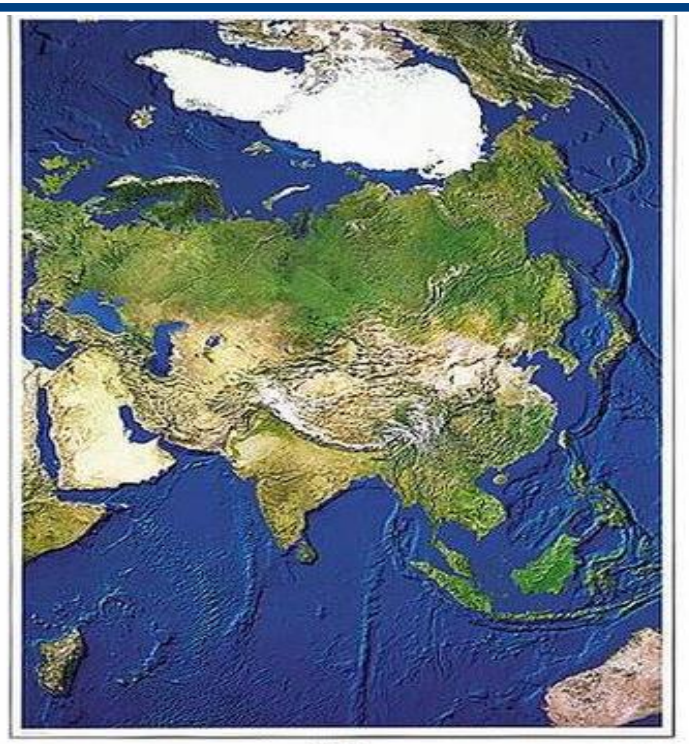
ITU – RRS21 for Asia Pacific
22 October 2021

Bashir Patel
Policy and Regulatory Advisor
GSC / ESOA

Global Satellite Coalition Partners

Region 2

Region 1



Region 3

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ABRASAT

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APSCC Asia-Pacific Satellite Communications Council

COMMUNICATIONS ALLIANCE LTD

Structure of CPM Report to WRC-23

CHAPTER 1 Fixed, Mobile and Broadcasting issues

Agenda items: 1.1, 1.2, 1.3, 1.4, 1.5

Co-Rapporteur Dr. Hiroyuki ATARASHI (J), for agenda items 1.1, 1.2 and 1.4, email: hiroyuki.atarashi.yt@nttdocomo.com

Co-Rapporteur Mr. Usman Aliyu MAHMUD (NIG), for agenda items 1.3 and 1.5, email: ualiyu@ncc.gov.ng

CHAPTER 2 Aeronautical and maritime issues

Agenda items: 1.6, 1.7, 1.8, 1.9, 1.10, 1.11

Rapporteur Mr. Mohammed ALHASSANI (UAE), email: mohammed.alhassani@tra.gov.ae

CHAPTER 3 Science issues

Agenda items: 1.12, 1.13, 1.14

Rapporteur Mr. Tarcisio Aurélio BAKAUS (B), email: bakaust@anatel.gov.br

CHAPTER 4 Satellite issues

Agenda items: 1.15, 1.16, 1.17, 1.18, 1.19, 7

Co-Rapporteur Ms. Florence Magnier (F) for agenda items 1.15, 1.16, 1.17, 1.18, 1.19, email: fmagnier@eutelsat.fr

Co-Rapporteur Mr. Georges KWIZERA (RRW) for agenda item 7, email: george.kwizera@rura.rw

CHAPTER 5 General issues

Agenda items: 2, 4 and 9.1 topics a) Res. 657 (Rev.WRC-19), b) Res. 744 (WRC-19), c) Res. 175 (WRC-19), and d) WRC-19 Doc. 535

Co-Rapporteur Mr. Jia HUANG (CHN), email: ferrero.huang@srrc.org.cn

Co-Rapporteur Dr. Jong Min PARK (KOR), email: jongmin@etrire.kr

ANNEX 1 Information on WRC-23 Agenda Item 10

WRC-23 Agenda Items and topics covered

Protect satellite bands from other services

1.2 IMT in 3/6/7/10 GHz - Res. 245 (WRC-19)
1.3 Mobile Service in 3600-3800 MHz in Region 1 - Res. 246 (WRC-19)
9.1 c) IMT in bands of the Fixed Service (FS) - Res. 175 (WRC-19)
Art 21 RR21.5 and IMT stations (WRC-19 doc. 550)

Enhance use of existing satellite bands

1.8 Use of FSS for CNPC links of UAS- Res. 155 (WRC-19)
1.15 GSO FSS earth stations on aircraft and vessels in 12.75-13.25 GHz - Res. 172 (WRC-19)
1.16 NGSO ESIMs in Ka-band - Res. 173 (WRC-19)
1.17 Satellite-to-satellite links in Ku and Ka-bands - Res. 773 (WRC-19)
7 Improvements to satellite procedures - Res. 86 (WRC-07)
9.1 d) EESS (passive) in 36-37 GHz vs FSS NGSO in 37.5-38 GHz (WRC-19 doc. 535)
Art 48 Invocation of CS Article 48 in relation to the RR

Develop new satellite bands

1.18 New MSS allocations for narrow-band mobile satellite systems - Res. 248 (WRC-19)
1.19 New primary FSS allocation in 17.3-17.7 GHz in R2 - Res. 174 (WRC-19)

10 **WRC-27 Agenda**

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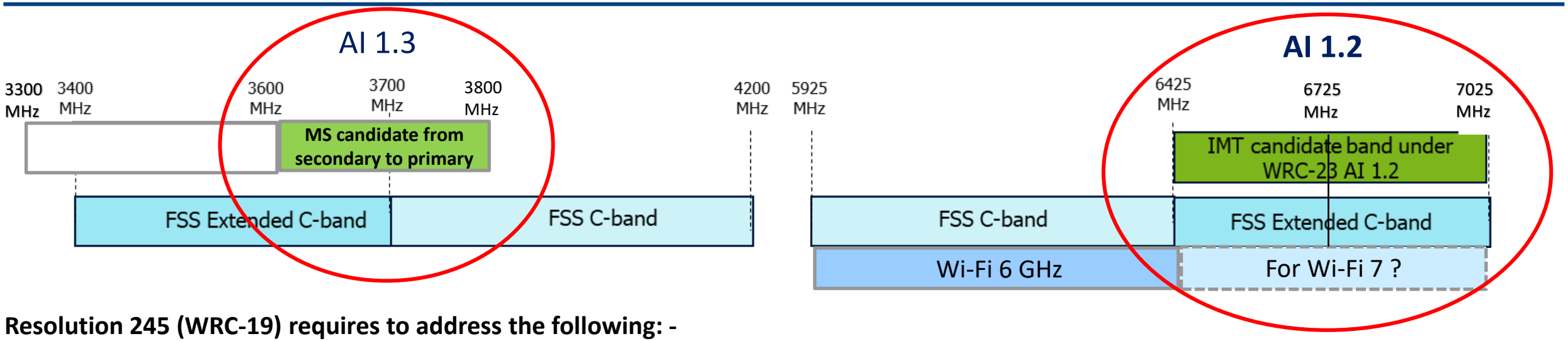
WRC-23 AI 1.2 – What's required



