW/27 MHz (This value is derived under the assumption that one UE is transmitting at an average output power of 15 dBm (over all resource blocks (RB)) per sector. It would therefore have to be verified consistently according to these conditions.)

These values are assumed to protect also SRS (passive).

During the course of the studies, it was shown in particular that current UE specifications in certain standards in the band 1 427-1 452 MHz present unwanted emission levels that are higher than those recommended in Resolution **750 (Rev.WRC-12)**. It was also shown that measured unwanted emission levels of UE based on these standards are lower than those recommended values if some operational conditions are applied, such as average transmission power, narrow transmitting bandwidth and appropriate size of guard bands.

It is confirmed that relevant combination of channel arrangements, guard bands and/or improved filters and other measures should allow designing mobile systems (base-stations and UE) compliant with the above values.

1/1.1/4.1.2.8.2 Radio astronomy service (1 400-1 427 MHz) and the mobile service/IMT in adjacent band

The results of three independent studies presented in draft new Report ITU-R RA.[RAS-IMT] show that to ensure the protection of RAS stations in the frequency band 1 400-1 427 MHz a separation distance of about a hundred kilometres is needed between an RAS antenna and IMT macro rural base-stations, whereas it is between 1 and 10 kilometres for UE.

1/1.1/4.1.2.9 Mobile-satellite service and mobile service/IMT

The frequency bands 1 518-1 559 MHz (space-to-Earth), 1 626.5-1 660.5 MHz (Earth-to-space) and 1 668-1 675 MHz (Earth-to-space) are currently in use by GSO MSS operators.

The ITU-R has studied sharing and compatibility between terrestrial IMT-Advanced systems in the band 1 518-1 527 MHz and mobile earth stations (MESs) in MSS space-to-Earth frequency bands, considering aeronautical, maritime and land MSS applications.

Geographic separation between IMT-Advanced stations and MES would be required to avoid harmful interference to MESs. The minimum separation distances depend on a number of factors, including the operational scenario for the MESs (whether land, maritime or aeronautical), and the propagation conditions between the two stations. Depending on, amongst others, these factors, example minimum separation distances for the assumed dB I/N[8] value range from 1 to 546 kilometres in normal propagation conditions, and from 105 to 830 kilometres in anomalous propagation conditions. Studies on sharing between terrestrial IMT-Advanced systems in the band 1 518-1 527 MHz to MESs in in the MSS have not been finalised.

Regarding adjacent band compatibility, preliminary studies have been presented to the ITU-R but no conclusions were reached. Further study of adjacent band interference may be needed to assess the potential for interference from IMT-Advanced systems operating below 1 518 MHz to MESs operating above 1 518 MHz.

1/1.1/4.1.3 Frequency range 1 695-1 710 MHz

1/1.1/4.1.3.1 Meteorological-satellite service and the mobile service/IMT

There are hundreds of MetSat stations worldwide in the 1 695-1 710 MHz frequency band operated by almost all national meteorological services and many other users worldwide.

Draft new Report ITU-R SA.[METSAT-IMT 1.7 GHz] shows that the required protection area around MetSat stations from which potential IMT base-stations in the 1 695-1 710 MHz frequency band would be up to several hundred kilometres. Therefore, sharing between IMT base-stations and MetSat stations in the 1 695-1 710 MHz frequency band is not feasible.

This report also provides assessments of protection areas around MetSat stations from which IMT UE in the 1 695-1 710 MHz frequency band would have to be excluded, with diverging results depending on the assumptions, parameters, and methodologies used.

Two studies depict required separation distances from 46 kilometres (GSO case) and 60 kilometres (NGSO case) up to more than 120 kilometres (NGSO case), even considering low rural deployment and conclude that sharing is not feasible between IMT UE and MetSat stations in the 1 695-1 710 MHz. Another study provides an example calculation resulting in separation distances ranging from 32 to 46 kilometres (NGSO case) and concludes that sharing between IMT UE and MetSat stations is feasible.

1/1.1/4.1.4 Frequency ranges 2 025-2 110 MHz and 2 200-2 290 MHz

1/1.1/4.1.4.1 Space research, Earth exploration-satellite, space operation services and mobile service/IMT

Draft new Report ITU-R SA.[2 025-2 290 MHz] assesses the feasibility for accommodation of IMT and IMT-Advanced systems in both the 2 025-2 110 MHz and 2 200-2 290 MHz frequency bands. These analyses show that sharing is not feasible between IMT systems and incumbent data relay satellites forward and return links operating in these bands in the SRS (space-to-space), EESS (space-to-space) and SOS (space-to-space).

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[8] The I/N value assumed was -10 dB. It is noted that other values may also apply.

These new studies reaffirmed earlier ITU-R studies as in Recommendation ITU-R SA.1154 that resulted in the adoption of RR No. **5.391** at WRC-97, which prohibits high-density mobile systems from operation within these frequency bands.

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1/1.1/4.1.5 Frequency bands within the range 2 700-2 900 MHz

1/1.1/4.1.5.1 Radiodetermination and mobile service (IMT)

All studies carried out were based on the parameters provided by ITU-R and show that within the same geographical area co-frequency operation of mobile broadband systems and radar is not feasible. Furthermore, there is widespread usage of this frequency range in some countries for radar. In addition, harmonized usage of all or a portion of this frequency range by MS for the implementation of IMT may not be feasible, in particular on a global basis.

In some countries the band is not fully used by radiodetermination systems, and there were studies undertaken in ITU-R which showed that sharing may be feasible in those countries subject to various mitigation measures, and to co-ordination with potentially affected neighbouring countries. However no conclusions as to the applicability, complexity, practicability or achievability of these mitigations could be reached.

1/1.1/4.1.5.2 Unwanted emissions in the frequency band 2 690-2 700 MHz

1/1.1/4.1.5.2.1 Radio astronomy service and the mobile service/IMT

The results presented in draft new Report ITU-R RA.[RAS-IMT] show that to ensure the protection of RAS stations in the frequency band 2 690-2 700 MHz a separation distance of about 60 kilometres is needed between an RAS antenna and IMT macro rural base-stations and of one kilometre for UE, for an assumed unwanted emission level of –50 dBm/MHz and a flat terrain profile.

1/1.1/4.1.6 Frequency bands within the range 2 900-3 100 MHz

1/1.1/4.1.6.1 Radiodetermination and mobile service (IMT)

All studies carried out were based on the parameters provided by ITU-R and show that within the same geographical area co-frequency operation of mobile broadband systems and radar is not feasible. Furthermore, there is widespread usage of this frequency range in some countries for radar. In addition, harmonized usage of all or a portion of this frequency range by MS for the implementation of IMT may not be feasible, in particular on a global basis.

In some countries the band is not fully used by radiodetermination systems, and there were studies undertaken in ITU-R which showed that sharing may be feasible in those countries subject to various mitigation measures, and to co-ordination with potentially affected neighbouring countries. However no conclusions as to the applicability, complexity, practicability or achievability of these mitigations could be reached.

1/1.1/4.1.7 Frequency bands within the range 3 300-3 400 MHz

1/1.1/4.1.7.1 Radiodetermination and the mobile service/IMT

The studies conducted in ITU-R were between IMT base-stations and UE and all relevant types of radar systems described in the Recommendation ITU-R M.1465-1, as well as radar systems into IMT base-stations and UE.

These results show that sharing between IMT and land based Radar B is not feasible in the same geographical area. As to other radar systems taken into account, the results vary depending on the

study. However 3 out of 4 studies conclude that sharing between IMT and airborne Radar A is not feasible in the same geographical area. The study that shows that sharing between IMT and airborne Radar A may be feasible relies on a level of additional isolation that may be very difficult to achieve and will not be guaranteed in all deployment scenarios.

For one study sharing between IMT indoor and land based Radar A was shown to be possible with a separation distance up to 1.1 km. However other two studies showed that sharing would not be possible unless the separation distance from 25 to 45 km is maintained.

The possible impact of radar systems on IMT has been also studied. Overall conclusion is that in-door IMT systems shall be separated from all the radar types specified in Recommendation ITU-R M.1465 by hundreds of kilometres.

All of the studies on the protection of in-door IMT from airborne Radar A indicate that required separation distance exceeds hundreds of kilometres. Some of the included studies indicate that the required separation distance between radar systems and IMT may even exceed 1 000 kilometres.

1/1.1/4.1.8 Frequency bands within the range 3 400-4 200 MHz

1/1.1/4.1.8.1 Fixed service and the mobile service/IMT

This study examines the compatibility of proposed IMT systems and FS systems operating in the 3 400-4 200 MHz frequency range.

The co-frequency channel results show that the required separation distance can range from less than one kilometre to nearly 100 kilometres, depending on the interference scenario and deployment environment. These results are based on worst-case assumptions including the pointing direction of the IMT base-station and the application of the propagation model. Furthermore, mobile operators can determine which locations are suitable for the deployment of IMT base-stations, which can prove advantageous in terms of meeting any required separation distances.

The adjacent channel results show that in the worst-case scenarios (FS receive station pointing directly toward a macro deployment of IMT base-stations) the separation distance needed to protect the FS station exceeds 30 kilometres. However, these pointing scenarios should be avoidable in practice, and for more realistic pointing scenarios, the interference can be mitigated through a combination of geographic separation and frequency separation. For these cases, the separation distance between macro base-stations and FS receive stations is on the order of a few kilometres coupled with a frequency separation of about one or two channel bandwidths, depending on the distance separation. It is important to note that the frequency separation results reflect channel centre-to-channel centre separations and not guard bands, which are usually expressed as channel edge-to-channel edge. It should also be noted that operators decide where to deploy IMT base-stations based on a variety of factors including minimizing interference near international borders in accordance with regulations.

The required geographic and frequency separations are significantly reduced for the small cell indoor base-station deployment scenario. For this case, the separation distance between small cell base-stations and FS receive stations is on the order of one kilometre coupled with a frequency separation of about one channel bandwidth or a few kilometres with no frequency separation, depending on the relative pointing directions of the IMT and FS stations.

These results also show that the interference from the IMT UE is relatively low. This interference can be mitigated by either a frequency separation of about one channel or a geographic separation of a few kilometres.

It should be noted that certain assumptions such as FS receive station placement and direction, use of propagation model, etc. overestimate interference from the IMT network.

1/1.1/4.1.8.2 Fixed-satellite service and mobile service/IMT

This frequency band has been used by the FSS for space-to-Earth links, together with the 5 850-6 725 MHz frequency band for Earth-to-space links, since the 1970s. The technology is mature and equipment is available at low cost.

