Qualcomm

IAFI 6th National Preparatory Workshop for WRC-23

14 July 2023

WRC-23 AI 1.1, 1.2 1.3

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Agenda

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- Agenda 1.2
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Agenda Item 1.1

Resolution 223 (Rev.WRC-19) - Additional frequency bands identified for International Mobile Telecommunications

invites the 2023 World Radiocommunication Conference

to consider, based on the results of ITU-R studies, possible measures to address, in the frequency band 4 800-4 990 MHz, protection of stations of the aeronautical and maritime mobile services located in international airspace and waters from other stations located within national territories, and to review the power flux density criteria in No. 5.441B in accordance with Resolution 223 (Rev.WRC-19)

5.441B

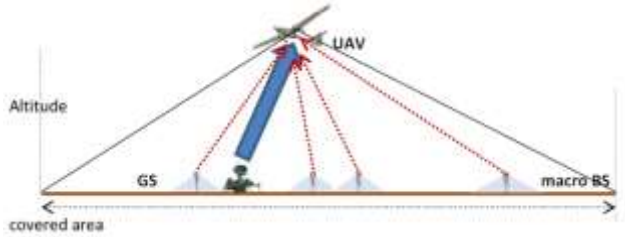
In Angola, Armenia, Azerbaijan, Benin, Botswana, Brazil, Burkina Faso, Burundi, Cambodia, Cameroon, China, Côte d'Ivoire, Djibouti, Eswatini, Russian Federation, Gambia, Guinea, Iran (Islamic Republic of), Kazakhstan, Kenya, Lao P.D.R., Lesotho, Liberia, Malawi, Mauritius, Mongolia, Mozambique, Nigeria, Uganda, Uzbekistan, the Dem. Rep. of the Congo, Kyrgyzstan, the Dem. People's Rep. of Korea, Sudan, South Africa, Tanzania, Togo, Viet Nam, Zambia and Zimbabwe, the frequency band 4 800-4 990 MHz, or portions thereof, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. The use of IMT stations is subject to agreement obtained under No. 9.21 with concerned administrations, and IMT stations shall not claim protection from stations of other applications of the mobile service. In addition, before an administration brings into use an IMT station in the mobile service, it shall ensure that the power flux-density (pfd) produced by this station does not exceed −155 dB(W/(m2 · 1 MHz)) produced up to 19 km above sea level at 20 km from the coast, defined as the low-water mark, as officially recognized by the coastal State. This pfd criterion is subject to review at WRC-23. Resolution 223 (Rev.WRC-19) applies. This identification shall be effective after WRC-19. (WRC-19)

Agenda Item 1.1

A Brief History

Allocation to services		
Region 1	**Region 2**	**Region 3**
4 800-4 990	FIXED MOBILE 5.440A 5.441A 5.441B 5.442 Radio astronomy 5.149 5.339 5.443	

- **Main aeronautical applications: Unmanned Aircraft Systems (UAS) for different types of missions (life rescue, life search, communication relay above the sea…), harmonised by NATO for military use**
- **Sharing between aeronautical mobile applications and IMT systems in 4 400-4 990 MHz is not practical.**



at WRC-15

3 countries (Vietnam, Laos, Cambodge) included in No. **5.441B with IMT** in the 4 800-4 990 MHz frequency band + a pfd limit produced by IMT station up to 19 km above sea level at 20 km from the coast in order to protect AMS. This criterion was subject to review at WRC-19.

at WRC-19

+37 countries included in No. **5.441B with IMT,** same pfd limit + additional condition (agreement obtained under No. 9.21), for 11 of these countries (Russia and other RCC countries, China, Brazil, South Africa, Zimbabwe) the pfd criterion in footnote RR No. **5.441B** was deactivated (under *resolves* 5 of Resolution **223)** .