Resolution 245 (WRC-19) requires to address the following: -

1. **to conduct and complete the appropriate studies of technical, operational and regulatory issues taking into account**:
   - evolving needs to meet emerging demands for IMT and to ensure the protection of existing services against any interference;
   - technical and operational characteristics of terrestrial IMT systems
   - the deployment scenarios envisaged for IMT systems and the related requirements of balanced coverage and capacity;
   - the needs of developing countries;
   - the time-frame in which spectrum would be needed

2. **to conduct and complete the sharing and compatibility studies**
   - 3 600-3 800 MHz and 3 300-3 400 MHz (Region 2);
   - 3 300-3 400 MHz (footnote 5.429B in Region 1);
   - 7 025-7 125 MHz (Globally);
   - **6 425-7 025 MHz (Region 1);**
   - 10 000-10 500 MHz (Region 2),

WRC-23 AI 1.2 Studies to be conducted

C-band uplink

	IMT-Advanced (4G) (5925-6425 MHz)	IMT-2020 (5G) (6425 – 7025 MHz)	WiFi in 6 GHz (5925 – 6425 MHz)
ITU	**Report ITU-R S.2367**	**To be done under AI1.2**	No studies
CEPT	No studies	No studies	**ECC Report 302**

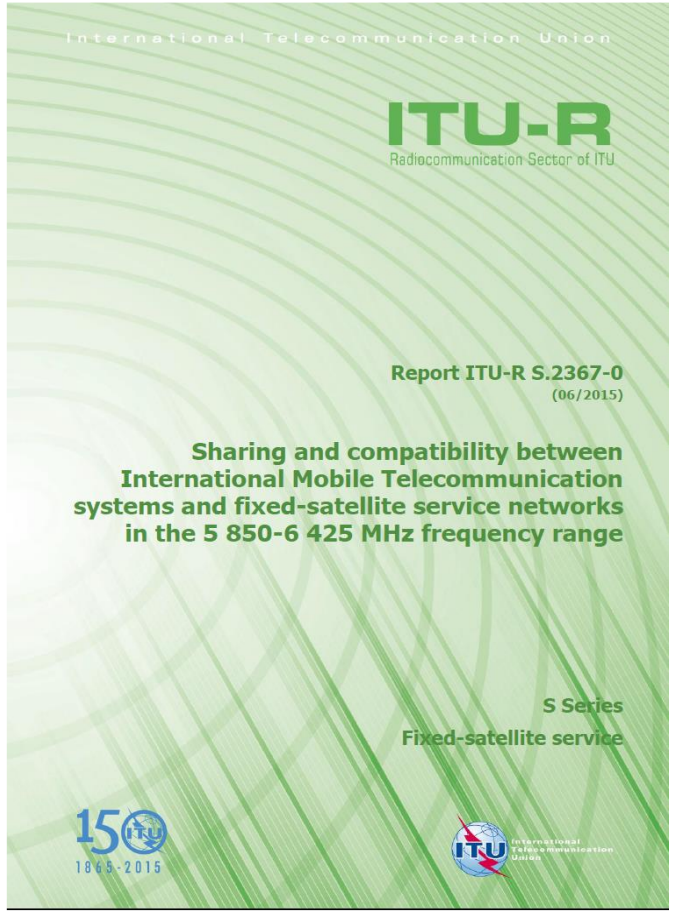
Sub Bands	Existing Utilisation	Existing / Future Studies
5925-6425 MHz:	Globally many countries have identified this band for unlicensed 6 GHz Wi-Fi connectivity, including Europe, Americas, ME, Asia etc	**Existing studies related to IMT-Advanced (Report ITU-R S.2367)** show very little potential for IMT operations while protecting FSS uplinks (indoor use only, EIRP limit necessary). Studies conducted so far at CEPT level have demonstrated that sharing with unlicensed WiFi indoor could be more feasible than IMT in this Band.
6425-6725 MHz:	Unplanned band, allocated to the FSS globally (earth-to-space). **Used for uplinks by large numbers of GSO FSS networks covering all Regions.** **Uses includes feeder links for MSS systems including safety services**.	▪ To conduct further in-band sharing technical studies for the E2S (uplink) operations to examine the results of aggregate interference from IMT B/S studies into receiving FSS space stations; ▪ To examine the space to earth satellite operations in-band sharing.
6725-7025 MHz:	**Planned FSS band – subject AP30B**, there are no existing studies with IMT/5G	▪ Plan contains all national allotments of all countries and needs particular attention due to the super-status of the Plan with regards to the List and other services ▪ Subject to the provisions and associated Plan for the FSS of Appendix **30B** of the Radio Regulations. Articles 1 and 2 of Appendix **30B** selected this band in 1985 to guarantee, for all countries, equitable access to the geostationary-satellite orbit in the frequency bands of the fixed-satellite service.
6 700-7 025 MHz	Allocated to the FSS globally (space-to-earth), Limited to feeder links for NGSO – MSS and is subject to coordination under No. **9.11A.**	▪ Co-existence issues between IMT and receiving FSS earth stations would be similar to those studied in Report ITU-R S.2368, i.e., separation distances and coordination contours would be necessary around receiving FSS earth stations to achieve co-existence

Leading to:

1. **Studies from IMT to FSS satellite receivers (GSO, non-GSO, including App 30B planned systems) – *most critical due international aspect***
2. **Studies from FSS transmitting earth stations to IMT receivers**
3. **Studies from IMT to receiving earth stations (non-GSO MSS feeder downlinks)**

Existing Studies (5925-6425 MHz) uplink

- Studies have been carried out for **IMT-Advanced in the band 5850-6425 MHz** in **ITU-R Report S.2367**
- **FSS characteristics used in S.2367 are similar to those in the band 6425-6575 MHz**
- Interference from Uplink Ground Earth Stations to IMT-Advanced BSs:
  - Example separation: "10-78 km to protect outdoor macro cell in a suburban environment"
- Interference from IMT-Advanced stations to FSS satellite receivers:
  - ITU-R Report S.2367 conclusion:
    - *that **FSS space receivers would be subjected to excessive levels of interference from the aggregate operation of IMT (small cell) base stations,** irrespective of whether they are deployed outdoors or indoors. It was stated that necessary conditions for deployment of IMT systems would include limitation to indoor only and establishment of strict limits on maximum allowable e.i.r.p. for IMT stations. T**hese conclusions are also relevant for the frequency band 6 425-7 025 MHz***