The low gaseous atmospheric absorption combined with lower attenuation due to rain enables satellite communication links utilising the band 3 400-4 200 MHz to be established with high availability . This band is used by earth stations throughout the world, but is particularly important in areas with severe rain fade conditions where use of higher frequencies (e.g. 11/14 GHz or 20/30 GHz) would not enable the required availabilities to be provided efficiently.

Furthermore, the wide coverage of satellites in these bands enable services to be provided to developing countries, to sparsely populated areas and over large distances (e.g. providing program content and data distribution between continents).

These factors have led to satellites networks in these bands being an important part of the telecommunications infrastructure in many countries, including developing countries offering a multitude of services, including very small aperture terminal (VSAT) networks, internet providers, point-to-multipoint links, satellite news gathering, TV and data broadcasting to satellite master antenna television (SMATV) and direct-to-home (DTH) receivers. In many countries receive-only earth stations or VSAT terminals are not individually licensed and their number, location or detailed characteristics are therefore not typically available.

Different types of FSS receiving earth stations are described in Reports ITU-R M.2109 and ITU-R S.2199. Due to their wide coverage characteristics, satellites operating in these bands have been extensively employed for disaster relief operations. In cases of major disasters such as tsunamis, earthquakes, hurricanes, etc., when the “wired” telecommunication infrastructure is significantly or completely destroyed by a disaster, only radiocommunication services and, especially networks operating in the FSS, can be employed for disaster relief operations providing the vital links between on-the-ground aid teams, governments and health care facilities. Satellite networks using small aperture earth stations, such as fixed VSATs and transportable earth stations, are one of the most viable solutions to provide emergency telecommunication services for relief operations. Systems operating in the FSS, are not only vital during relief operations, but are also extremely important even before a disaster happens, enabling alerting all those who may be concerned.

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In addition, FSS systems in this frequency range are used as part of the ground infrastructure for transmission of aeronautical and meteorological information. Some mobile-satellite systems use parts of the band 3 400-4 200 MHz for feeder links to provide a variety of services, including aeronautical and maritime services. The use of these frequency bands by the FSS furthermore includes governmental uses and collection and distribution of meteorological data by the WMO.

As of December 2012, a total of about 180 geostationary satellites were operating in these bands, about one satellite every second degree around the geostationary arc and the number of both satellites and earth stations operating in these bands are expected to increase.

In addition to the satellites carrying traffic in these bands, many satellites that operate in other frequency bands have their TT&C operations (telemetry, tracking and command) in the 3 400-4 200 MHz range.

(1) In-band emissions

In the case of IMT-Advanced suburban/urban macro-cell deployment scenarios:

- For the long-term interference criterion, the required separation distances are at least in the tens of kilometres. For the short-term interference criterion, the required separation

distances, including when the effects of terrain are taken into account, exceed 100 kilometres for most of the cases. Both the long-term and short-term interference criteria would have to be met.

- In some cases, the required separation distances are larger, up to 525 kilometres. In other cases, the required separation distances could be reduced by taking into account additional effects of natural and artificial shielding. However these effects are site specific.

In the case of IMT-Advanced small-cell outdoor deployment scenarios:

- For the long-term interference criterion, the required separation distances are in the tens of kilometres. For the short-term interference criterion, the required separation distances, including when the effects of terrain and clutter are taken into account, are around 30 kilometres in typical IMT-Advanced small-cell deployment using low antenna height in urban environment. In some cases the required separation distances were found to exceed 100 kilometres. Both the long-term and short-term interference criteria would have to be met.

In the case of IMT-Advanced small-cell indoor deployment scenarios:

- The required protection distance for an indoor small cell deployment was smaller relative to small cell outdoor due to the fact that some degree of building attenuation was assumed, as well as lower base-station e.i.r.p and antenna height.
- For the long-term interference criterion, the required separation distances vary from about 5 kilometres to tens of kilometres. For the short-term interference criterion, the required separation distances vary from about 5 kilometres to tens of kilometres, and in some instances up to 120 kilometres. Both the long-term and short-term interference criteria would have to be met.
- The wide range of distances is a consequence of earth stations in a variety of terrain conditions, assumed clutter loss, and different assumptions for the building penetration loss (0 to 20 dB).

The above mentioned separation distances were derived assuming an IMT-Advanced deployment limited to indoor. If a percentage of IMT-Advanced UE is used outdoors, the required separation distances would normally be larger.

FSS earth station receivers that are deployed with low elevation angles require a path between space and earth to and from the satellite that is clear of ground clutter. For this reason, it should not be assumed that clutter is available to attenuate emissions from an IMT-Advanced UE that is located in the azimuth of the main beam of the FSS earth station receiver, especially those that have been installed with low elevation angles.

(2) Adjacent band emissions

Adjacent band compatibility between IMT-Advanced systems in the bands or parts of the bands 3 300-3 400 MHz / 4 400-4 500 MHz / 4 800-4 990 MHz and FSS systems in the bands 3 400-4 200 MHz/4 500-4 800 MHz have been studied.

- Using the long-term interference criteria, the required separation distance is from 5 kilometres up to tens of kilometres for IMT-Advanced macro-cell and from 900 metres to less than 5 kilometres for IMT-Advanced small-cell outdoor deployments, respectively, with no guard band.
- In the case of IMT-Advanced deployment in the adjacent band, the separation distance between IMT-Advanced base-stations and a single FSS receiver earth station could be

reduced by employing a guard band between the edge of the IMT-Advanced emission and FSS allocation.

- For a specific macro-cell deployment scenario studied, the required separation distances from the edge of the IMT-Advanced deployment area are in the range of 30 kilometres to 20 kilometres with an associated guard band of 2 MHz to 80 MHz respectively. Likewise, for a specific small-cell deployment studied, the required separation distances from the edge of the IMT-Advanced deployment area are in the range of 20 kilometres to 5 kilometres with an associated guard band of 1 MHz to 2 MHz respectively.

One study shows that the use of a common representative FSS receive LNA/LNB front-end RF filter provides an insignificant decrease in the required separation distance to protect the FSS earth station receiver from adjacent band emissions. Moreover, inclusion of an RF filter provides little additional rejection of adjacent band emissions over what is already provided by the IF selectivity of the tuner.

(3) LNA/LNB overdrive

The results show that emissions from one IMT-Advanced base-station can overdrive the FSS receiver LNA, or bring it into non-linear operation, if a macro cell deployment is closer than a required protection distance that ranges from 4 kilometres to 9 kilometres to an earth station in the band 3 400-4 200 MHz and 4 500-4 800 MHz. The required protection distance to prevent overdrive of the FSS receiver by IMT-Advanced emissions ranges from one hundred metres to 900 metres for the case of small cell deployments.

(4) Intermodulation

The required protection distance to prevent intermodulation interference produced in the receiver of the FSS earth station from being caused by multiple IMT-Advanced base-stations ranges from 2 kilometres to 8 kilometres in the case of macro cell deployments. The required protection distance in the small cell deployment scenario to limit the possibility of intermodulation interference being caused into the earth station receivers in the band 3 400-4 200 MHz and 4 500-4 800 MHz is at least 100 metres to as high as half a kilometre.

Conclusions

The sharing between IMT-Advanced and FSS is feasible only when FSS earth stations are at known, specific locations, and deployment of IMT-Advanced is limited to the areas outside of the minimum required separation distances for each azimuth to protect these specific FSS earth stations. In this case, the FSS protection criteria should be used to determine the necessary separation distances to ensure protection of the existing and planned FSS earth stations.

When FSS earth stations are deployed in a typical ubiquitous manner or with no individual licensing, sharing between IMT-Advanced and FSS is not feasible in the same geographical area since no minimum separation distance can be guaranteed.

Deployment of IMT-Advanced would constrain future FSS earth stations from being deployed in the same area in the bands 3 400-4 200 MHz as shown by the studies.

1/1.1/4.1.8.3 Unwanted emissions into the band 4 200-4 400 MHz

Radio altimeters are operational in the band 4 200-4 400 MHz, and operational and technical characteristics and protection criteria are provided in Recommendation ITU-R M.2059. Those altimeters are an essential component of aeronautical safety of life systems, including precision approach, landing, ground proximity and collision avoidance systems.

No studies were provided regarding protection of radio altimeters from unwanted emissions from IMT operating in the frequency band 3 400-4 200 MHz.

1/1.1/4.1.9 Frequency bands within the range 4 400-4 900 MHz

1/1.1/4.1.9.1 Aeronautical mobile systems and mobile service/IMT

For co-channel interference, one sharing study shows large separation distances are required to protect certain types of AMS stations. In the case of protecting airborne station receivers from a single IMT base-station interference, the protection distances vary between ranges from 162-509 kilometres for aircraft altitude at 2.4 kilometres and 19 kilometres respectively. In the case of protecting airborne station receivers from IMT base-station aggregated interference, the protection distances range from 446-706 km for aircraft altitudes at 2.4 km and 19 km respectively. In this case, the corresponding protection zones encompass an area of about 623 318 km^2 and 1.5 million km^2, respectively. Based on this analysis, co-channel sharing between aeronautical mobile applications and IMT systems in the 4 400-4 990 MHz is not practical in the geographic areas located within the exclusion zones required up to 706 kilometres.

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Also for co-channel interference, another sharing study shows large separation distances are required to protect certain types of AMS stations. For separation distances between IMT base-station and airborne receiver close to 400 km based on a free-space propagation model, it is shown that IMT base-station e.i.r.p. levels need to be restricted to 38.8 dBm/MHz for a single IMT base-station interferer to protect an airborne receiver.

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For adjacent channel interference, one study shows the separation distance required to protect one of three mobile ground receivers (i.e. AMT ground receiver) is approximately five kilometres assuming a 43.6 dB frequency offset factor.

Some administrations are of the view that “The adjacent channel study assumes that incumbent systems for aeronautical/ground mobile applications do not use the entire 4 400-4 990 MHz band and there could be free spectrum available to implement potential IMT system using the adjacent channel solution in this band. If systems in incumbent services, the FS and MS, currently use the entire band, the use of adjacent channel solution would result in loss of spectrum for these services, which may impact operations and future planning for the incumbent services.” Some administrations are of the view that “the use of an adjacent channel solution for IMT may be feasible in some countries due to incumbent aeronautical/ground mobile applications not using the entire 4 400-4 990 MHz band.”

1/1.1/4.1.9.2 Fixed service and mobile service (IMT)

This report provides the results of compatibility studies between IMT system and point-to-point fixed wireless systems in the frequency band 4 400-4 990 MHz. Three studies were performed, each of which is presented in a separate Annex to this Report. The results of these studies can be summarized as follows.