CPM 23-2 | Agenda Item 1.1

Review pfd limit to protect stations of the aeronautical and maritime mobile services in the frequency band **4 800-4 990 MHz**

Method	Description
A	NOC (keeping the existing pfd limit)
B	Keeping the existing pfd limit and applying it to all countries listed in RR No. 5.441B through modifying Resolves 5 of Res 223
C	New pfd value applying only to the countries it is applied now. Five alternatives proposed with different pfd limits as well as with different distances from the coast where the pfd would be applicable. In addition, alternatives also include Russian proposal for using Exclusive Economic Zone (EEZ) described in UNCLOS (UN Convention on Law of Sea). There is not much support for the use of EEZ since there is no mention in its description in UNCLOS to apply it to telecommunication matters.
D	Same as Method C + applying it to all countries listed in RR No. 5.441B.
E	Keeping the existing pfd and extend it to list of countries where it is not currently applied. France opposes this Method since it has the potential of removing the protection of AMS/MMS by exempting from the pfd limit most or all of the countries listed in 5.441B. A group of countries from Africa (Nigeria, South Africa and Zimbabwe) support this Method and suggest that other mechanisms such as bilateral/multilateral coordination can take place between the Administrations involved
F	No pfd limit + Application of only RR No. 9.21 providing a mechanism for protection of AMS operations from IMT in areas up to 450 km around respective ground stations located in countries which authorized the use of AMS applications in question. France opposes this Method since this may not cover protection of operations between aircrafts or between aircrafts and ships.
G	No pfd limit + Application of only RR No. 9.21 + bilateral/multilateral coordination agreements. This was added by Russian Federation. Under this method no additional measures such as pfd limit are imposed on IMT stations for the protection of AMS/MMS stations in international airspace/waters. This method also suggests that the protection of AMS/MMS stations is limited to the areas of national territories of countries using these stations.
H	No pfd limit + Application of RR No. 9.21 + no protection to AMS/MMS in international waters This Method needs further clarification and differentiation with Method F.

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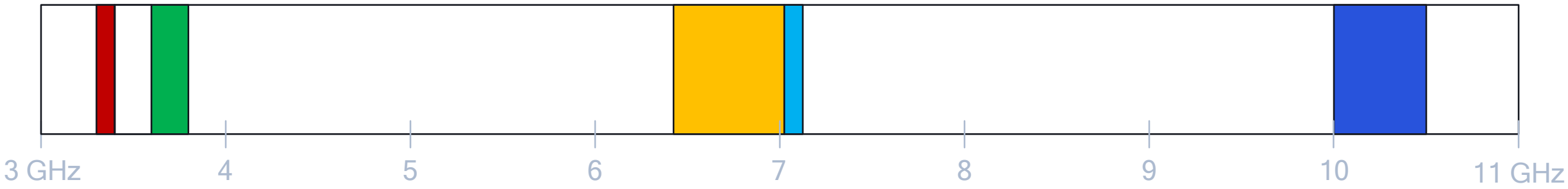
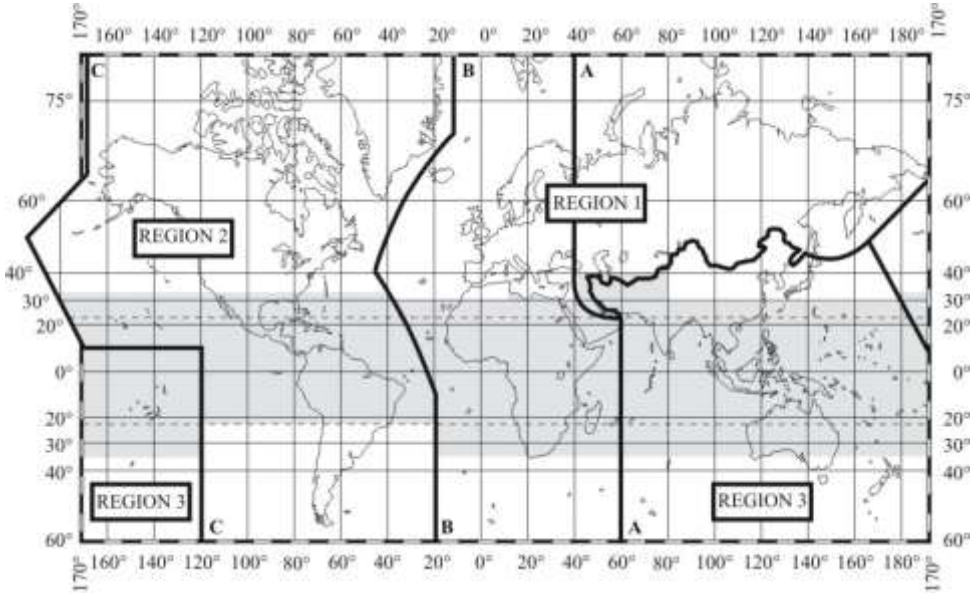
Overview of AI 1.2