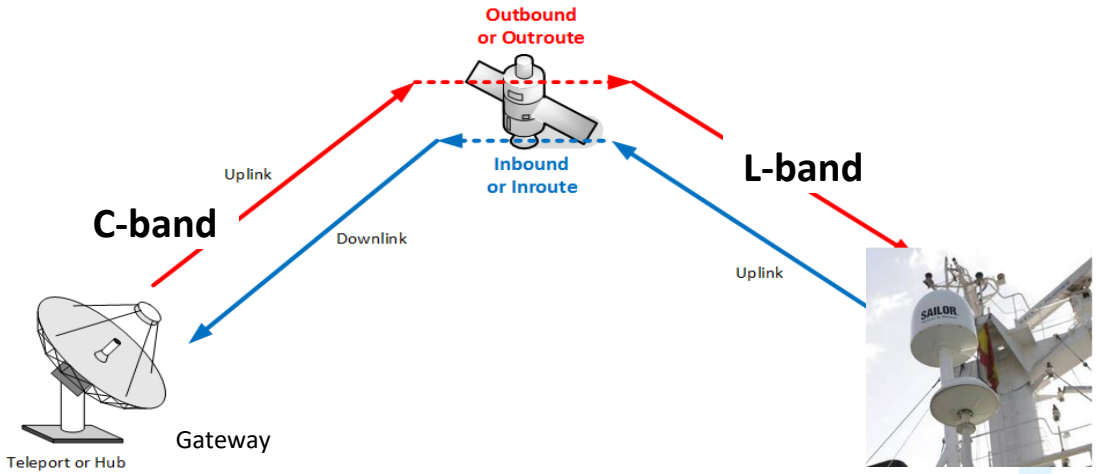


Current Status

1. *Resolves* 1 of Resolution 245 (WRC-19), CPM23-1 defined that the date by which technical and operational characteristics needed for sharing and compatibility studies are to be available is **15 June 2021**.
2. WP5D & WP4A provided the necessary parameters to undertake sharing and compatibility studies July 2021
3. At the most recent WP5D Meeting some initial studies have been shared with considerable variation in assumptions that needs to be aligned in order to compare. [type of study (deterministic/Monte Carlo as per M.2102), clutter loss (application of P.2108, specific percentage, etc.), Ra/Rb options, polarization discrimination, UE power control, elevation angles used in the study, network loading factor (20% or 50%), 3dB contour, Apportionment (Yes/no), Rural scenario (Yes/no), Aggregate interference calculation, etc.]

Usage in Unplanned band 6425-6725 MHz

- **Used by “global beam” antennas, to allow use by gateway stations in almost any country**
- **Used for feeder links for GNSS augmentation (SBAS) on some satellites**
- **Used to support the L-band service uplinks and downlinks**
- **Feeder links used to carry maritime and aeronautical safety traffic**

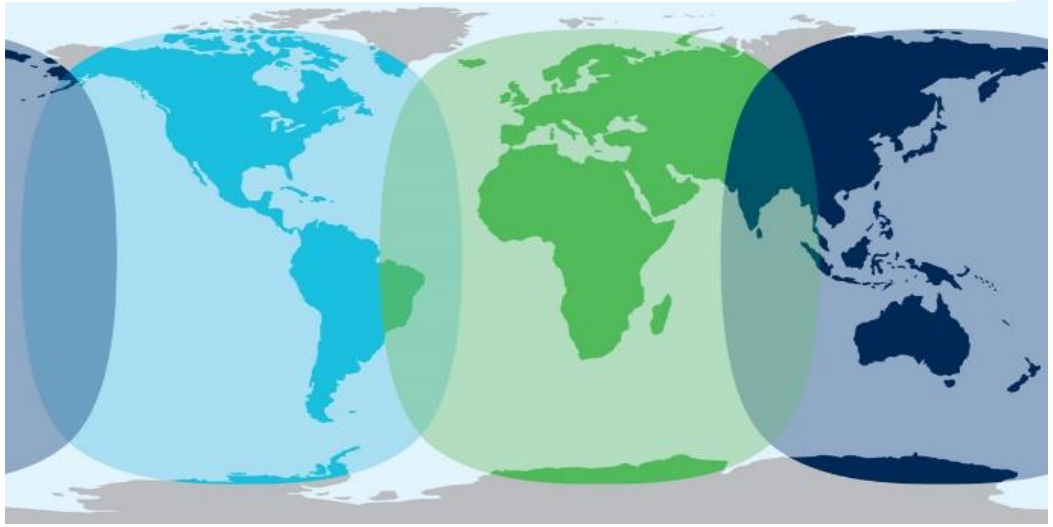


<u>C band (standard and extended)</u>

Downlink: 3 400 - 4 200 MHz , Uplink: 5 850 - 6 725 MHz

Feeder links used in L/C payload operating in the ‘extended C-band’ operating through more than 20+ Land Earth Stations carrying safety services traffic (C2L, L2C,)

Down link: 3550 – 3700 MHz,
Uplink : 6425 – 6575 MHz



Need to protect critical safety services

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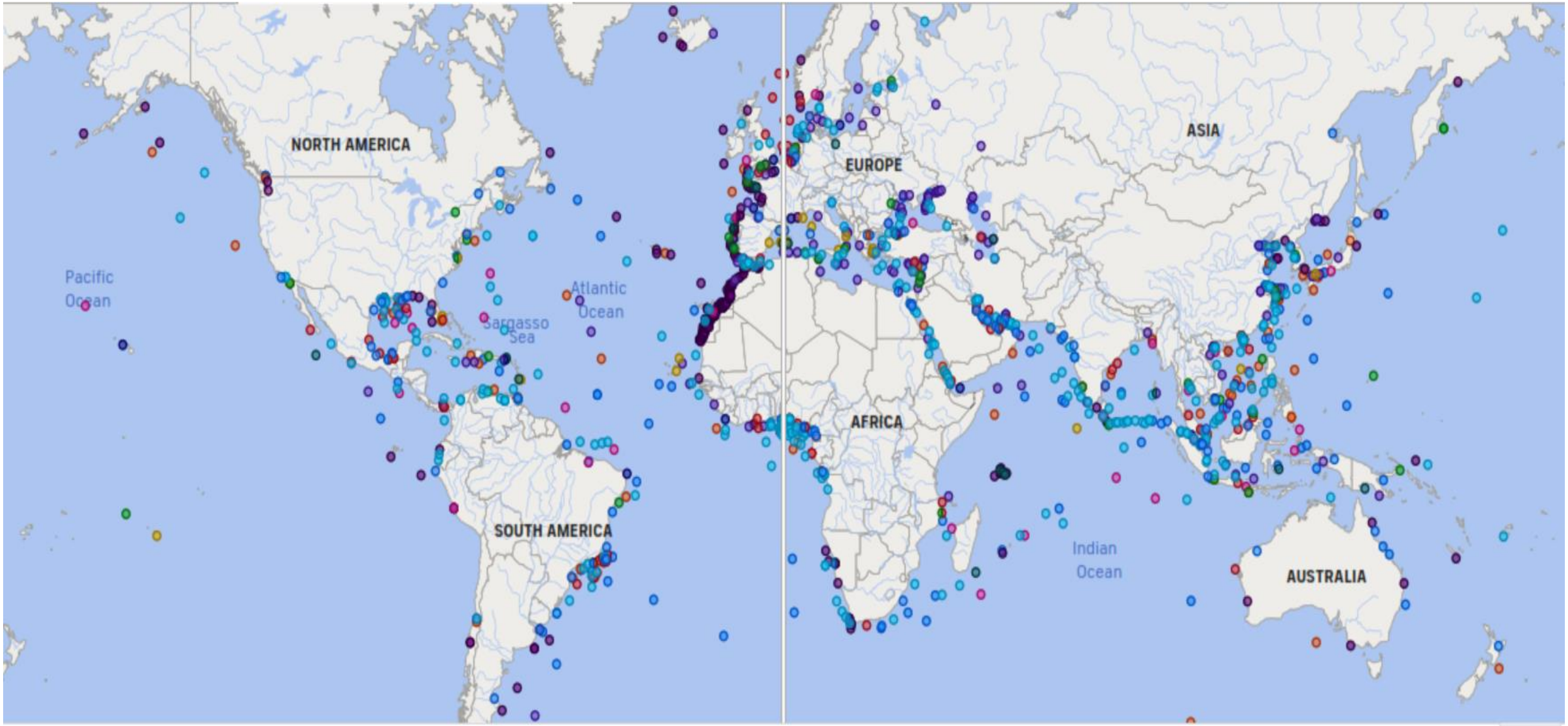
GMDSS Distress Calls Map



Usage in Planned Band 6725-7025 MHz - AP30B Considerations

- In ITU Region 1, **the band 6725-7025 MHz is subject to Appendix 30B of the ITU Radio Regulations**
- This appendix is intended to **guarantee, for all countries, equitable access to the geostationary-satellite orbit in the 6725-7025 MHz band**.
- Therefore, Many **Developing countries Administrations have rights to operate this band over their territory without time limits.**
- **Any deployment of wireless technologies in the 6725-7025 MHz band will need to protect the Appendix 30B national allotments** of all Developing countries.

