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Caribbean Telecommunications Union

Shaping Caribbean Telecommunications

Creating New Frontiers in Global Communications

Meeting of the Caribbean Spectrum Management Task Force

Caribbean Telecommunications Union

Port of Spain, Trinidad and Tobago, 18-19 July 2019

Omnispace Overview

Global Mobile Connectivity

Global Hybrid NGSO Platform

- Global hybrid system operating in 2 GHz band
- Non-geostationary MEO MSS network with intermittent global coverage
- Hybrid architecture with CGC network
- Cost-effective coverage and scalable capacity for MSS, emergency services, IoT, connected car, public safety, and security

Operational NGSO Today Next Generation Planned

- Acquired US$ 1B+ of ICO Global's NGSO satellite assets
- Only operational global 2 GHz NGSO satellite network
- Global non-continuous coverage with on-orbit F2 satellite and international gateways
- Planned investment of US$ 1B+ in next generation NGSO satellite platform

Key Spectrum and Regulatory Milestones Achieved

- Priority ITU filings for service links (2 GHz) and feeder links (5/7 GHz) have been brought into use
- 2 GHz standardized in several band classes at 3GPP to support CGC
- Regulatory / licensing underway in markets in the Caribbean, Latin America, Asia, Africa

World Class Team, Investors and Partners

- Seasoned management team that has successfully built telecom / satcom systems
- World class investors Columbia Capital, Telcom Ventures, Greenspring, and Intelsat
- Global strategic partnership with Intelsat, world's largest satellite operator

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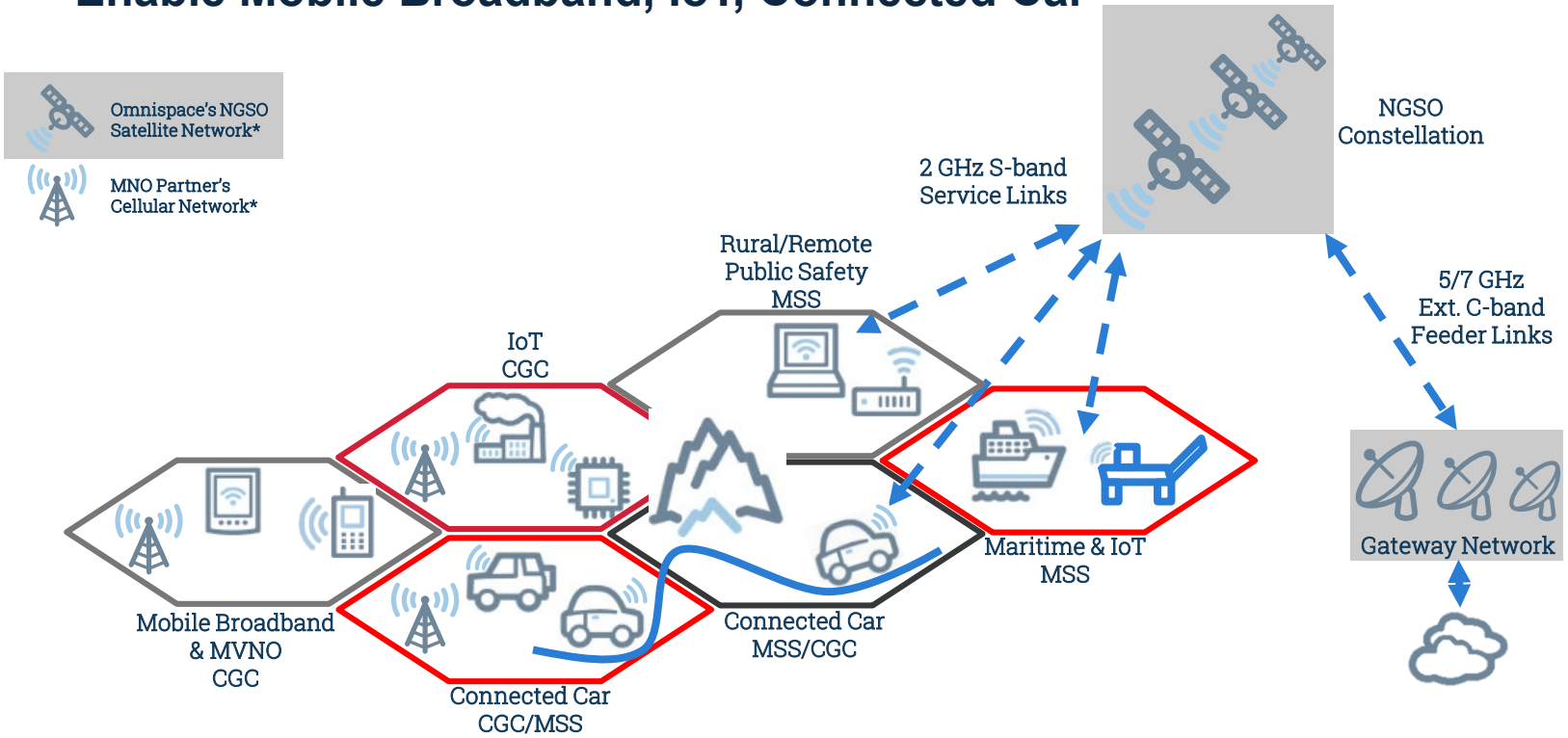
Hybrid Mobile Platform: Global Coverage and Scalable Capacity to Enable Mobile Broadband, IoT, Connected Car