WRC-23 agenda item 1.2 considers International Mobile Telecommunications (IMT)

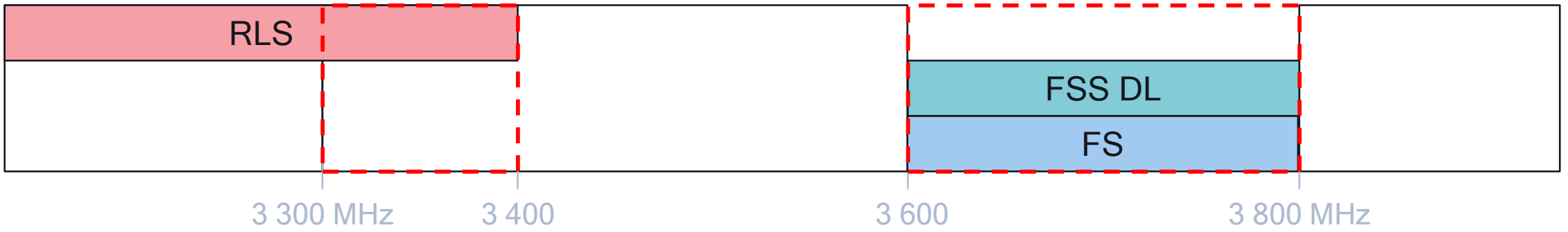


- Band 1 – 3 300-3 400 MHz (amend footnote in Region 1)
- Band 2 – 3 300-3 400 MHz (Region 2)
- Band 3 – 3 600-3 800 MHz (Region 2)
- Band 4 – 6 425-7 025 MHz (Region 1)
- Band 5 – 7 025-7 125 MHz (globally)
- Band 6 – 10.0-10.5 GHz (Region 2)



3 GHz (Band 1, 2 & 3)

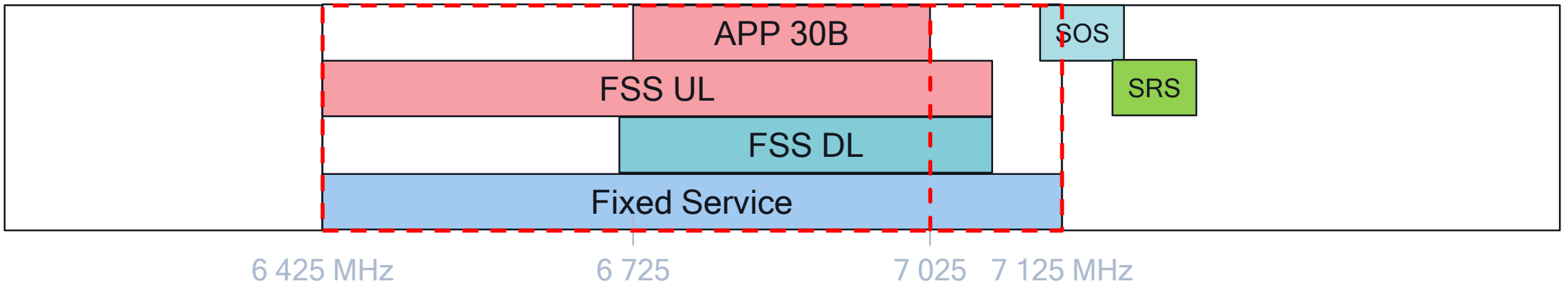
Frequency range 3 300-3 800 MHz – Sharing studies



- The frequency range 3 100-3 400 MHz is allocated to the RLS on a primary basis
- The frequency range 3 600-3 800 MHz is allocated to the FS, FSS, MS in Region 2 on a primary basis