Study #1: With regard to the IMT base-station (using 61 dBm e.i.r.p.) interfering FS receiver (assuming 22.5 dBi antenna gain based on Recommendation ITU-R F.758) in the band 4 400-4 500 MHz and 4 800-4 990 MHz analysis, the following observations may be reached:

- Co-channel interference analysis between a single IMT base-station and a FS receiver predicts that the required separation distance to protect the FS station receiver is up to 70 kilometres for the worst case, taking into account of terrain. The required separation distance to protect FS stations from an aggregated IMT interference would be worse.

For adjacent channel interference, 45 dB of adjacent channel leakage ratio (ACLR) is assumed for IMT base-station to the FS receiver. This results in a required distance separation on the order of

several tens of kilometres. If an additional 30 dB of attenuation can be found through filtering and/or additional guard bands this distance may be reduced to 5 km. It should be noted that at this time, methods to obtain this additional attenuation have not been documented in this report. The adjacent band study assumes that existing systems do not use the whole allocated band and there is free spectrum available to implement the adjacent band solution for administrations. If an administration's incumbent FS systems currently use the all of the frequency band 4 400-4 990 MHz (for example as per Recommendation ITU-R F.1099-5), then the use of adjacent band solutions would result in loss of spectrum for the incumbent FS systems.

Study #2: With regards to the IMT base-station (using 61 dBm e.i.r.p.) causing interference to FS receivers (assuming 22.5 dBi antenna gain) in the band 4 400-4 500 MHz and 4 800-4 990 MHz the analysis, obtained results show that protection of FS station receivers from interference caused by single outdoor IMT base-station transmitters requires separation distances up to 70 kilometres. In the case of network of outdoor IMT base-station transmitters the required separation distance grows up to 120 kilometres. It will be difficult to provide compatibility of proposed IMT systems with existing FS stations in the same geographical region where FS networks are widely deployed in the both frequency bands. In case of aggregate interference from a network of IMT base-stations required separation distance increases that increases the difficulties of providing of compatibility of IMT systems with FS systems.

Study #3: This study predicted the required separation distance to prevent interference for single IMT base-station or a single UE to four representative FS systems. This study also provides an aggregate interference analysis which predicts the size of the area, surrounding a FS system, from which IMT base-stations would have to be excluded to protect the FS system from interference. IMT base-stations were modelled using maximum e.i.r.p. value up to 61 dBm with a 20 MHz bandwidth and 64 dBm with a 40 MHz bandwidth. For FS systems modelled on Recommendation ITU-R F.758-5, typical antenna gains are approximately 22 dBi and an I/N threshold of -10 dB is used as an interference criterion. The propagation model assumed a smooth spherical Earth. This model does not account for potential signal enhancements or reductions due to terrain features. A summary of the results are shown in the following table.

Required distance separation or exclusion area between FS systems and IMT

IMT station type	FS antenna coupling	F.758-5		Units
		System A	System B	
Base-station	Main beam	157	145	km
	Back lobe	78	71	km
UE	Main beam	28	25	km
	Back lobe	8	6	km
Base-station	Aggregate	165,781	133,733	km^2

1/1.1/4.1.9.3 Fixed-satellite service and the mobile service/IMT

It is worth mentioning that RR Appendix **30B** contains worldwide Plans in the 4/6 GHz and 10-11/13 GHz frequency bands. The Plans and their associated procedure are a worldwide treaty. This Appendix and its 4/6 GHz Plan are envisaged and used as supporting backbone to the telecommunication infrastructure of many developing countries, in particular those which are located in high rain fall zones/areas of the globe.

WRC-07 revised the regulatory procedure of the above-mentioned Appendix using the approach currently applied in RR Appendices **30** and **30A**. As a consequence of that, the application of the procedure became much more rapid by administrations and the Bureau. Member States are therefore applying the procedure of Articles 6 and 7 of that Appendix more frequently than they applied before WRC-07.

Several developing countries which did not succeed in applying the procedure of RR Article **9** in coordinating the FSS in non-planned bands due to very high congestion as result of considerable high number of submitted networks under that Article have since sometime re-directed their applications towards RR Appendix **30B**. Several regional and sub-regional networks are now using frequency bands contained in this Appendix.

Concerning sharing studies to assess the technical feasibility of deploying IMT-Advanced systems in the 4 400-4 990 MHz frequency band, that are utilized by FSS and other services as stipulated in the RR similar considerations on the results of sharing studies obtained in the 3 400-4 200 MHz frequency band are applicable to the 4 500-4 800 MHz frequency band.

The sharing between IMT-Advanced and FSS is feasible only when FSS earth stations are at known, specific locations, and deployment of IMT-Advanced is limited to the areas outside of the minimum required separation distances for each azimuth to protect these specific FSS earth stations. In this case, the FSS protection criteria should be used to determine the necessary separation distances to ensure protection of the existing and planned FSS earth stations.

When FSS earth stations are deployed in a typical ubiquitous manner or with no individual licensing, sharing between IMT-Advanced and FSS is not feasible in the same geographical area since no minimum separation distance can be guaranteed.

Deployment of IMT-Advanced would constrain future FSS earth stations from being deployed in the same area in the bands 4 500-4 800 MHz as shown by the studies.

1/1.1/4.1.9.4 Unwanted emissions into the band 4 200-4 400 MHz

Radio altimeters are operational in the band 4 200-4 400 MHz, and operational and technical characteristics and protection criteria are provided in Recommendation ITU-R M.2059. Those altimeters are an essential component of aeronautical safety of life systems, including precision approach, landing, ground proximity and collision avoidance systems.

No studies were provided regarding protection of radio altimeters from unwanted emissions from IMT operating in the frequency band 4 400-4 900 MHz.

1/1.1/4.1.10 Frequency bands within the range 4 800-5 000 MHz

1/1.1/4.1.10.1 Aeronautical mobile systems and mobile service/IMT

NOTE: See section 1/1.1/4.1.9.1 above.

1/1.1/4.1.10.2 Fixed service and mobile service (IMT)

NOTE: See section 1/1.1/4.1.9.2 above.

1/1.1/4.1.10.3 Radio astronomy service and the mobile service/IMT

The results presented in draft new Report ITU-R RA.[RAS-IMT] show that to ensure the protection of RAS stations in the frequency band 4 990-5 000 MHz for the case of in-band sharing with IMT systems, a separation distance of a thousand kilometres is needed between IMT macro rural base-stations and an RAS antenna, and of 300 kilometres for UE, for an assumed flat terrain profile. This indicates that in-band sharing will be very difficult, if not impossible, to achieve in practice.

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1/1.1/4.1.10.3.1 Unwanted emissions in the frequency band 4 990-5 000 MHz

For the case of IMT systems operating in the adjacent frequency band 4 800-4 990 MHz, a separation distance of about 60 kilometres is needed between IMT base-stations and an RAS antenna and of one kilometre for UE, for an assumed unwanted emission level of –50 dBm/MHz, for an assumed flat terrain profile.

1/1.1/4.1.10.4 Radionavigation-satellite service and mobile service/IMT

NOTE: See section 1/1.1/4.1.2.1 above.

1/1.1/4.1.11 Frequency bands within the range 5 350-5 470 MHz

1/1.1/4.1.11.1 EESS (active) and the mobile service/RLANs

Given the RLAN parameters considered in ITU-R (e.i.r.p., bandwidth, antenna, and deployment environment) several studies were performed to assess the compatibility between EESS (active) and potential future operations of RLANs in the 5 350-5 470 MHz band under the general assumptions that the RLANs would be limited to indoor only (incidental use up to 5% was modelled without building attenuation) and an e.i.r.p. up to a maximum of 200 mW.

Study A shows, by parametric dynamic simulations, that the sharing between EESS and RLAN in the band 5 350-5 470 MHz is not feasible without some mitigation techniques which would enable to decrease the interference from RLAN to EESS by 10.5 to 26.5 dB, respectively for low and high density deployments.

Study B performs parametric analysis under different methodologies and concludes that RLANs cannot share the band 5 350-5 470 MHz with EESS (active) due to large negative margins (9.4 dB under optimistic assumptions, 30.4 dB under pessimistic assumptions).It further concludes that no potential mitigation techniques would be effective in filling these large negative margins and furthermore would also be enforceable/verifiable by administrations.

Study C shows that up to 43 simultaneously transmitting RLAN connections can operate within the Radarsat Constellation Mission (operating under the EESS (active) (RCM) footprint (~225 kilometres^2) without exceeding the interference threshold level specified in Recommendation ITU-R RS.1166-4. When compared to the other studies, it was shown that the expected number of simultaneously transmitting RLAN devices reported by those studies significantly exceed the number of RLAN devices that the RCM can tolerate (by a factor of 50 (or 17 dB) times in some cases). No practical and effective mitigation techniques have yet been found.

Study D shows that the rules established in adjacent bands for RLAN are insufficient to enable sharing with incumbent systems in the 5 350-5 470 MHz frequency range. Further study is required to determine if changes to these dynamic frequency selection (DFS) parameters or to see if other mitigation techniques can provide a compatible scenario. Initial studies indicate that a change to DFS detection threshold and the aggregate time for channel detection, channel closing, and channel move time could provide protection of EESS, however further study is required to examine the ability of RLAN to implement such changes and to define the specific levels required. Studies on alternate mitigation measures have not been completed in the ITU-R and further study is required to determine their applicability.

Study E performs both a static and dynamic analysis looking at the sensitivity of the results for different outdoor usage assumptions. It also considers the effect of various combinations of mitigation techniques and carries out an analysis which places a cap on the maximum density of active RLAN networks based on maximum network activity and calculated frequency re-use distances. The results of these analyses indicate that sharing may only be feasible if additional RLAN mitigation measures are implemented. The analyses also shows that when using a

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combination of mitigation techniques there may be a possibility of sharing with lower power RLAN use (e.g. 50 mW or below). In addition if it is assumed that there will be more than 1% of RLANs operating outdoor with an e.i.r.p. up to a maximum of 200 mW then it appears that the only viable mitigation techniques that would be able to protect the most sensitive EESS operations in urban areas are techniques that can employ temporal and geographical sharing techniques that take account of the satellite orbits (e.g. a geo-location database).

Results of sharing studies show that with the RLAN parameters described above, sharing between RLAN and EESS (active) systems in the 5 350-5 470 MHz range would not be feasible. Sharing may only be feasible if additional RLAN mitigation measures are implemented.