EXAMPLE:

Country	Allotment code	Nominal orbital position (deg)
Burundi	BDI00000	-3.5
Kenya	KEN00000	78.2
Rwanda	RRW00000	17.6
South Sudan	-	-
Tanzania	TZA00000	67.5
Uganda	UGA00000	31.5

Significantly important for Developing Countries to protect their interest

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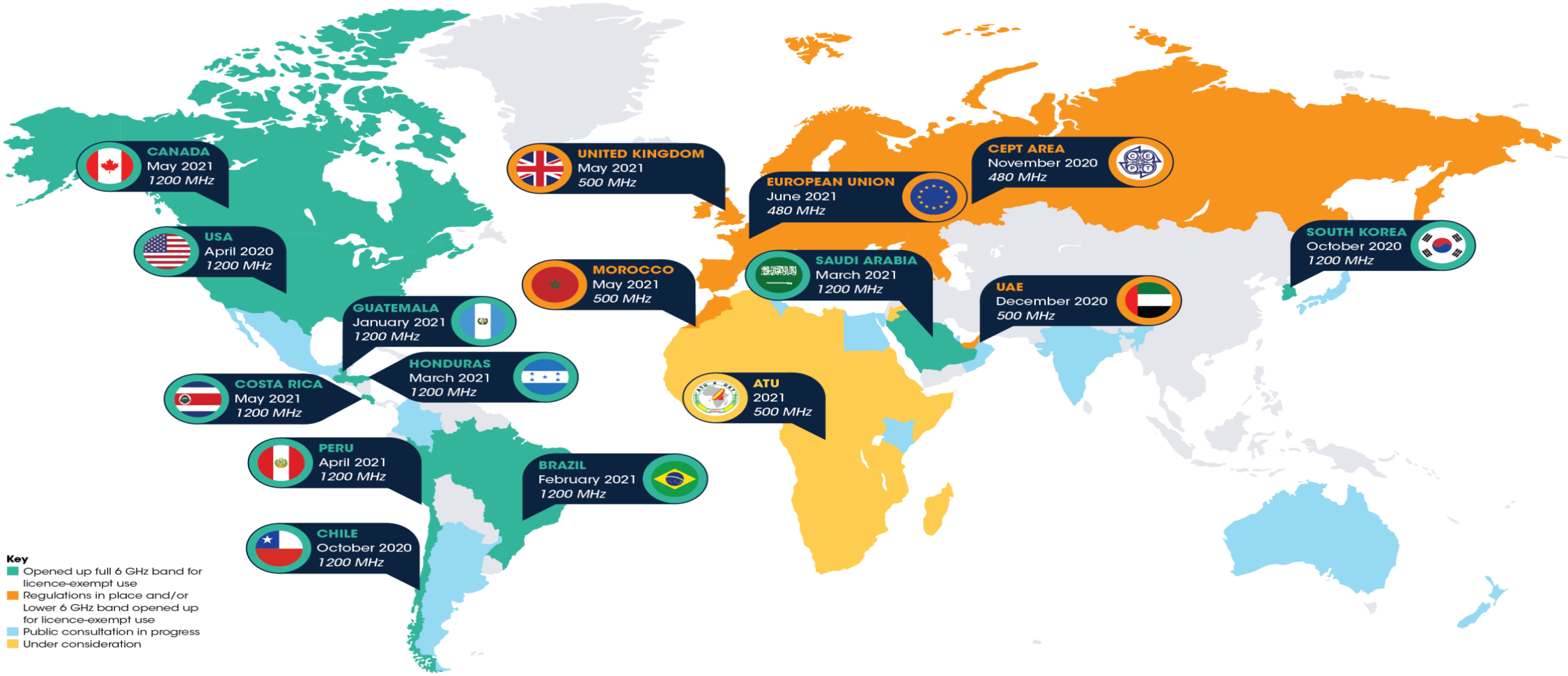
Growth of Wi-Fi / RLANs Considerations



Global 6GHz Wi-Fi Momentum

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Growth of Wi-Fi Generations

	Wi-Fi generations				Future Growth
	Wi-Fi 4	Wi-Fi 5	Wi-Fi 6	Wi-Fi 6E	Wi-Fi 7 (expected)
Launch date	2007	2013	2019	2021	2024
IEEE standard	802.11n	802.11ac	802.11ax		802.11be
Max data rate	1.2 Gbps	3.5 Gbps	9.6 Gbps		46 Gbps
Bands	2.4 GHz and 5 GHz	5 GHz	2.4 GHz and 5 GHz	6 GHz	1–7.25 GHz (including 2.4 GHz, 5 GHz, 6 GHz bands)
Security	WPA 2	WPA 2	WPA 3		WPA3
Channel size	20, 40 MHz	20, 40, 80, 80+80, 160 MHz	20, 40, 80, 80+80, 160 MHz	20, 40, 80, 80+80, 160 MHz	Up to 320 MHz
Modulation	64-QAM OFDM	256-QAM OFDM	1024-QAM OFDMA		4096-QAM OFDMA (with extensions)
MIMO	4x4 MIMO	4x4 MIMO, DL MU-MIMO	8x8 UL/DL MU-MIMO		16x16 MU-MIMO

Source: IEEE, Intel Corporation, Wi-Fi Alliance

1. 1200 MHz to attend growing demand for wireless capacity.
2. Long term vision, planning for Wi-Fi 7 and future spectrum requirements.
3. Meeting increased demand for Internet access considering the COVID-19 situation.
4. Economic benefits even if there are no licensing fees.
5. Global momentum to make the entire 6 GHz band available for unlicensed use.
6. Chipsets and equipment already available (>30 certified devices,1200 MHz band).

Resolution 245 (WRC-19) – AI 1.2 Considerations

Factors for Considerations:

- Examine current utilisation and spectrum already available for Mobile/IMT services and possible future requirements, re-farm existing spectrum, use alternative bands, evolutionary development etc
- National policy and growth of unlicensed band services including Wi-Fi 6 and 7 in 6 GHz bands nationwide (growing need to utilise full 1200 MHz – 5925-7125 MHz – many countries are opting for this includes U.S., Saudi Arabia, Canada, South Korea, Brazil..)
- National/Regional protection of band 6725-7025 MHz that is subject to Appendix 30B of the ITU Radio Regulations. Domestic development of satellite based services including bridging the digital divide particularly among many developing countries.
- National / Regional considerations on provisioning safety services for national emergencies/disasters, maritime and aeronautical services in compliance with IMO & ICAO requirements. National and Regional Rescue Coordination operations (RCC).