6 GHz (Band 4 & 5)

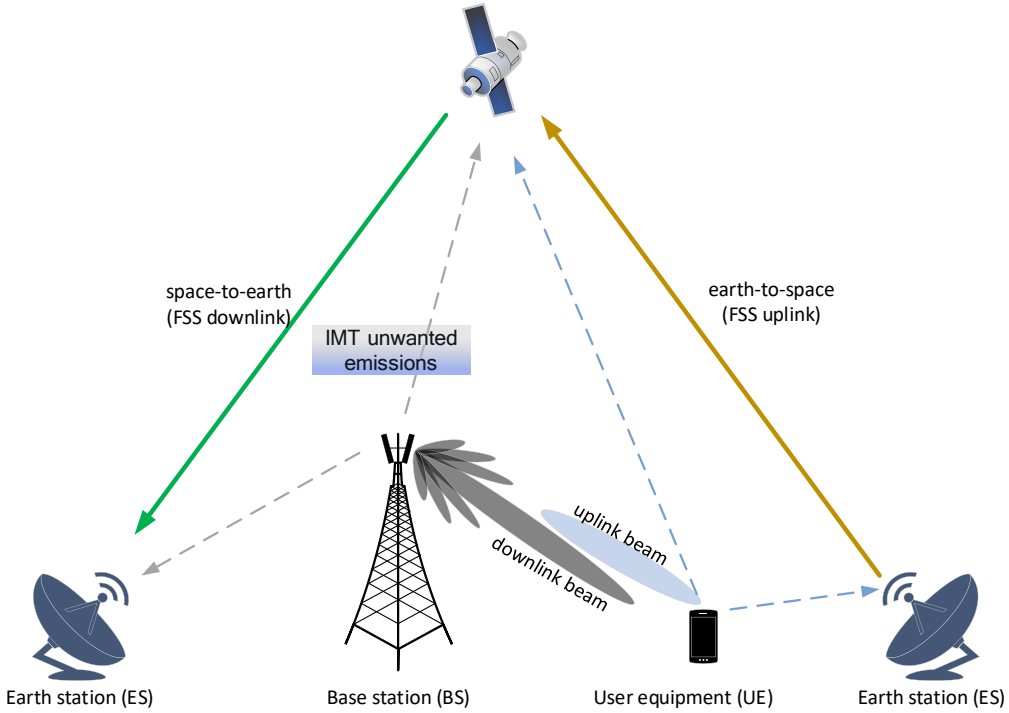
Frequency range 6 425-7 125 MHz – Sharing studies highlight

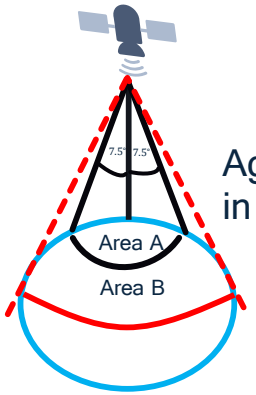


- The frequency range 6 425-7 125 MHz is allocated to the FS, FSS, MS, SOS on a primary basis
- The frequency bands adjacent to this frequency range are allocated to the FS, FSS, MS, SOS, SRS (deep space).
- RR Appendix 30B covers 6 725-7 025 MHz for FSS UL (AP30B is to guarantee in practice, for all countries, equitable access to the geostationary-satellite orbit in the frequency bands covered by it)
- RR Nos. **5.149** and **5.458** refer to RAS and EESS/SRS (passive) usage in this frequency band. However, this frequency band is not allocated to these services and, therefore, studies were not carried out under WRC-23 agenda item 1.2.

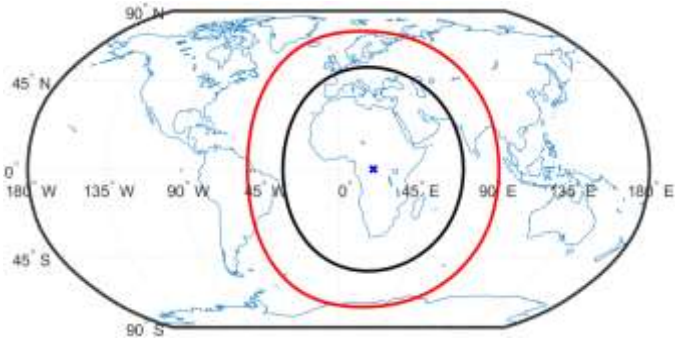
FSS Uplink (6 425-7 075 MHz) Sharing Studies

- ITU-R WP5D considered a number of studies
  - Studies considered various positions in a geostationary orbit for global, hemi, zone and spot beams