Two mitigation measures (EESS post-processing and RLAN e.i.r.p. mask) were deemed to be inappropriate for further consideration with respect to sharing between EESS (active) and RLANs. No agreement was reached on the applicability of other additional RLAN mitigation techniques. Some additional RLAN mitigation techniques to enable sharing with EESS (active) are being studied by the ITU-R, but no conclusions can be drawn at this time.

1/1.1/4.1.11.2 Radar systems and the mobile service/RLANs

- Members of ITU-R were unable to reach agreement on the applicability of specific additional RLAN mitigation techniques.
- The regulatory provisions in the 5 150-5 350 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 range. It should be noted that some of these RDS radars operate across the 5 250- 5 850 MHz frequency range.
- Some additional RLAN mitigation techniques to enable sharing are being studied by the ITU-R but no conclusions can be drawn at this time.
- Further study by ITU-R is required to determine if these additional mitigation techniques can be utilized to mitigate potential interference to these particular radar types.

1/1.1/4.1.12 Frequency bands within the range 5 725-5 850 MHz

Some administrations submitted contributions indicating that the study results for the 5 350-5 470 MHz frequency range are applicable to the 5 725-5 850 MHz frequency range to ensure protection of certain radars that operate across or in portions of the 5 250-5 850 MHz frequency range. Some other administrations raised concerns regarding these results because no RLAN characteristics were previously agreed for the 5 725-5 850 MHz frequency range and that the RLAN characteristics utilized for the 5 350-5 470 MHz frequency range cannot be applied similarly to the 5 725-5 850 MHz frequency range. Some administrations also highlighted that the sharing environment is significantly different between the two bands due to the ISM designation of the 5 725-5 875 MHz frequency band. There are current deployments of RLAN in the 5 725-5 850 MHz band in some countries in all three ITU Regions. Therefore, agreement was not reached on the conclusions in these documents.

No other sharing/compatibility studies were provided for this frequency band.

1/1.1/4.1.13 Frequency bands within the range 5 925-6 425

1/1.1/4.1.13.1 Fixed service and the mobile service/IMT

The frequency band 5 925-6 425 MHz has been proposed as a possible candidate band for IMT identification. However this band is heavily used for point-to-point FS links. The objective is to study the sharing and compatibility between indoor IMT small cells and FS stations.

The study considers only the impact of interference from IMT indoor small cells into point-to-point FS station receivers.

The results of the studies showed that the permissible I/N = –10 dB with indoor IMT small cells operating in co-channels with point-to-point FS receivers could be reached starting from 20-200 metres distances in most directions, except for the main and first side lobes of antenna pattern. In the main lobe direction of antenna pattern this distance corresponds to 8-50 kilometres, depending on the value of additional losses due to local clutter shielding, which will be present in IMT urban environment. The likelihood of an IMT small cell lying within the main or first side lobes of point-to-point antenna pattern hasn't been studied. These results are derived based on a single interferer and do not consider cumulative effect, which could lead to different values.

When detailed information on point-to-point links deployment is available, more detailed planning of IMT systems could be performed to reduce the separation distances mentioned above.

The calculated separation distances are going to be dependent on a number of local considerations including deployment and geographical distribution of both IMT and FS stations at national level and may require coordination with neighbouring administrations.

1/1.1/4.1.13.2 Fixed-satellite service and mobile service/IMT

Concerning the protection of a receiving geostationary FSS space network, the studies showed that GSO FSS space networks would be subjected to excessive levels of interference from the aggregate operation of IMT-Advanced (small cell) base-stations, irrespective of whether they are deployed outdoors or indoors. The e.i.r.p. limit of IMT station to protect FSS satellites is dependent on dissemination of IMT-Advanced stations, activity factors, actual channelization scheme and building penetration losses. The studies show that for case when IMT-Advanced stations are limited only to indoor use (deployed 95% indoors and 5% without building attenuation) the e.i.r.p. of IMT-Advanced station should be limited to 10-15 dBm. Under certain conditions for the 15 dBm e.i.r.p. limit, interference above the 6% $\Delta T/T$ criterion equal to several dBs could be observed for some beams with high gain antennas. For approximately 1% of beams analysed such excess equals to 3-6 dB and up to 9 dB in single instances. In such cases usually only one of multiple beams of a satellite is identified as possibly affected. Other beams of the satellite covering same region will have smaller $\Delta T/T$ increase. The limitation may be placed on the e.i.r.p. in the total bandwidth of the emission, rather than on the power spectral density. The above limits are based on the assumption that the whole of the band 5 925-6 425 MHz is identified for IMT-Advanced stations. If a narrower or wider band is identified for IMT-Advanced (or used in a particular country), the power limits should be adjusted according to the following formula: Adjustment $=10\times\log(500/B)$ in dB, where B is the available bandwidth for IMT-Advanced systems, in MHz.

It was concluded that for protection of a single receiving IMT-Advanced base-station separation distances up to many tens of kilometres would be required between a single transmitting FSS earth station and a single outdoor IMT-Advanced receiving base-station, in order to protect the IMT-Advanced station from co-frequency interference. For indoor deployed IMT-Advanced stations, a separation distance ranging from several hundreds of meters up to several kilometres would be required. The effectiveness of frequency selective scheduling (described in draft new Report ITU-R [FSS-IMT C-BAND UPLINK], Annex 1, section 4.3) as a method to mitigate

interference from a transmitting FSS Earth station into IMT-Advanced system has been studied. For the specific case studied, the entirety of the interfering FSS carrier was contained within the bandwidth of the IMT-Advanced channel. The results indicated that the use of this mitigation technique could reduce the separation distance to around 100 meters– even with the IMT-Advanced protection criteria being exceeded. It should be noted that the effectiveness of such a mitigation technique is expected to be more limited, relative to the specific case studied, when the bandwidth of the FSS carrier is larger than the bandwidth of the IMT-Advanced channel or larger than the aggregate bandwidth of the combined IMT-Advanced channels. Thus it is generally concluded that no specific separation distance is required between FSS transmitting station and indoor IMT-Advanced small cell.

Based on studies described in draft new Report ITU-R [FSS-IMT C-BAND UPLINK] it is concluded that sharing and compatibility between IMT-Advanced systems and FSS networks in 5 925-6 425 MHz frequency range is feasible under certain conditions. These conditions include deployment of IMT-Advanced systems only indoor and establishment of a limit on the maximum allowable e.i.r.p. for IMT-Advanced stations in this frequency range. In addition it is generally concluded that no specific separation distance is required between FSS transmitting station and indoor IMT-Advanced small cell.

1/1.1/4.2 Potential candidate frequency bands

The following bands are considered as potential candidate frequency bands from among the suitable frequency ranges provided by the ITU-R. These frequency bands were proposed by one or more administrations and were studied by ITU-R (see section 1/1.1/3.2). No consensus was reached on the proposed candidature of any of these bands for mobile broadband, including IMT. However, the frequency bands listed below, and detailed in sections 1/1.1/3.2 and 1/1.1/4.1, were proposed as potential candidate frequency bands for which there were support and opposition.

In studying agenda item 1.1, inputs were received reflecting views on certain frequency ranges/bands. These views were compiled/consolidated in Annex 1 of the Document 4-5-6-7/715. It should be emphasized that this Annex was neither examined nor approved by JTG 4-5-6-7, thus its inclusion in Document 4-5-6-7/715 is for information only.

Studies related to various frequencies bands (studies initiated, carried out, not completed, completed), as well as an overview of which services were and were not studied for each band, are addressed in sections 1/1.1/3.2 and 1/1.1/4.1 above.

Frequency band 470-694/698 MHz

Frequency band 1 350-1 400 MHz

Frequency band 1 427-1 452 MHz

Frequency band 1 452-1 492 MHz

Frequency band 1 492-1 518 MHz

Frequency band 1 518-1 525 MHz

Frequency band 1 695-1 710 MHz

Frequency band 2 700-2 900 MHz

Frequency band 3 300-3 400 MHz

Frequency band 3 400-3 600 MHz

Frequency band 3 600-3 700 MHz

Frequency band 3 700-3 800 MHz

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Frequency band 3 800-4 200 MHz

Frequency band 4 400-4 5 00 MHz

Frequency band 4 500-4 800 MHz

Frequency band 4 800-4 990 MHz

Frequency band 5 350-5 470 MHz

Frequency band 5 725-5 850 MHz

Frequency band 5 925-6 425 MHz

1/1.1/5 Method(s) to satisfy the agenda item

The following methods are considered to satisfy this agenda item and can be applied to all potential candidate bands. These are:

Method A – No change, which may be accompanied by reasons.

Method B – Make an allocation to MS on a primary basis (either by new allocation or upgrade of an existing secondary allocation) with a view to facilitate the development of terrestrial mobile broadband applications.

Method B-ToA - Make an allocation to MS on a primary basis in the Table of Frequency Allocations.

Method B-FN - Make an allocation to MS on a primary basis in a footnote.

Method C - To identify the frequency band for IMT either in a new or existing footnote. This Method can be applied individually if there is already a primary mobile allocation or in conjunction with Method B.

In addition, any condition of use specific to a frequency band by MS or IMT systems will be described under the specific frequency band under Methods B and/or C.

Other considerations - Current status of the frequency band: There is an allocation on a primary basis for MS for a frequency band in a Region and identified for IMT in certain countries in that Region. Those countries which may wish to add their names to that footnote can submit proposals to WRC-15 taking into account Resolution **26 (Rev.WRC-07)** in accordance with Resolution **233 (WRC-12)**.

The frequency bands considered as potential candidate bands under this agenda item together with the applicable methods identified to satisfy the agenda item are summarized in the table below:

Methods that may be applicable to the potential candidate bands, taking into account existing frequency allocations contained in Article 5 of the RR

Number / Bands (MHz)	Applicable Methods				
	Method A	Method B-ToA	Method B-FN	Method C	Options
1 / 470-694/698	A	B	B	C	1/1.1/5.1
2 / 1 350-1 400	A	B	B	C	1/1.1/5.2
3 / 1 427-1 452	A			C	1/1.1/5.3
4 / 1 452-1 492	A	B	B	C	1/1.1/5.4
5 / 1 492-1 518	A			C	1/1.1/5.5
6 / 1 518-1 525	A	B	B	C	1/1.1/5.6
7 / 1 695-1 710	A	B	B	C	1/1.1/5.7
8 / 2 700-2 900	A	B	B	C	1/1.1/5.8
9 / 3 300-3 400	A	B	B	C	1/1.1/5.9
10 / 3 400-3 600	A	B	B	C	1/1.1/5.10
11 / 3 600-3 700	A	B	B	C	1/1.1/5.11
12 / 3 700-3 800	A	B	B	C	1/1.1/5.12
13 / 3 800-4 200	A	B	B	C	1/1.1/5.13
14 / 4 400-4 500	A			C	1/1.1/5.14
15 / 4 500-4 800	A			C	1/1.1/5.15
16 / 4 800-4 990	A			C	1/1.1/5.16
17 / 5 350-5 470	A				1/1.1/5.17
18 / 5 725-5 850	A				1/1.1/5.18
19 / 5 925-6 425	A			C	1/1.1/5.19

Note: In the above table, Methods B-ToA and B-FN, when identified as applicable for a frequency band, do not necessarily apply to all regions.