Many countries rely heavily on C-band satellite offering vital services which in many cases cannot be reliably provided or provided at all by other means. Given the above factors together with existing ITU-R studies between FSS and IMT, it is evident that sharing is not practical nor feasible in 6 GHz Bands:

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WRC-23 Agenda Item 1.3

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)****;*

Responsible Group: Working Party 5A

Resolution 246 (WRC-19)

Resolves to invite ITU-R

"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 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,"**

Resolves to invite WRC-23

"based on the results of studies in resolves to invite ITU-R, 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,"

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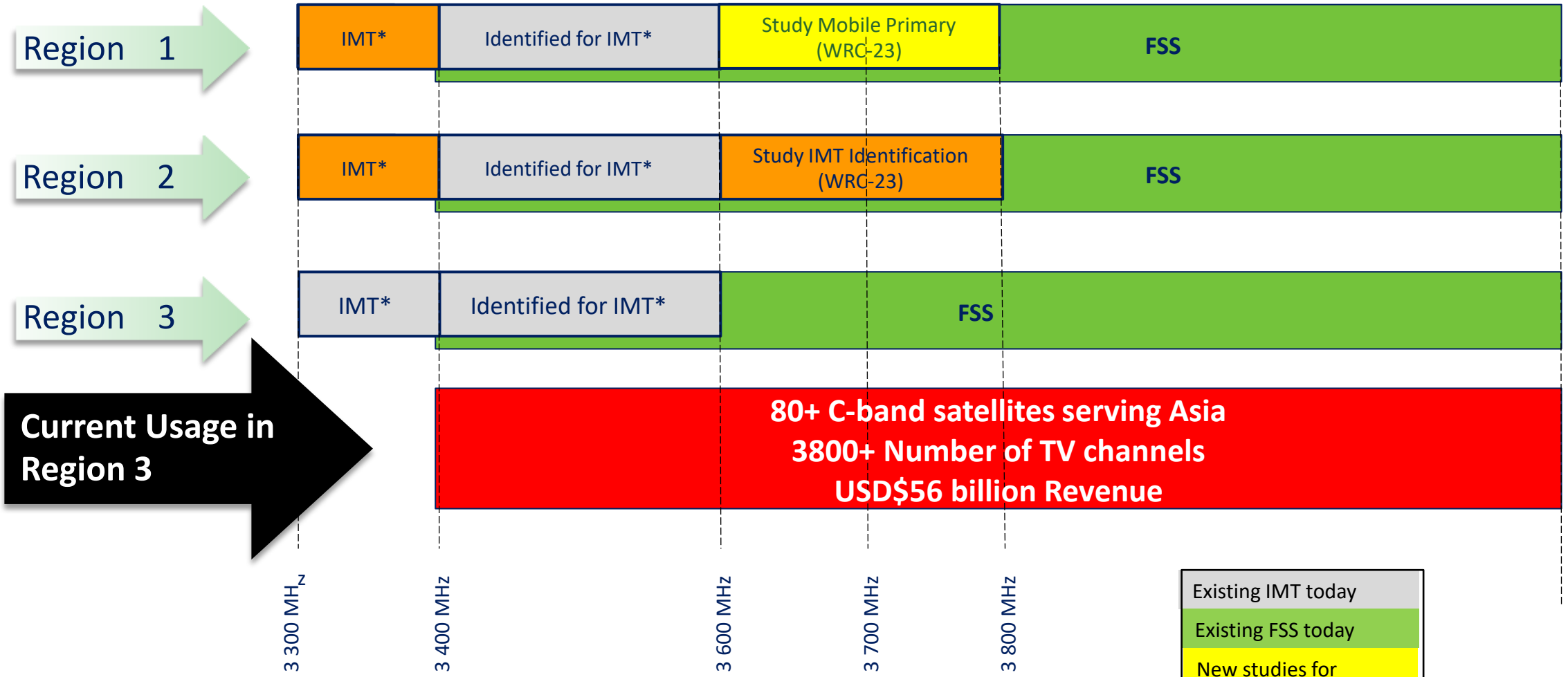
C-Band Status Post WRC-19



*Footnotes 5.429B , 5.429D, 5.429F, 5.430A, 5.431B, 5.432B, 5.433A

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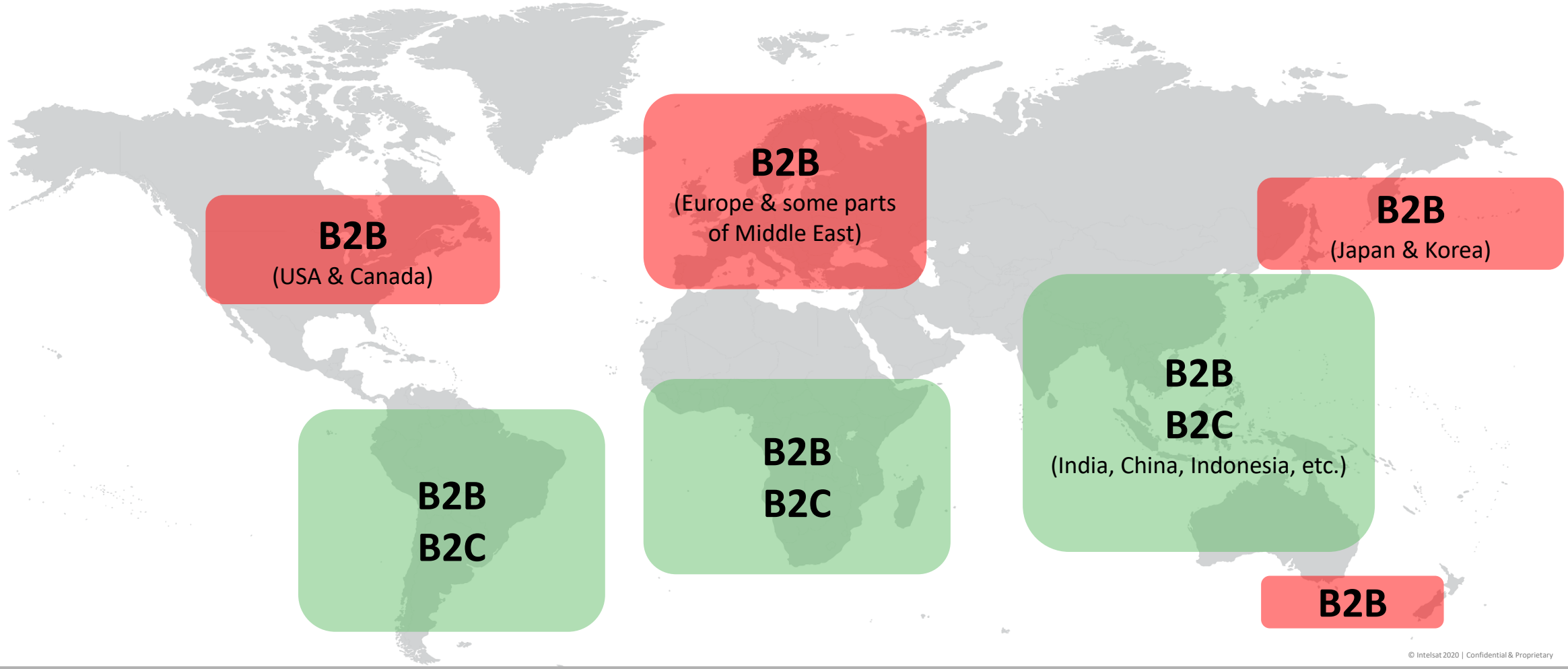
How FSS C-band is used around the world