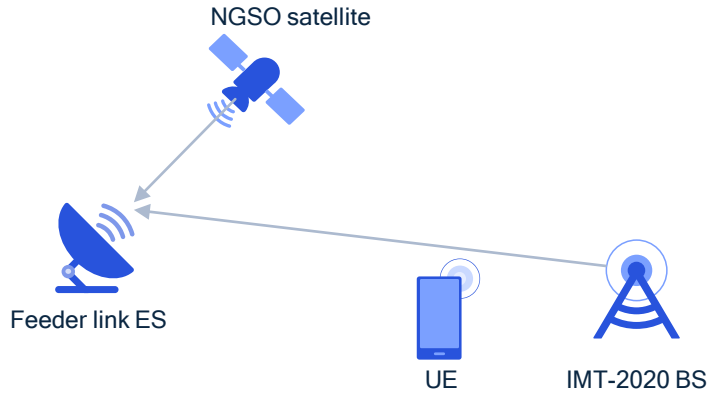
Aggregated interference in a large area

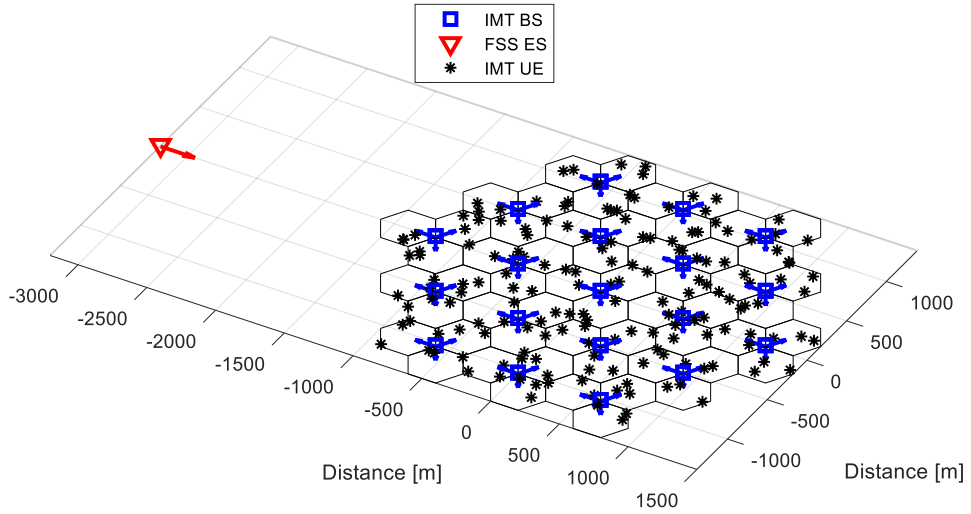


Large variance in the outcomes of the studies due to
- Different assumptions (IMT density, Satellite footprint, FSS receiver characteristics)
- Clutter Loss modeling and FS Apportionment

FSS downlink (6 700-7 075 MHz)

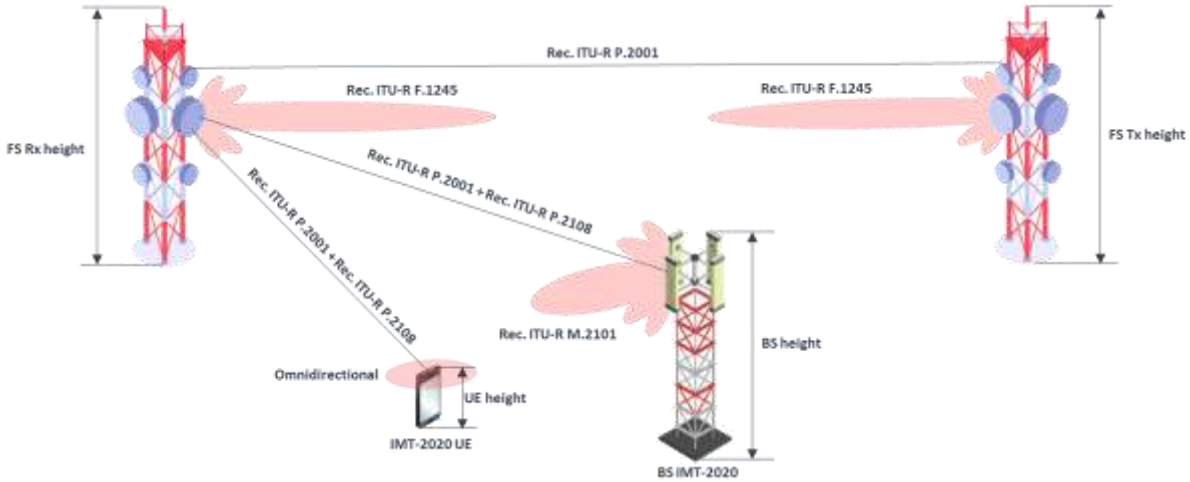
- All studies show that separation distances are required in order to protect the operation of non-GSO FSS Earth stations
- Separation distances: between few kilometers to tens of kilometers
- Impact on separation distance:
  - site specific
  - propagation parameters, local terrain topography, surrounding clutter on the earth
  - orbital parameters of the non-GSO system, and satellite selection strategy
- Site specific coordination between FSS Earth stations and IMT deployments required in this frequency range