1/1.1/5.1 For frequency band 470-694/698 MHz:

Methods A, B, C could apply.

The following options apply in case of **Method A**:

For Method A, Option 1 - No change for Region 1. See section 1/1.1/4.1.1.1.1.3.

For Method A, Option 2 - No change for Region 2. See section 1/1.1/4.1.1.1.2.

For Method A, Option 3 - No change for Region 3.

The following options apply in case of **Method B**:

For Method B-ToA, Option 1– applies to Region 1 and Region 2 in the frequency band, or portion of the band, as the case may be.

For Method B-ToA, Option 2 – applies to Region 1 in the frequency band, or portion of the band, as the case may be.

For Method B-ToA, Option 3 – applies to Region 2 in the frequency band, or portion of the band, as the case may be.

For Method B-FN, Option 4 – applies to [list countries of Region 1 and Region 2] subject to agreement obtained under RR No. **9.21**. In Region 2 this may be applied by modification of existing footnotes or by new footnote in the frequency band, or portion of the band, as the case may be.

The following options apply in case of **Method C**:

For Method C, Option C1

RR Article **5** footnote to specify the application of RR No. **9.21** to safeguard regulatory priority of the incumbent services by requiring that administrations that choose to implement IMT in the frequency band will be obligated to seek the agreement of other affected administrations.

1/1.1/5.2 For band 1 350-1 400 MHz

Methods A, B, and C apply.

The following options apply in case of Methods B or C, as appropriate.

Option C1a

Relevant mandatory unwanted emission levels in Resolution **750 (Rev.WRC-12)** for the band 1 400-1 427 MHz consistent with DN Report ITU-R RS.[EESS-IMT 1.4 GHz] will have to be included in the Radio Regulations to ensure the protection of EESS (passive).

Option C1b

Relevant recommended unwanted emission levels in Resolution **750 (Rev.WRC-12)** for the band 1 400-1 427 MHz consistent with DN Report ITU-R RS.[EESS-IMT 1.4 GHz] will have to be included in the RR to ensure protection of EESS (passive).

Options C1a and C1b are alternative, while the following Option(s) can be used in conjunction with either C1a or C1b.

Option C2

TBD by the proponent of the option (taking into account the information provided in section 1/1.1/6)

Option B1

RR Article **5** footnote to specify that stations of the MS operating in the frequency band 1 350-1 400 MHz shall not cause harmful interference to or claim protection from stations in RLS.

1/1.1/5.3 For frequency band 1 427-1 452 MHz:

Methods A and C apply.

The following options apply in case of Method C:

Option C1a

Relevant mandatory unwanted emission levels in Resolution **750 (Rev.WRC-12)** Table **1-1** for the band 1 400-1 427 MHz consistent with DN Report ITU-R RS.[EESS-IMT 1.4 GHz] will have to be included in the RR to ensure the protection of EESS (passive).

Option C1b

Relevant recommended unwanted emission levels in Resolution **750 (Rev.WRC-12)** Table **1-2** for the band 1 400-1 427 MHz will have to be revised in accordance with DN Report

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ITU-R RS.[EESS-IMT 1.4 GHz] to ensure protection of EESS (passive). It should be noted that the revised values should be retained as "recommended" values.

Options C1a and C1b are alternative, while the following Options can be used in conjunction with either C1a or C1b.

Option C2

RR Article **5** footnote to specify that stations in MS operating in the frequency band 1 429-1 452 MHz shall not cause harmful interference to or claim protection from stations in the aeronautical telemetry listed in RR No. **5.342**

Option C3

RR Article **5** footnote to specify that the frequency band 1 429-1 452 MHz can be used by stations in MS subject to agreement obtained under RR No. **9.21** from the countries listed in RR No. **5.342**.

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1/1.1/5.4 For frequency band 1 452-1 492 MHz:

Methods A and C apply.

The following options apply in case of Method C.

Option C1

In order to facilitate the coexistence between IMT and BSS in the band 1 452-1 492 MHz, the current regulatory procedures governing the relation between BSS and terrestrial services would be modified by inserting a pfd value of [-113 dBW/m²/MHz] in RR Article **21** with the view to provide a more stable (long-term stability) situation to IMT.

RR Appendix **5** would be modified so as to enable countries wishing to continue to apply the coordination procedure under RR No. **9.11** to do so. Therefore a pfd limit will apply to BSS with respect to all terrestrial services except for countries wishing to continue to apply RR No. **9.11**, because of more stringent protection requirement (e.g. in order to protect telemetry systems).

Option C2

Applying the current practice of ITU to facilitate the use of IMT through bilateral/multilateral coordination with neighbouring countries since this frequency band is already allocated to MS and to continue to have coordination between BSS and MS pursuant to RR Nos. **9.11** and **9.19**.

Option C3

JTG 4-5-6-7 received a proposal to include for the band 1 452-1 492 MHz a new method aiming to put new constraints on existing BSS allocation.

In this connection it should be stated that:

- WARC-92 has made frequency allocations to BSS (sound) and complementary terrestrial broadcasting in frequency band 1 452-1 492 MHz;
- RR No. **5.345** stipulate that the use of the band 1 452-1 492 MHz by BSS is subject to Resolution **528 (WARC-92).**

Resolution **528 (Rev.WRC-03)** resolved that a competent conference should be convened, preferably not later than 1998, for the planning of BSS (sound) in the frequency bands allocated to this service in the range 1-3 GHz; and the development of procedures for the coordinated use of complementary terrestrial broadcasting;

This Resolution also resolved that in the interim period, the use of BSS systems are in accordance with the procedures contained in Sections A to C of Resolution **33 (Rev.WRC-03)**, or in RR Articles **9** to **14**, as appropriate (see *resolves* 1 and 2 of Resolution **33 (Rev.WRC-03)**).

The same Resolution also resolved that the calculation methods and the interference criteria to be employed in evaluating the interference should be based upon relevant ITU-R Recommendations agreed by the administrations concerned as a result of Resolution **703 (Rev.WARC-92)** or otherwise.

The relation between BSS and terrestrial service is thus currently governed by RR No. **9.11** triggered by frequency overlapping as referred to Appendix **5** to the RR.

Any modification to the regulatory regime from RR No. **9.11** to any other regime is subject to a decision to be taken by a competent conference for the planning of BSS (sound) in the bands allocated to this service in the range 1-3 GHz and the development of procedures for the coordinated use of complementary terrestrial broadcasting.

In addition it should be reminded that CPM-07 received contribution CPM07-2/79 indicating that

Quote 1

that NGSO systems operating in the frequency band 1 467-1 492 MHz should no longer be subject to Article **22.2**, but coordinated under Article **9.11A**.

Unquote l

Corrigendum 1 to Revision 1 to Document CPM07-2/134 reflects the conclusion of CPM07-2 as follows:

Quote 2

The meeting considered input Documents CPM07-2/79 and 36 (§ 2 Issue 19) from Lebanon and APT respectively, dealing with proposals regarding regulatory procedures concerning non-GSO systems in the frequency band 1 467-1 492 MHz. The Chairman of the CPM also included in the discussion the output of the SC regarding this matter (CPM07-2/2, § 2.18). After some discussion of the documents, the meeting agreed that the issue will be summarized in Chapter 6 of the CPM Report in the following manner:

It will be stated that CPM-07 received contributions CPM07-2/79 and 36, with reference to the views from the Special Committee as contained in CPM07-2/2. The views of the CPM on the matter will be as follows: “CPM concluded that this issue needs to be considered by WRC-07”.

Unquote 2

In light of the foregoing and in line with the conclusion reached by CPM07-2 on a similar issue (changing regulatory regime applicable to the band 1 452-1 492 MHz from that contained in the RR to a new one) the proposal aiming to put new constraints on an existing BSS allocation and change its regulatory status is outside of the Terms of Reference decided by CPM 15-1 (see Annex 10 of BR Administrative Circular CA/201).

It was recognized that in carrying out the studies in relation to any frequency band under the agenda item of any WRC, such studies shall not modify the regulatory environments and conditions in force and applicable to the incumbent service. Any contrary action would be in contradiction and contravene the principles enshrined in the RR, unless the agenda item specifically calls for any modification in the regulatory environment. It was also emphasized that the regulatory examples given under Method C for this approach are not consistent with the description of Method C.

Option C4

In order to harmonize the usage of the frequency band in all three Regions allocation to MS in the frequency band 1 452-1 492 MHz in Region 1 needs to be modified, taking into account protection of existing mobile application.

1/1.1/5.5 For frequency band 1 492-1 518 MHz

Methods A and C apply.

Under Method C the following option applies:

Option C1

Applying the current practice of ITU to facilitate the use of IMT through bilateral/multilateral coordination with neighbouring countries since this frequency band is already allocated to MS in Regions 2 and 3.

Option C2

Applying additional regulatory provisions in the RR to protect MSS systems operating above 1 518 MHz.

Option C3

RR Article **5** footnote to specify that stations in MS operating in the frequency band 1 492-1 518 MHz shall not cause harmful interference to or claim protection from the aeronautical telemetry stations mentioned in RR No. **5.342**.

Option C4

RR Article **5** footnote to specify that the frequency band 1 492-1 518 MHz can be used by stations in MS subject to agreement obtained under RR No. **9.21** from the countries listed in RR No. **5.342**.

1/1.1/5.6 For frequency band 1 518-1 525 MHz:

Methods A and C apply.

The following options apply in case of Method C:

Option C1

Applying the current practice of ITU to facilitate the use of IMT through bilateral/multilateral coordination with neighbouring countries since this frequency band is already allocated to MS in Regions 2 and 3.

Option C2

RR Article **5** footnote to specify that stations in MS operating in the frequency band 1 518-1 525 MHz shall not cause harmful interference to or claim protection from the aeronautical telemetry stations mentioned in RR No. **5.342**.