B2C has thousands of earth stations hence re-farming is not possible as it is for B2B

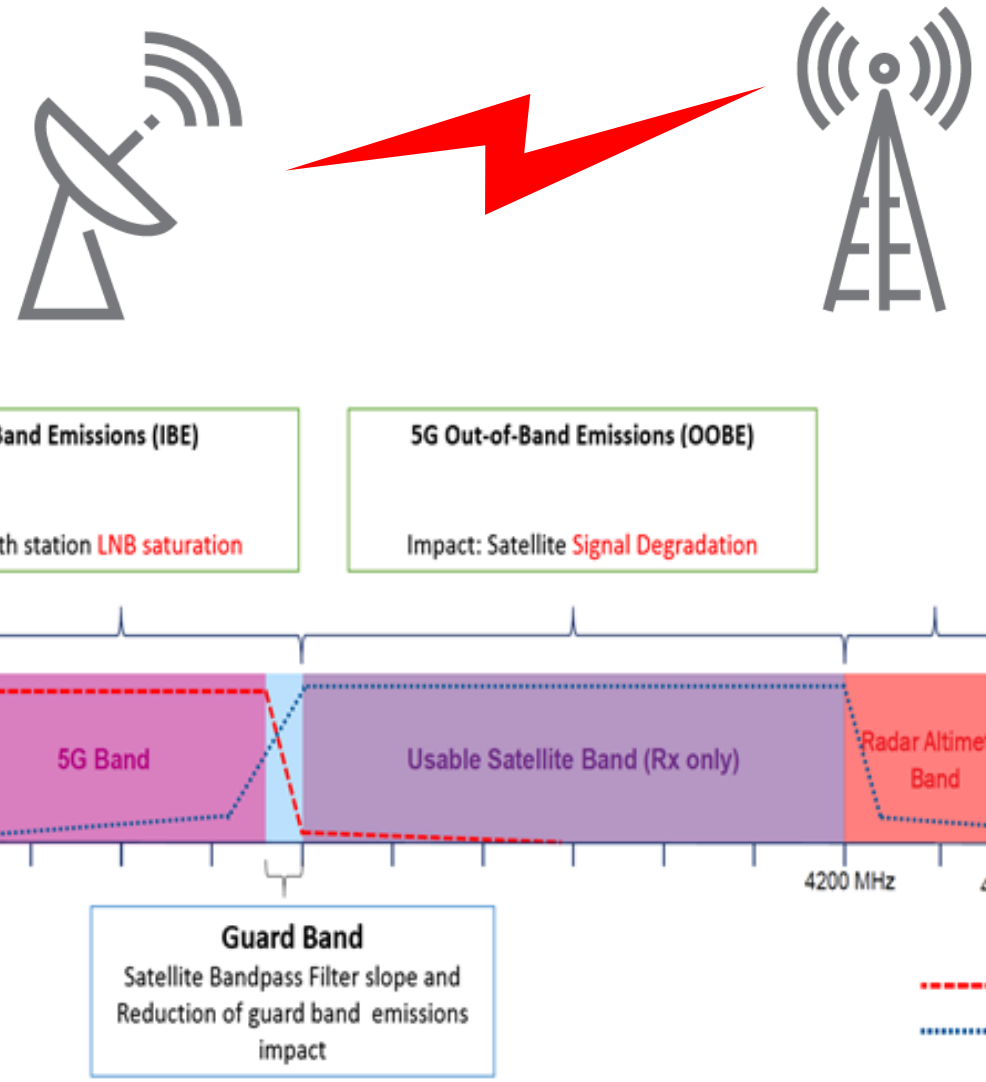
FSS and 5G in adjacent frequency bands

Operations must be carefully managed

- **Satellite earth station** are very **sensitive** to interference

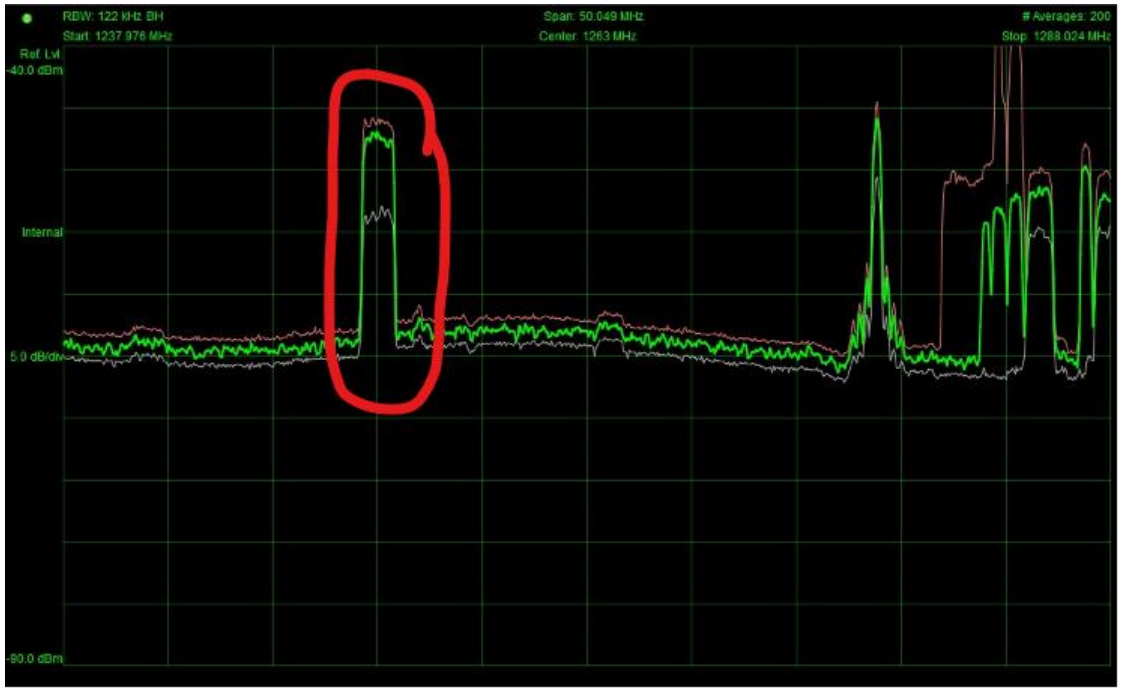
- **5G signals** can **interfere** with FSS receivers in **two ways**:
  - **Saturate the LNB** of the earth station – even when the 5G signal is adjacent to the satellite signal
  - **Out-of-Band-Emissions** (OOBE) of the 5G signal can cause in-band interference to FSS signal

- **Managing interference** from 5G to FSS receiver requires:
  - Earth stations be fitted with **bandpass filter**
  - Impose a **guard band** between the FSS and 5G signal
  - Adopt **OOBE limits** on 5G transmissions