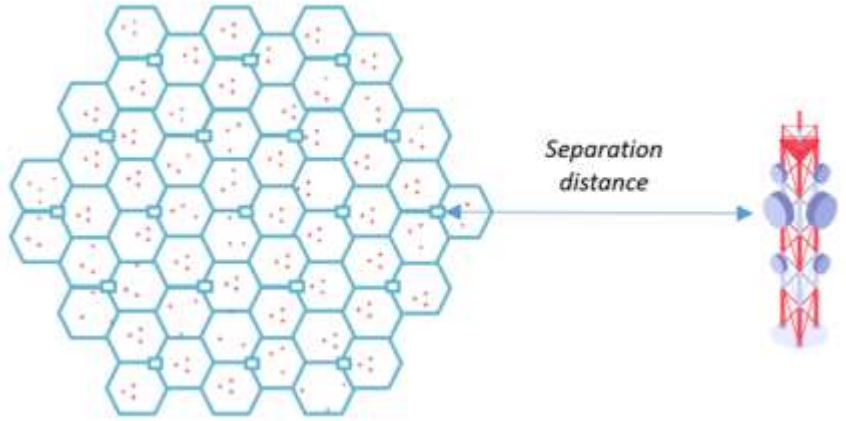




FS (6 425-7 125 MHz)

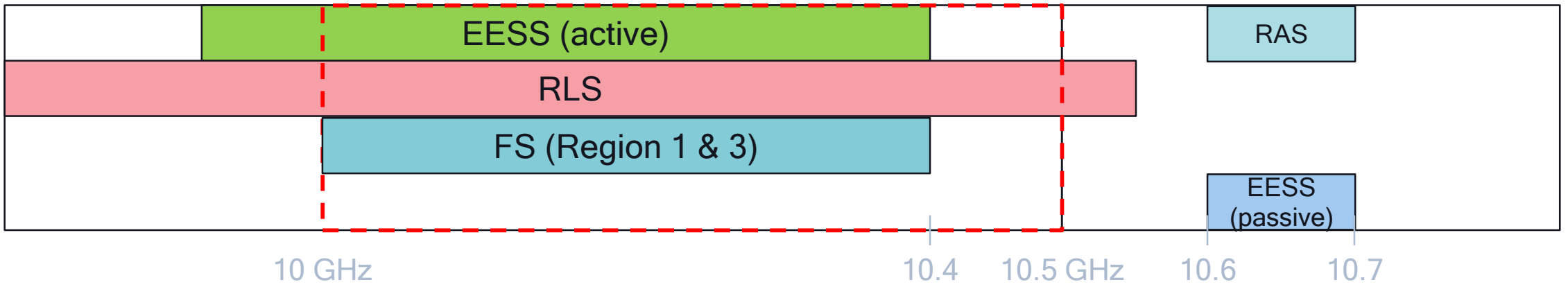
- Separation distances in 4 Monte-Carlo simulations ranged from 1 km to 68 km, one deterministic calculation without clutter and with worst case FS system parameters indicated up to 200 km
- Main protection criterion: long term total I/N −10 dB I/N (exceeded up to 20% of time)
- Impact on separation distance: the coexistence scenario, ways to account for clutter losses and propagation losses
- Coordination
  - possible by considering mutual positioning of the elements (back lobe vs main lobe scenario) and locating the IMT BS within the clutter
  - Required site by site if IMT and FS are deployed in the same or in adjacent geographical areas