Option C3

RR Article **5** footnote to specify that the frequency band 1 518-1 525 MHz can be used by stations in MS subject to agreement obtained under RR No. **9.21** from the countries listed in RR No. **5.342**.

1/1.1/5.7 For frequency band 1 695-1 710 MHz:

Methods A, B, and C apply.

The following options apply in case of Method C:

Option C1

RR Article **5** footnote limiting the use of MS allocation to terminals and stressing the need for protection of METSAT stations.

1/1.1/5.8 For frequency band 2 700-2 900 MHz:

Methods A, B and C apply.

The following options apply in case of Methods B and C.

Option 1

Allocate the frequency band to MS on a primary basis in a new footnote listing the countries in which the allocation applies, subject to agreement to be obtained under RR No. **9.21**, and identify the frequency band for IMT in the same footnote.

Option 2

RR Article **5** footnote to specify that stations in MS operating in the frequency band 2 700-2 900 MHz shall not cause harmful interference to or claim protection from systems in ARNS.

1/1.1/5.9 For frequency band 3 300-3 400 MHz:

Methods A, B and C apply.

The following option applies in case of Methods B or C, as appropriate:

Option 1

RR Article **5** footnote to specify that stations in MS operating in the frequency band 3 300-3 400 MHz shall not cause harmful interference to or claim protection from systems in RLS.

1/1.1/5.10 For frequency band 3 400-3 600 MHz:

In case that Method A applies:

No change, due to the fact that the frequency band 3 400-3 600 MHz was under agenda item 1.4 of WRC-07. After lengthy and extensive discussion, consensus emerged for Regions 1 and 3 to allocate the frequency band to MS and/or identify for IMT in footnotes (RR Nos. **5.430A**, **5.432A**, **5.432B**, **5.433A**), as the case may be. The principles based on which consensus was reached at WRC-07 need to be maintained. Method A is therefore applied.

The following options apply in case of **Method B-ToA and Method B-FN**

Option 1

Allocate the frequency band to MS on a primary basis either in the Table of Frequency Allocations or in a new footnote without application of RR No. **9.21** and pfd limits to protect FSS in the neighbouring countries.

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Option 2

Allocate the frequency band to MS on a primary basis either in the Table of Frequency Allocations or in a new footnote, together with technical and regulatory conditions in a footnote/Resolution including the application of RR Nos. **9.17**, **9.18**, **9.21**, RR Table **21-4** pfd limits, pfd limits for MS and any additional conditions, if necessary as appropriate.

Option 3

Add new country names to existing footnotes RR Nos. **5.430A**, **5.431A** and **5.432B**.

Option 4

Allocations to MS beyond those mentioned in footnotes RR Nos. **5.430A**, **5.431A**, **5.432B** should strictly retain four conditions (RR No. **9.21**, RR Table **21-4** pfd limits, pfd limits for MS, RR Nos. **9.17**, **9.18**) referred to in those footnotes, i.e. no change of conditions of use as currently enforced to be made.

The following options apply in case of **Method C**:

Option 1

Identify for IMT without any additional conditions. Conditions applicable to the MS in the frequency band equally apply to IMT.

Option 2

Identify for IMT, together with technical and regulatory conditions in a footnote/WRC Resolution including the application of RR Nos. **9.17**, **9.18**, **9.21**, RR Table **21-4** pfd limits for FSS, pfd limits for MS/IMT and any additional conditions, if necessary as appropriate.

Option 3

Add new country names to existing footnotes RR Nos. **5.430A**, **5.432B**, and **5.433A**

Option 4

Identification for IMT beyond those mentioned in footnotes RR Nos. **5.430A**, **5.432A**, **5.432B**, **5.433A** should strictly retain four conditions (RR No. **9.21**, RR Table **21-4** pfd limits, pfd limits for MS, RR Nos. **9.17**, **9.18**) referred to in those footnotes, i.e. no change of conditions of use as currently enforced to be made.

Note: Options 1 and 2 for Method B and Options 1 and 2 for Method C may require consequential suppression/modification of existing footnotes in the frequency band 3 400-3 600 MHz.

1/1.1/5.11 For frequency band 3 600-3 700 MHz:

Method A applies.

Options 1 and 2 for Method B as well as Options 1 and 2 for Method C, as described in section 1/1.1/5.10, apply to the frequency band 3 600-3 700 MHz, taking into account existing allocations to MS in this frequency band.

1/1.1/5.12 For frequency band 3 700-3 800 MHz:

Method A applies.

Options 1 and 2 for Method B as well as Options 1 and 2 for Method C, as described in section 1/1.1/5.10, apply to the frequency band 3 700-3 800 MHz, taking into account existing allocations to MS in this band.

1/1.1/5.13 For frequency band 3 800-4 200 MHz:

Method A applies.

Options 1 and 2 for Method B as well as Options 1 and 2 for Method C, as described in section 1/1.1/5.10, apply to the frequency band 3 800-4 200 MHz, taking into account existing allocations to MS in this band.

1/1.1/5.14 For frequency band 4 400-4 500 MHz:

Methods A and C apply.

Option 1

Applying the current practice of ITU to facilitate the use of IMT through bilateral/multilateral coordination with neighbouring countries since this band is already allocated to MS in Regions 2 and 3.

1/1.1/5.15 For frequency band 4 500-4 800 MHz:

Option 1

Option 1 for Method C, as described in section 1/1.1/5.10, apply to the frequency band 4 500-4 800 MHz, taking into account the need to preserve the integrity of the RR Appendix **30B** and its future development, which is a worldwide treaty included in the RR, and associated existing procedures.

Option 2

Option 2 for Method C, as described in section 1/1.1/5.10, apply to the frequency band 4 500-4 800 MHz, taking into account the need to preserve the integrity of the RR Appendix **30B** and its future development, which is a worldwide treaty included in the RR, and associated existing procedures.

Option 3

Identify to IMT, together with technical and regulatory conditions in a footnote/Resolution providing protection to the allotments and assignments subject in RR Appendix **30B** and their future development taking into account receiving FSS ES in RR Appendix **30B** could be located anywhere within the service area of the FSS network.

1/1.1/5.16 For frequency band 4 800-4 990 MHz:

Methods A and C apply.

Option 1

Applying the current practice of ITU to facilitate the use of IMT through bilateral/multilateral coordination with neighbouring countries since this frequency band is already allocated to MS in Regions 2 and 3.

1/1.1/5.17 For frequency band 5 350-5 470 MHz:

Only Method A applies.

Option 1

No change due to unresolved issues:

a) Results of studies show that with the RLAN parameters utilized, sharing between RLAN and EESS (active) systems in the 5 350-5 470 MHz range would not be feasible. Sharing may only be feasible if additional RLAN mitigation measures are implemented, but no agreement was reached on the applicability of additional RLAN mitigation techniques. Some additional RLAN mitigation techniques to enable sharing with EESS (active) are being studied by the ITU-R, but no conclusions can be drawn at this time.

b) The regulatory provisions in the 5 150-5 350 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 range. Some additional RLAN mitigation techniques to enable sharing are being studied by the expert groups in the ITU-R but no conclusions can be drawn at this time. Further study by ITU-R is required to determine if these additional mitigation techniques can be utilized to mitigate potential interference to these particular radar types.

1/1.1/5.18 For frequency band 5 725-5 850 MHz:

Only Method A applies.

Option 1

No change due to unresolved issues.

Some administrations submitted contributions indicating that the study results for the 5 350-5 470 MHz frequency range are applicable to the 5 725-5 850 MHz frequency range to ensure protection of certain radars that operate across or in portions of the 5 250-5 850 MHz frequency range. Some other administrations raised concerns regarding these results because no RLAN characteristics were previously agreed for the 5 725-5 850 MHz frequency range and that the RLAN characteristics utilized for the 5 350-5 470 MHz frequency range cannot be applied similarly to the 5 725-5 850 MHz frequency range. Some administrations also highlighted that the sharing environment is significantly different between the two bands due to the ISM designation of the 5 725-5 875 MHz frequency band. There are current deployments of RLAN in the 5 725-5 850 MHz band in some countries in all three ITU Regions. Therefore, agreement was not reached on the conclusions in these documents.

1/1.1/5.19 For frequency band 5 925-6 425 MHz:

Methods A and C apply.

The following options apply in case of Method C

Option C1

Adding a Resolution in the identification footnote establishing a regulatory e.i.r.p. limit for IMT stations and limiting IMT deployment to indoor.

Option C2

Identify the band 5 925-6 425 MHz for IMT by a footnote without any additional conditions. Conditions applicable to the MS in the frequency band equally apply to IMT.

Option C3

Modification of existing Resolutions, such as WRC Resolutions **212**, **223**, and **224**, to include additional conditions on the use of the band 5 925-6 425 MHz by MS.

Option 4

IMT system operation under the condition of not claiming protection from FSS earth stations.

1/1.1/6 Regulatory and procedural considerations

For Method A (No change):

NOC

For Method B-FN:

ADD

5.A11 *Additional Allocation:* [In Country Names], the frequency bands [aa-bb, and cc-dd MHz] are also allocated to the mobile, except aeronautical mobile service on a primary basis. (WRC-15)

For Method C:

ADD

5.B11 [In Regions/Country Names], the frequency bands [aa-bb, and cc-dd MHz], or portions of those frequency bands as the case may, be are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of these bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. [See/Subject to application of WRC Resolution and/or WRC Recommendation, which may include conditions of use, as appropriate.] (WRC-15)

For Method B-FN and C:

ADD

5.C11 *Additional Allocation:* [In Country Names], the frequency bands [aa-bb, and cc-dd MHz] are also allocated to the mobile, except aeronautical mobile, service on a primary basis and are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. See [WRC Resolution and/or WRC Recommendation]. (WRC-15)

For footnote satisfying other considerations

MOD

5.313A ~~The band, or portions of the band 698-790 MHz, i~~In [add administration(s)/Region], Bangladesh, China, Korea (Rep. of), India, Japan, New Zealand, Pakistan, Papua New Guinea, Philippines and Singapore, the frequency band 698-790 MHz, or portions of that frequency band as the case may be, ~~are~~ is identified for use by these administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. In China, the use of IMT in this band will not start until 2015. (WRC-~~12~~15)

Note by the Secretariat: The guidelines regarding examples of modifications of Section IV – Table of Frequency Allocations of RR Article 5, either to MOD a relevant part of the Table, MOD a footnote and/or ADD a new footnote, have not been fully implemented in this section 1/1.1/6 of the draft CPM Report in order to limit the number of pages.