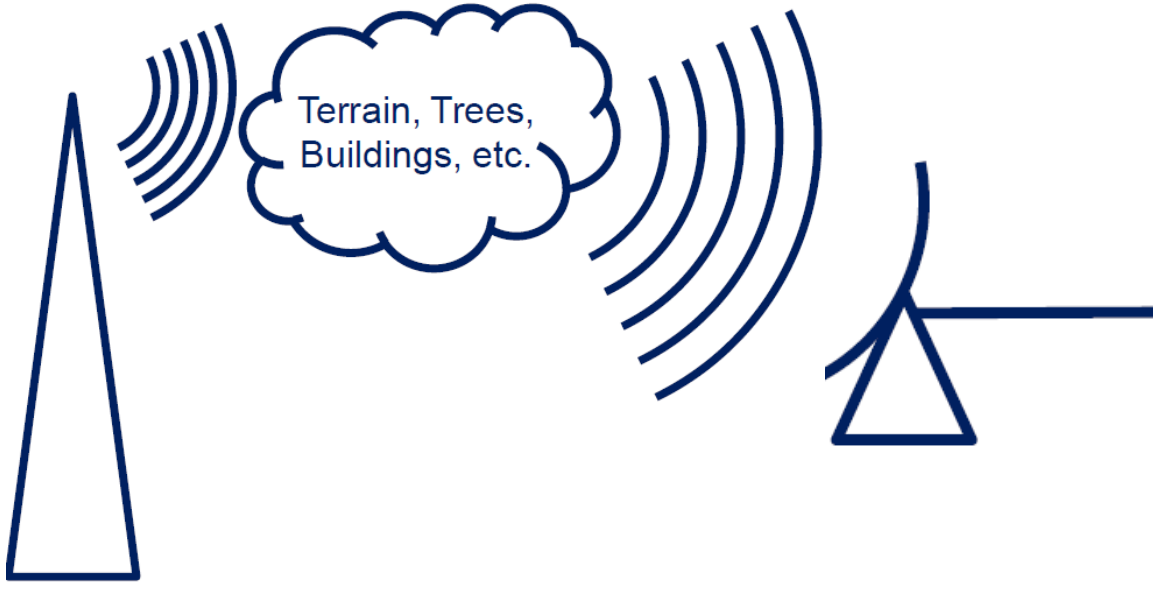


Field Test Measurement Possible OOBE of 5G to FSS (C-Band)

- **Even when 5G and FSS operate in adjacent bands, interference into FSS will occur**



Measures to protect FSS operations



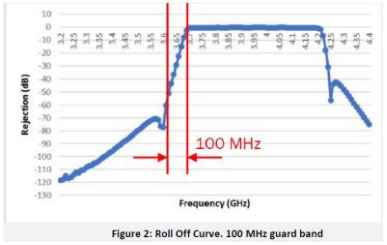


Figure 2: Roll Off Curve. 100 MHz guard band

LNB

Filter (BPF)

Out of Band Emission Limits (OOBE) + **Earth Station Registration** + **Guard Band**

Country	Guard band
Hong Kong	100 MHz
Singapore	50 MHz
Taiwan	44 MHz

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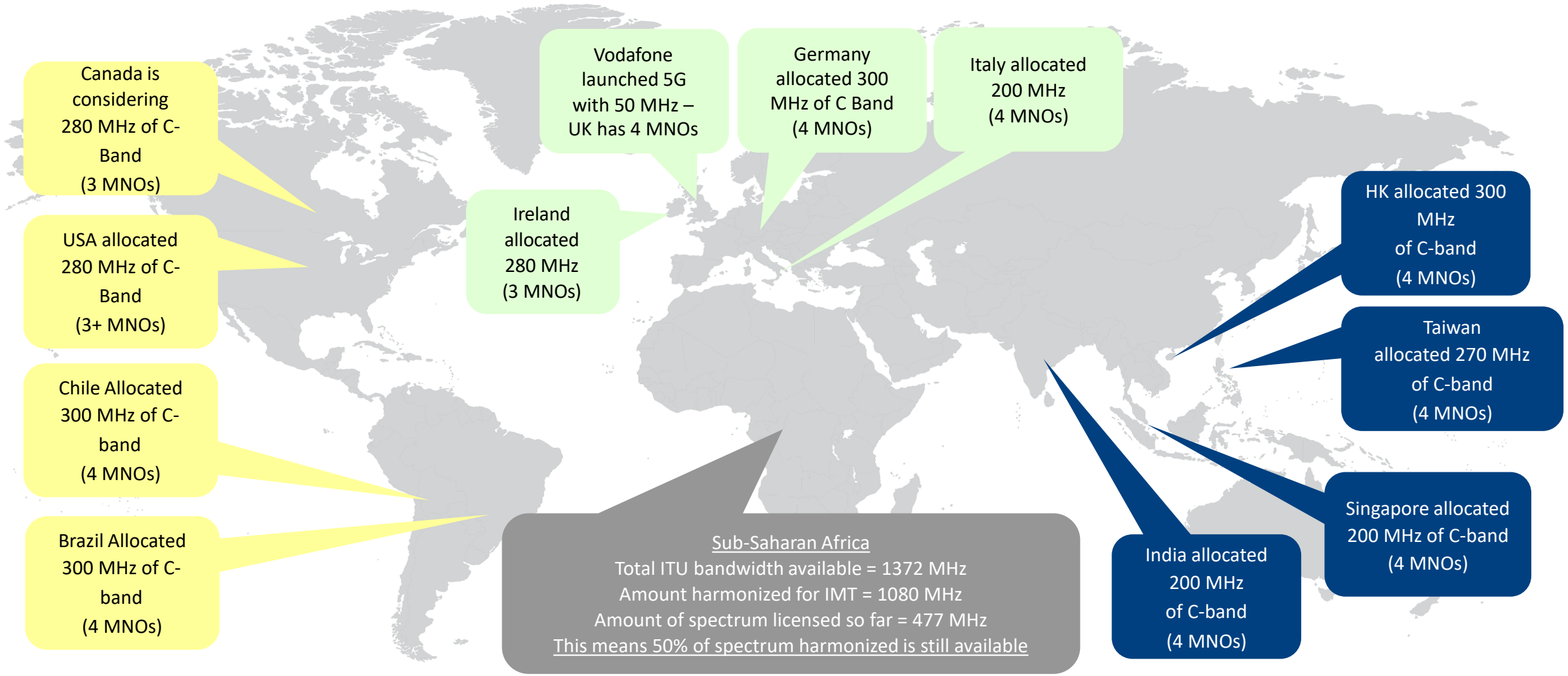
The Myth of 100 MHz-per-MNO



Ofcom study de-bunks the 5G “80-100 MHz per operator” myth – This is supported by real-world cases

Outcome from Initial Studies on 1.3

- Based on the outcome from initial studies, a separation distance of **96-149 km** was required for any FSS earth station in order to co-exist with MS base station. In other words, **there can be no MS deployment within 96-149 km of any FSS earth station.**
- These results are based on interference caused by a single MS BS, impact of full 5G deployment have not been considered. **In reality, the required separation distance would be much larger.**
- Due to sensitivity of FSS receivers resulting in large separation distances, a regulatory framework is required to protect Earth stations close to borders from potential interference from MS in neighboring countries.
- Reality of current and future use of C-band must guide regulators' decisions. **C-band FSS** satellites will continue to provide **critical services** and enable socio-economic growth across societies. **Taking C-band away FSS** now will **harm vital services** that rely on satellites.