10 GHz (Band 6)

Frequency range 10 -10.5 GHz – Sharing studies



- The frequency range 10-10.5 GHz is allocated to the EESS (active), FS, MS and RLS on a primary basis
- The frequency bands adjacent to this frequency range are allocated to the EESS (active), EESS (passive), FS, MS, RAS and RLS
- IMT parameters: Hot spot only, max. EIRP 60 dBm

AI 1.2 Method Analysis

Method Analysis

Band 1 – 3 300-3 400 MHz (Region 1)

	Description
1A	NoC
1B	Modify Footnote, add countries (south of 30° parallel north), and identify IMT
1C	Modify FN, add countries, and identify IMT
1D	Primary MS allocation and IMT via new FN
1E	Primary MS allocation, IMT via modified FN

Band 2 – 3 300-3 400 MHz (Region 2)

	Description
2A	NoC
2B	Primary MS allocation and identify for IMT via: • Upgrade freq. alloc. table to MS • Modify existing FN to apply to FS only • Modify existing FN for IMT identification
2C	Like B, but limited to MS except aeronautical mobile

Band 3 – 3 600-3 800 MHz (Region 2)

	Description
3A	NoC
3B	IMT with protection of space stations
3C	B + pdf limit RR No. **5.431B** + RR Nos. **9.17**, **9.18**
3D	C with revised pfd limit + RR Nos. **9.21**
3E	IMT remains in 3 600-3 700 MHz, additional Region 2 countries
3F	E but full Region 2

Method Analysis

Band 4 - 6 425-7 025 MHz (Region 1)

	Description
4A	NoC
4B	IMT without any conditions
4C	IMT with conditions
4D	IMT with conditions, applied only within portion of the band
4E	IMT with conditions, with use expected as of 2030

Band 5 -7025-7125 MHz (globally)

	Description
5A	NoC
5B	IMT without any conditions
5C	IMT with conditions
5D	IMT with conditions, applied only within portion of the band
5E	IMT with conditions, with use expected as of 2030

Band 6 - 10.0-10.5 GHz (Region 2)

	Description
6A	NoC
6B	IMT with conditions
6C	IMT with conditions, two additional FN to protect RLS & RAS

India Views on AI 1.2 in APG23-5

- Band 1 – 3 300-3 400 MHz (amend footnote in Region 1):
  - **Method 1D**: Primary allocation to the mobile (except aeronautical mobile) service in the frequency band 3 300-3 400 MHz in interested Region 1 countries and identification of IMT.
- Band 2 – 3 300-3 400 MHz (Region 2)
  - **Method 2C**: Allocation of the frequency band 3 300-3 400 MHz to the mobile (except aeronautical) service on a primary basis and identification of IMT in Region 2.
- Band 5 - 7 025-7 125 MHz (globally)
  - **Method 5B**: Identification of the frequency band 7 025-7 125 MHz for IMT without any conditions.

India supported the band for IMT identification as it would lead towards global harmonization of band, bringing in economies of scale; subject to ensuring protection to services in adjacent band based upon studies.

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Agenda Item 1.3

*to consider primary allocation of the band 3 600-3 800 MHz to mobile service within Region 1 and take appropriate regulatory actions, in accordance with **Resolution 246** (WRC-19);*