1/1.1/6.1 For frequency band 470-694/698 MHz:

1/1.1/6.1.1 For Method C, Option C1:

ADD

5.D11 The operation of stations in the mobile service for the implementation of International Mobile Telecommunications (IMT) in the frequency band 470-694 MHz in Region 1, in 470-608 MHz and 614-698 MHz in Region 2, and in 470-698 MHz Region 3 shall be subject to agreement obtained under No. **9.21**. (WRC-15)

1/1.1/6.2 For frequency band 1 350-1 400 MHz:

1/1.1/6.2.1 For Method B or C, Option C1a

ADD

5.E11 *Additional Allocation:* In [Country Names], the frequency band 1 350-1 400 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis and is also identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. Such use is subject to the application of Resolution **750 (Rev.WRC-15)**. (WRC-15)

1/1.1/6.2.2 For Method B or C, Option C1b

The same regulatory example as in section 1/1.1/6.2.1 applies.

1/1.1/6.2.3 For Method C, Option 2, C2

ADD

5.F11 IMT Stations of the mobile service operating in the frequency band 1 350-1 400 MHz in Region 1 shall not cause harmful interference to or claim protection from stations in the radiolocation service. (WRC-15)

1/1.1/6.2.4 For Method B, Option 1, B1

ADD

5.G11 Stations of the mobile service operating in the frequency band 1 350-1 400 MHz in Regions 2 and 3 shall not cause harmful interference to or claim protection from stations in the radiolocation service. (WRC-15)

1/1.1/6.3 For frequency band 1 427-1 452 MHz:

1/1.1/6.3.1 For Method C, Option C1a

ADD

5.H11 [In Regions/Country Names], the frequency band 1 427-1 452 MHz is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. Such use is subject to the application of Resolution **750 (Rev.WRC-15)**, which include conditions of use, as appropriate. (WRC-15)

1/1.1/6.3.2 For Method C, Option C1b

The same regulatory example as in section 1/1.1/6.3.1 applies.

1/1.1/6.3.3 For Method C, Option C2

ADD

5.I11 IMT **s**tations in the mobile service operating in the frequency band 1 429- 1 452 MHz shall not cause harmful interference to or claim protection from stations in the aeronautical telemetry listed in No. **5.342**. (WRC-15)

1/1.1/6.3.4 For Method C, Option C3

ADD

5.J11 The frequency band 1 429-1 452 MHz can be used by IMT stations in the mobile service subject to agreement obtained under No. **9.21** from the countries listed in No. **5.342**. (WRC-15)

1/1.1/6.4 For frequency band 1 452-1 492 MHz:

1/1.1/6.4.1 For Method C, Option C1

No consensus was reached on inclusion of this regulatory proposal in section 1/1.1/6.

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ARTICLE 21

Terrestrial and space services sharing frequency bands above 1 GHz

Section V – Limits of power flux-density from space stations

MOD

TABLE **21-4** (Rev.WRC-~~12~~15)

Frequency band	Service*	Limit in dB(W/m^2) for angles of arrival (δ) above the horizontal plane			Reference bandwidth
		0°-5°	5°-25°	25°-90°	
1 452-1 492 MHz[7A]	Broadcasting-satellite	[-113]	[-113]	[-113]	1 MHz

ADD

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7A **21.16.1A** These limits do not apply over the territory of *[list of countries]*.

APPENDIX 5 (REV.WRC-12)

Identification of administrations with which coordination is to be effected or agreement sought under the provisions of Article 9

MOD

TABLE 5-1 (Rev.WRC-~~12~~15)

Technical conditions for coordination
(see Article **9**)

Reference of Article 9	**Case**	**Frequency bands (and Region) of the service for which coordination is sought**	**Threshold/condition**	**Calculation method**	**Remarks**
No. **9.11** GSO, non-GSO/ terrestrial	A space station in the BSS in any band shared on an equal primary basis with terrestrial services and where the BSS is not subject to a Plan, in respect of terrestrial services	620-790 MHz (see Resolution **549 (WRC-07)**) 1 452-1 492 MHz (only over the territory of countries listed in **21.16.1A**) 2 310-2 360 MHz (No. **5.393**) 2 535-2 655 MHz (Nos. **5.417A** and **5.418**) 17.7-17.8 GHz (Region 2) 74-76 GHz	Bandwidths overlap: The detailed conditions for the application of No. **9.11** in the bands 2 630-2 655 MHz and 2 605-2 630 MHz are provided in Resolution **539 (Rev.WRC-03)** for non-GSO BSS (sound) systems pursuant to Nos. **5.417A** and **5.418**, and in Nos. **5.417A** and **5.418** for GSO BSS (sound) networks pursuant to those provisions.	Check by using the assigned frequencies and bandwidths	

1/1.1/6.4.2 For Method C, Option C2

Note: Example of regulatory text to be provided.

1/1.1/6.4.3 For Method C, Option C3

Note: Example of regulatory text to be defined.

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1/1.1/6.4.4 For Method C, Option C4

MOD

5.342 *Additional allocation:* in Armenia, Azerbaijan, Belarus, the Russian Federation, Uzbekistan, Kyrgyzstan and Ukraine, the frequency bands 1 429-1452 MHz, 1 492-1 535 MHz, and in Bulgaria the frequency band 1 525-1 535 MHz, are also allocated to the aeronautical mobile service on a primary basis exclusively for the purposes of aeronautical telemetry within the national territory. ~~As of 1 April 2007, the use of the band 1 452-1 492 MHz is subject to agreement between the administrations concerned.~~ (WRC-~~12~~15)

ADD

5.K11 In Armenia, Azerbaijan, Belarus, the Russian Federation, Uzbekistan, Kyrgyzstan and Ukraine, the use of the frequency band 1 452-1 492 by the aeronautical mobile service for telemetry has priority over other uses by the mobile service. Usage of this band by IMT stations in mobile service in Region 1 is subject to agreement with countries listed above obtained under No. **9.21**. (WRC-15)

1/1.1/6.5 For frequency band 1 492-1 518 MHz:

1/1.1/6.5.1 For Method C, Option C1

Note: Example of regulatory text to be defined.

1/1.1/6.5.2 For Method C, Option C2

Note: Example of regulatory text to be defined.

1/1.1/6.5.3 For Method C, Option C3

ADD

5.L11 IMT stations in the mobile service operating in the frequency band 1 492-1 518 MHz shall not cause harmful interference to or claim protection from the aeronautical telemetry stations mentioned in No. **5.342**. (WRC-15)

1/1.1/6.5.4 For Method C, Option C4

ADD

5.M11 The frequency band 1 492-1 518 MHz can be used by IMT stations in the mobile service subject to agreement obtained under No. **9.21** from the countries listed in No. **5.342**. (WRC-15)

1/1.1/6.6 For frequency band 1 518-1 525 MHz:

1/1.1/6.6.1 For Method C, Option C1

Note: example of regulatory text to be defined

1/1.1/6.6.2 For Method C, Option C2

ADD

5.N11 IMT stations in the mobile service operating in the frequency band 1 518-1 525 MHz shall not cause harmful interference to or claim protection from the aeronautical telemetry stations mentioned in No. **5.342**. (WRC-15)

1/1.1/6.6.3 For Method C, Option C3

ADD

5.O11 The frequency band 1 518-1 525 MHz can be used by IMT stations in the mobile service subject to agreement obtained under No. **9.21** from the countries listed in No. **5.342**. (WRC-15)

1/1.1/6.7 For frequency band 1 695-1 710 MHz:

1/1.1/6.7.1 For Method C, Option C1a

ADD

5.P11 The frequency band 1 695-1 710 MHz is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) for transmissions by user equipment. Transmissions by IMT base-stations are prohibited. The use of this band by IMT shall not cause harmful interference to stations in the meteorological-satellite service. (WRC-15)

1/1.1/6.7.2 For Method C, Option C1b

ADD

5.Q11 The frequency band 1 695- 1 710 MHz is identified for use by International Mobile Telecommunications (IMT) for transmissions by user equipment. Transmissions by IMT base-stations are prohibited. (WRC-15)

1/1.1/6.8 For frequency band 2 700- 2 900 MHz:

1/1.1/6.8.1 For Method B and C, Option C1

ADD

5.R11 In [*Regions/country names list*] the frequency band 2 700-2 900 MHz, or portions of that frequency band as the case may be, is also allocated to the mobile, except aeronautical mobile, service on a primary basis, subject to agreement under No. **9.21**, and is also identified for use by International Mobile Telecommunications (IMT). This identification does not preclude the use of

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this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-15)

1/1.1/6.8.2 For Method B and C, Option C2

ADD

5.S11[9] IMT stations in the mobile service operating in the frequency band 2 700-2 900 MHz shall not cause harmful interference to or claim protection from systems in the aeronautical radionavigation service, radiolocation service, and ground-based meteorological radars operating under No. **5.423**, and maritime radionavigation service operating under No. **5.424**. (WRC-15)

1/1.1/6.9 For frequency band 3 300-3 400 MHz:

1/1.1/6.9.1 For Method C, Option C1:

ADD

5.T11 IMT stations in the mobile service operating in the frequency band 3 300-3 400 MHz shall not cause harmful interference to or claim protection from systems in the radiolocation service. (WRC-15)

1/1.1/6.10 For frequency band 3 400-3 600 MHz:

Note: Modifications to the Table of Frequency Allocations will vary depending on the options chosen and to which Region those options are applied, thus only some examples of footnotes for the frequency band 3 400-3 600 MHz are provided below. These footnotes could be also used as an examples to cover options for the frequency bands 3 600-3 700 MHz, 3 700-3 800 MHz, 3 800-4 200 MHz taking into account existing allocations to the MS in these bands across different Regions. Square brackets in the examples below are introduced to provide flexibility in combining different technical and regulatory conditions for specific proposals. Conditions in the example footnotes should be included in WRC Resolution that is cross-referenced in the footnote, where justified.

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1/1.1/6.10.1 For Method B, Option 1:

ADD

5.U11 [In *Regions/Country Names*], the frequency band [3 400-3 600] MHz, or portions of that frequency band as the case may be[10], is allocated to the mobile service, except aeronautical mobile, on a primary basis. (WRC-15)

---

[9] This option is based on the assumption that the secondary radiolocation services are upgraded from secondary to primary.

[10] Note: Specific proposals may address only allocation to portions of the frequency band, which will be specified exactly by the proponents, under certain circumstances and taking into account current allocations to mobile service.