AI 1.3: C-band Considerations

C-BAND FSS IS CRITICAL

- **REACH:** covers large geographic areas**,** facilitate intercontinental & global communications
- **ECONOMICS:** 100s of thousands of installed earth stations, over 100+satellites, global reach and distribution efficiency
- **RESILIENCE:** unique propagation and coverage characteristics that cannot be replicated in other bands

BALANCE NEEDS OF STAKEHOLDERS

- **MARKETS:** not take a wholesale approach, each region is different
- **HARMONIZE:** at the extent you can
- **LICENSE**: there is a gap between the spectrum assigned and the one yet to be licensed

OTHER MID- SPECTRUM OPTIONS

- **RE-FARMING:** Re- use 2G and 3G spectrum
- **2.3 GHz & 2.6 GHz:** provides capacity & coverage
- **3.4-3.6 GHz:** spectrum can be shared between MNOs

TECHNICAL CONSIDERATIONS

- **IDENTIFY:** know where the earth stations are.
- **Filters:** All earth stations must be fitted with bandpass filters.
- **Guard band:** Needed for the filter to work.
- **OOBE**: Impose strict OOBE limits on 5G

C-band is irreplaceable and not substitutable

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WRC-23 Topic 9.1 Topic c

Topic 9.1 c) *Study the use of International Mobile Telecommunication system for fixed wireless broadband in the frequency bands allocated to the fixed services on primary basis, in accordance with Resolution **175 (WRC-19)**;*

Responsible Groups: Working Parties 5A and 5C

Resolution 175 (WRC-19)

"c) that the ITU-R Handbook on "Fixed Wireless Access" addressed the use of International Mobile Telecommunication (IMT) systems for Fixed Wireless Access, and **Recommendation ITU-R M.819** contains specific requirements pertaining to fixed wireless access,"

resolves to invite ITU-R

"**to conduct any necessary studies on the use of International Mobile Telecommunication systems for fixed wireless broadband in the frequency bands allocated to the fixed service on primary basis, taking into account the relevant ITU-R studies, Handbooks, Recommendations and Reports,"**

WRC-23 9.1 Topic c – ESOA View

1. Ensure that the **results of studies under this Topic should only be reflected in the Report of the Director of the Radiocommunication Bureau** and **lead to possible updates of existing ITU-R publications**, e.g. Handbook on Land Mobile, Volume 1: Fixed Wireless Access and relevant Recommendations of ITU-R F-Series. There is currently no proof that a separate stand-alone report or working document to address this topic would be required.
2. Updates to existing ITU-R Handbooks, Reports and Recommendations should not facilitate the use of IMT in fixed service (FS) bands shared with FSS.
3. In line with guidelines of CPM23-1 (CA/251), **only a short summary of the results for Chapter 5 of the CPM Report should be developed under this topic**, there should be no related Methods and Regulatory or Procedural considerations – nor any changes to the Radio Regulations proposed.
4. Considering existing provisions of the Radio Regulations and technology neutrality, there is no need to consider specific frequency bands under this topic. Consequently, there is no need for future agenda item for WRC-27 on FWA in FS bands.
5. As agreed in the **first joint session of WPs 5A & 5C, the scope of the studies should be IMT technologies used for FWA**, not the development of Mobile Systems in the FS. Using IMT systems in the FS is not compliant with the Radio Regulations definition **No. 1.20** “fixed service: A radiocommunication service between specified fixed points.”
6. Any activities on FWA, regardless of technology considered, should be addressed by ITU-R WPs 5A & 5C, not by ITU-R WP 5D.
7. **Furthermore, use of any technology in the FS should operate under the existing regulatory framework of the FS and ensure the protection of other services, including FSS satellite networks.**

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Agenda Item 9 Article 21 @ WRC-23 Agenda”

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Agenda Item 9 Article 21
(RR21.5 and IMT stations WRC-19 doc. 550)

RR21.5 and IMT stations *"ITU-R is invited to study, as a matter of urgency, the applicability of the limit specified in No. **21.5** of the Radio Regulations to IMT stations, that use an antenna that consists of an array of active elements, with a view to recommend ways for its possible replacement or revision for such stations, as well as any necessary updates to Table **21-2** related to terrestrial and space services sharing frequency bands. Furthermore, the ITU-R is invited to study, as a matter of urgency, verification of No. **21.5** regarding the notification of IMT stations that use an antenna that consists of an array of active elements, as appropriate." **(WRC-19 doc. 550)**;*

Responsible Group: Working Party 5D

Background

1. The matter which was raised in the context of WRC-19 AI1.13 is the applicability of RR21.5 limit **to mobile/fixed stations (including IMT stations) and the update of Table 21-2).** Some may interpret the application of these limits to array type IMT stations in such a way that it would allow a significant increase in the power radiated towards the GSO arc.
2. **Power limits of Article 21 are intended to protect satellite receivers from interference of terrestrial stations, by limiting the aggregate interference from fixed/mobile stations (including IMT stations) in a space receivers**.
3. **These limits use the parameter "power delivered by a transmitter to the antenna", which leads to some ambiguity when applying the limits to antennas that use an array of active antennas.**
4. If the RR21.5 limit (+10 dBW) were to be applied to each radiating element, that would allow IMT base station radiated power 35 dB higher than was assumed in the ITU-R studies, which would significantly exceed the satellite protection criteria.
5. It may be noted that AAS antennas are being considered for use in mobile systems operating in bands which are not identified for IMT and are being considered for use in fixed service systems.
6. **This ambiguity in application of RR No. 21.5 should be addressed and consequently there is a need to clarify the application of Article 21 to AAS antennas for stations in the fixed or mobile service including IMT stations.**

RR21.5 and IMT stations (WRC-19 doc. 550)

ESOA position:

1. **RR21.5 power limits should apply to all stations (whether with passive or active antennas) in the fixed or mobile service including IMT stations** consistently with the intention of the provision to protect satellite reception, in frequency bands for reception by space stations where the frequency bands are shared with equal rights with the fixed or mobile services.

2. ESOA **supports the application of Article 21 to AAS antennas for stations in the fixed or mobile service including IMT stations through confirmation of the RR21.5 limit of 10dBW using the Total Radiated Power (TRP) of the antenna, (with a reference bandwidth of 200MHz (as per WRC-19 studies).**

3. ESOA also **supports an update of Table 21-2 to include frequency bands for reception by space stations** (Earth-to-space) where the frequency bands are shared with equal rights with the fixed or mobile services (including for IMT stations) and not yet included in Table **21-2**.

4. ESOA has reviewed the RR 2020 edition and identified, at this stage, the following frequency bands that should be added to Table 21-2:
   - FSS allocations in 24.65-25.25 GHz (Region 1), 24.75-25.25 GHz (Region 2), 42.5-43.5 GHz, 47.2-50.2 GHz, 50.4-51.4 GHz and 81-86 GHz.
   - MSS allocations in 43.5-47 GHz, 66-71 GHz, and 81-84 GHz.
   - ISS allocations in [AA-BB, CC-DD] GHz

While there are bands above 86 GHz that may also need to be added to Table 21-2, it seems premature to add those bands at this time, without a more detailed evaluation. The following Note could be added to Table 21-2: *The frequency bands above 86 GHz are not currently addressed in Table 21-2, but may be considered for addition by a future competent World Radiocommunication Conference*".

ESOA
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Thank you
Questions

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