resolves to invite the ITU Radiocommunication Sector

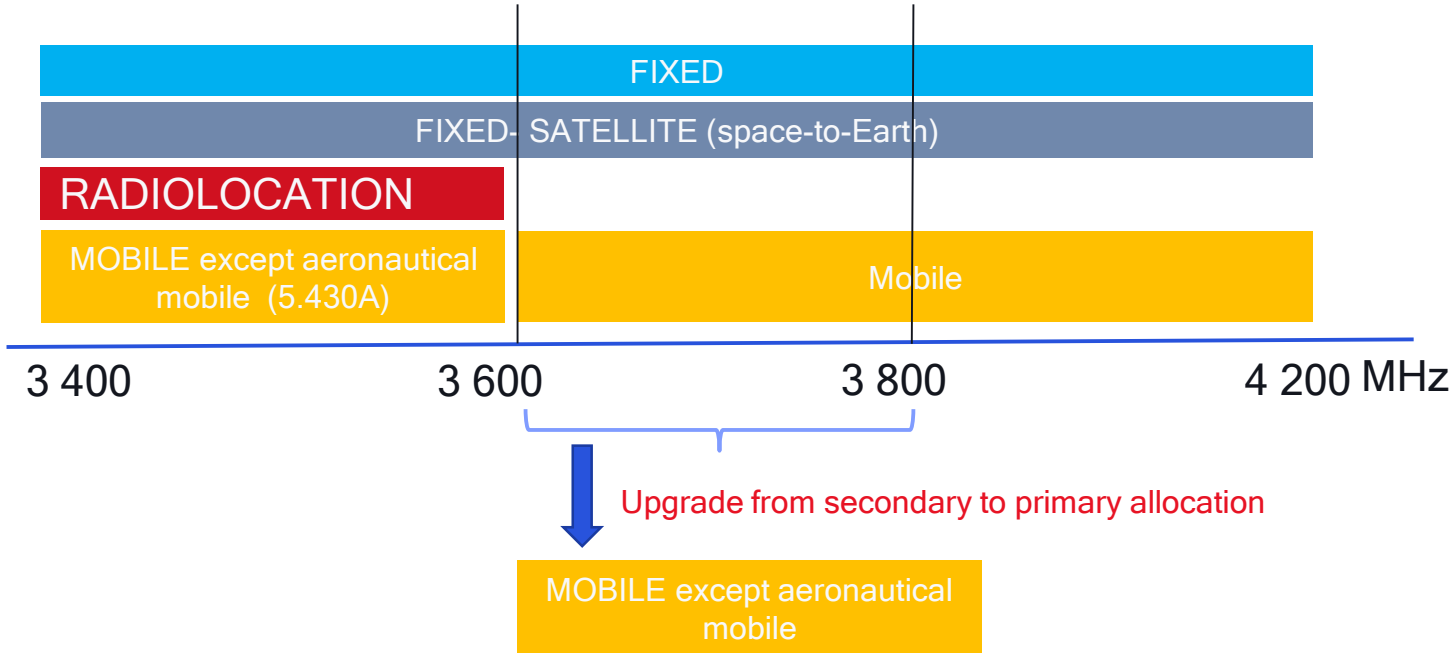
to conduct sharing and compatibility studies in time for WRC-23 between the mobile service and other services allocated on a primary basis within the frequency band 3 600-3 800 MHz and adjacent frequency bands in Region 1, as appropriate, to ensure protection of those services to which the frequency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

invites the 2023 World Radiocommunication Conference

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

Agenda Item 1.3 | Band Overview

- Band allocated « Primary » in Region 2 and 3
- Band used for IMT in many countries in Region 1 (Europe and GCC countries)
- Agenda Item proposed by ASMG and a number of African countries



- Main considerations:
  - Protection of the existing services within the band and in adjacent frequency bands
  - Any regulatory and technical provisions remain consistent with those implemented in the 3400-3600 MHz band (5.430A: band identified for IMT with pfd limit of -154.5 dBW/m²/4 kHz)

Agenda Item 1.3

Upgrade the Mobile allocation in the band 3.6-3.8 GHz (Region 1)

Method	Description
A	NOC
B	Upgrade to primary without conditions
C	Upgrade to primary with regulatory and/or technical conditions
D	Upgrade to primary without conditions + identification for IMT

C1	C2	C3	C4	C5
Upgrade + agreement to be obtained under RR No. **9.21**. Same technical and regulatory conditions as for 3 400-3 600 MHz (the pfd limit)	Upgrade + new footnote Same technical and regulatory conditions as for 3 400-3 600 MHz (the pfd limit)	Upgrade in the frequency band 3 600-3 800 MHz, or parts thereof + recognizing the need of the appropriate protection of the FSS at the border of each country Same technical and regulatory conditions as for 3 400-3 600 MHz (the pfd limit) TBD	Upgrade + with regulatory conditions in a footnote including the application of RR No. **9.21**.	Upgrade + alternative pfd protection limits, to include a pfd limit of [−154.5] dB(W/(m² · 4 kHz)) at 3 m above ground not to be exceeded for more than 0.005% of the time at the border of the territory.

Thank you

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