1/1.1/6.10.2 For Method B, Option 2:

ADD

5.V11 [In *Regions/Country Names*], the frequency band [3 400-3 600] MHz, or portions of that frequency band as the case may be[11], is allocated to the mobile service, except aeronautical mobile, on a primary basis, [subject to agreement obtained under No. **9.21** with other administrations]. [At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply]. [Before an administration brings into use a (base or mobile) station of the mobile service in this band, it shall ensure that the power flux-density (pfd) produced at 3 metres above ground does not exceed −154.5 dB(W/(m^2 · 4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above]. [Stations of the mobile service in the frequency band [3 400-3 600] MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations.] (WRC-15)

1/1.1/6.10.3 For Method B, Option 3:

MOD

5.431A *Different category of service*: in *[Country Names],* Argentina, Brazil, Chile, Costa Rica, Cuba, French overseas departments and communities in Region 2, Dominican Republic, El Salvador, Guatemala, Mexico, Paraguay, Suriname, Uruguay and Venezuela, the band 3 400-3 500 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis, subject to agreement obtained under No. **9.21**. Stations of the mobile service in the band 3 400-3 500 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations (Edition of 2004). (WRC-~~12~~15)

1/1.1/6.10.4 For Method B, Option 4:

ADD

5.W11 [In *Regions/Country Names*], the frequency band [3 400-3 600] MHz, or portions of that frequency band as the case may be[12], is allocated to the mobile service, except aeronautical mobile, on a primary basis, subject to agreement obtained under No. **9.21** with other administrations. At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply. Before an administration

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[11] Note: Specific proposals may address only allocation to portions of the frequency band, which will be specified exactly by the proponents, under certain circumstances and taking into account current allocations to mobile service.

[12] Note: Specific proposals may address only allocation to portions of the frequency band, which will be specified exactly by the proponents, under certain circumstances and taking into account current allocations to mobile service.

brings into use a (base or mobile) station of the mobile service in this band, it shall ensure that the power flux-density (pfd) produced at 3 metres above ground does not exceed −154.5 dB(W/(m^2 · 4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service in the frequency band [3 400-3 600] MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations. (WRC-15)

1/1.1/6.10.5 For Method C, Option 1:

ADD

5.X11 [In *Regions/Country Names*], the frequency band [3 400-3 600] MHz, or portions of that frequency band as the case may be, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-15)

1/1.1/6.10.6 For Method C, Option 2:

ADD

5.Y11 [In *Regions/Country Names*], the frequency band [3 400-3 600] MHz, or portions of that frequency band as the case may be, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT), [subject to agreement obtained under No. **9.21** with other administrations]. This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. [At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply]. [Before an administration brings into use a (base or mobile) station of the mobile service in this band, it shall ensure that the power flux-density (pfd) produced at 3 metres above ground does not exceed −154.5 dB(W/(m^2 · 4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above]. [Stations of the mobile service in the frequency band [3 400-3 600] MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations]. (WRC-15)

1/1.1/6.10.7 For Method C, Option 3:

MOD

5.433A In [*Country Names*], Bangladesh, China, French overseas communities of Region 3, Korea (Rep. of), India, Iran (Islamic Republic of), Japan, New Zealand and Pakistan, the frequency band 3 500-3 600 MHz is identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply. Before an administration brings into use a (base or mobile) station of the mobile service in this band it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed −154.5 dB(W/(m^2 · 4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service in the frequency band 3 500-3 600 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations (Edition of 2004). (WRC-~~12~~15)

1/1.1/6.10.8 For Method C, Option 4:

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ADD

5.Z11 [In *Regions/Country Names*], the frequency band [3 400-3 600] MHz, or portions of that frequency band as the case may be, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT), subject to agreement obtained under No. **9.21** with other administrations. This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply. Before an administration brings into use a (base or mobile) station of the mobile service in this band, it shall ensure that the power flux-density (pfd) produced at 3 metres above ground does not exceed −154.5 dB(W/(m^2 · 4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service in the frequency band [3 400-3 600] MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations. (WRC-15)

1/1.1/6.11 For frequency band 3 600-3 700 MHz:

The regulatory examples as in section 1/1.1/6.10 for Options 1 and 2, for Method B and Options 1 and 2, for Method C, apply taking into account existing allocations to MS in the frequency band 3 600-3 700 MHz.

1/1.1/6.12 For frequency band 3 700-3 800 MHz:

The regulatory examples as in section 1/1.1/6.10 for Options 1 and 2, for Method B and Options 1 and 2, for Method C, apply taking into account existing allocations to MS in the frequency band 3 700-3 800 MHz.

1/1.1/6.13 For frequency band 3 800-4 200 MHz:

The regulatory examples as in section 1/1.1/6.10 for options 1 and 2 for Method B and Options 1 and 2 for Method C apply taking into account existing allocations to the MS in the frequency band 3 800-4 200 MHz.

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1/1.1/6.14 For frequency band 4 400-4 500 MHz

1/1.1/6.14.1 For Method C, Option C1:

Note: Example of regulatory text to be provided.

1/1.1/6.15 For frequency band 4 500-4 800 MHz

Note: Only some examples of footnotes for the frequency band 4 500-4 800 MHz are provided below. Square brackets in the examples below are introduced to provide flexibility in combining different technical and regulatory conditions for specific proposals. Conditions in the example footnotes should be included in WRC Resolution that is cross-referenced in the footnote, where justified.

1/1.1/6.15.1 For Method A:

NOC for RR

1/1.1/6.15.2 For Method C, Option 1:

ADD

5.AA11 [In *Regions/Country Names*], the frequency band [4 500-4 800] MHz, or portions of that frequency band as the case may be, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-15)

1/1.1/6.15.3 For Method C, Option 2:

ADD

5.AB11 [In *Regions/Country Names*], the frequency band [4 500-4 800] MHz, or portions of that frequency band as the case may be, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT), [subject to agreement obtained under No. **9.21** with other administrations]. This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. [At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply]. [Before

an administration brings into use a (base or mobile) station of the mobile service in this band, it shall ensure that the power flux-density (pfd) produced at 3 metres above ground does not exceed −154.5 dB(W/(m^2 · 4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above]. [Stations of the mobile service in the frequency band [4 500-4 800] MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations].

(WRC-15)

1/1.1/6.15.4 For Method C, Option 3:

ADD

5.AC11 [In *Regions/Country Names*], the frequency band [4 500-4 800] MHz, or portions of that frequency band as the case may be, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT), subject to agreement obtained under No. **9.21** with other administrations. This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply. Before an administration brings into use a (base or mobile) station of the mobile service in this band, it shall ensure that the power flux-density (pfd) produced at 3 metres above ground does not exceed −154.5 dB(W/(m^2 · 4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service in the frequency band [4 500-4 800] MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations. (WRC-15)

1/1.1/6.16 For frequency band 4 800-4 990 MHz

1/1.1/6.16.1 For Methods A and C, Option C1:

Note: Example of regulatory text to be defined.

1/1.1/6.17 For frequency band 5 350-5 470 MHz

TBD

1/1.1/6.18 For frequency band 5 725-5 850 MHz

TBD

1/1.1/6.19 For frequency band 5 925-6 425 MHz:

1/1.1/6.19.1 For Method C, Option 1

ADD

5.AD11 The frequency band 5 925-6 425 MHz is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of these bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. Resolution **A11** (**WRC-15**) applies. (WRC-15)

ADD

DRAFT NEW RESOLUTION [A11-5925TO6425MHz] (WRC-15)

Use of the frequency band 5 925-6 425 MHz by the mobile service for IMT systems

The World Radiocommunication Conference (Geneva, 2015),

considering

a) that this Conference has identified the frequency band 5 925-6 425 MHz for IMT;

b) that the frequency band 5 925-6 425 MHz is allocated worldwide on a primary basis to the fixed-satellite service (FSS) (Earth-to-space);

c) that the frequency band 5 925-6 425 MHz is also allocated to the mobile service, on a primary basis;

d) that results of studies in ITU-R indicate that sharing in the frequency band 5 925-6 425 MHz between IMT systems and the FSS satellites is feasible under specified conditions;

e) that there is a need to specify an appropriate e.i.r.p. limit and operational restrictions for IMT systems in the mobile service in the frequency band 5 925-6 425 MHz in order to protect FSS satellite receivers,

further considering

a) that the interference from a single IMT station, 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 frequency band 5 925-6 425 MHz;

b) that such FSS satellite receivers may experience an unacceptable effect due to the aggregate interference from IMT stations 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 IMT stations and it may not be possible for administrations to determine the location of the source of the interference and the number of IMT stations in operation simultaneously,

recognizing

a) that interference criteria of FSS satellite receivers based on $\Delta T/T$ ratio is given in Recommendation ITU-R S.1432;

b) that some administrations have extensive deployments of fixed service systems in the band 5 925-6 425 MHz;

c) that the use of the frequency band 5 925-6 425 MHz by IMT systems will provide substantial additional capacity to address additional spectrum requirements for IMT;

d) that there is a need for administrations to ensure that IMT stations meet the required mitigation techniques, for example, through equipment or standards compliance procedures;

e) that no specific separation distance is required to protect IMT stations operating indoors from FSS transmitting stations,

resolves

1 that in the frequency band 5 925-6 425 MHz, IMT stations shall be restricted to indoor use with a maximum mean e.i.r.p.[13] of [10-15][14] dBm;

2 that if the band made available for IMT systems by any administration is less than 500 MHz, the power limit in *resolves* 1 shall be reduced by the following amount: reduction =10×log(500/B) in dB, where B is the available bandwidth for IMT systems, in MHz,

invites administrations

1 to adopt appropriate regulation if they intend to permit the operation of IMT stations in the frequency band 5 925-6 425 MHz,

2 to monitor whether the aggregate interference levelshave exceeded, or will exceed in the future, the ΔT/T criteria at FSS satellite receivers given in Recommendation ITU-R S.1432 in order to enable a future competent Conference to take appropriate action.

1/1.1/6.19.2 For Method C, Option 2

ADD

5.AE11 The frequency band 5 925-6 425 MHz is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of these bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-15)

1/1.1/6.19.3 For Method C, Option 3

Note: Example of regulatory text to be defined.

1/1.1/6.19.4 For Method C, Option 4

ADD

5.AF11 The frequency band 5 925-6 425 MHz is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not

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[13] 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.

[2] *[Editor’s note: The range 10-15 dBm is based on sharing studies results described in section 1/1.1/4.1.12]*

preclude the use of these bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. Resolution [**A11-5925to6425MHz]** (**WRC-15**) applies. In the frequency band 5 925-6 425 MHz, IMT stations in the mobile service shall not claim protection from earth stations in the fixed-satellite service. (WRC-15)