*Omnispace's NGSO satellite network delivers mobile satellite service (MSS) and operates in conjunction with a complementary ground component (CGC), on a MNO partner's cellular network that uses 2 GHz spectrum leased from and managed by Omnispace.

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WRC-19 Agenda Item 9.1.1

- Agenda Item (AI) 9.1.1: Technical and operational measures to ensure coexistence and compatibility between the terrestrial component of IMT and the satellite component of IMT (in the mobile service and the mobile-satellite service) in the frequency bands 1980-2010 MHz and 2170-2200 MHz in different countries

- As noted in Resolution 212 (Rev. WRC-15), the availability of the satellite component of IMT simultaneously with the terrestrial component of IMT would improve the overall implementation and the attractiveness of IMT

- To achieve compatibility and enable the development of both the terrestrial and satellite components of IMT, both services must use the frequency band 1980-2010 MHz as an uplink as indicated in View 1 of the CPM Report
  - Validated by a diverse and congruent body of technical evidence consisting of theoretical analysis, computer simulation, and empirical measurements
  - Supported by CEPT, RCC, China, Papua New Guinea, Inmarsat, Intelsat, Omnispace, and others

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ITU Allocations in the S-Band

- The fixed, mobile, and mobile-satellite services (MSS) are **co-primary** services
  - 1980-2010 MHz/2170-2200 MHz in all regions
  - 2010-2025 MHz in Region 2 (R2)
- Both geostationary (GSO) and non-GSO MSS systems have been brought into use, while deployment of terrestrial IMT is just beginning
- Many countries in the Caribbean and Region 2 use the 1980-1990 MHz band for mobile downlinks in the Personal Communications Service (PCS), making it unusable for MSS uplinks (see 5.389B)
- Continued deployment of IMT terrestrial mobile downlinks such as what has occurred in Region 2 will effectively phase out the co-primary status of MSS
- WRC-19 agenda item 9.1.1 is the opportunity to establish a regulatory framework to ensure co-existence between the mobile and mobile-satellite services on a global basis and in the remainder of the S-band in Region 2

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 980-2 010	FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 5.351A 5.388 5.389A 5.389B 5.389F	
2 010-2 025 FIXED MOBILE 5.388A 5.388B 5.388	**2 010-2 025** FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 5.388 5.389C 5.389E	**2 010-2 025** FIXED MOBILE 5.388A 5.388B 5.388
....		
2 170-2 200	FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A 5.388 5.389A 5.389F	

5.388 The frequency bands 1 885-2 025 MHz and 2 110-2 200 MHz are intended for use, on a worldwide basis, by administrations wishing to implement International Mobile Telecommunications (IMT). Such use does not preclude the use of these frequency bands by other services to which they are allocated. The frequency bands should be made available for IMT in accordance with Resolution **212 (Rev.WRC-15)** (see also Resolution **223 (Rev.WRC-15)**). (WRC-15)

5.389B The use of the band 1 980-1 990 MHz by the mobile-satellite service shall not cause harmful interference to or constrain the development of the fixed and mobile services in Argentina, Brazil, Canada, Chile, Ecuador, the United States, Honduras, Jamaica, Mexico, Peru, Suriname, Trinidad and Tobago, Uruguay and Venezuela.

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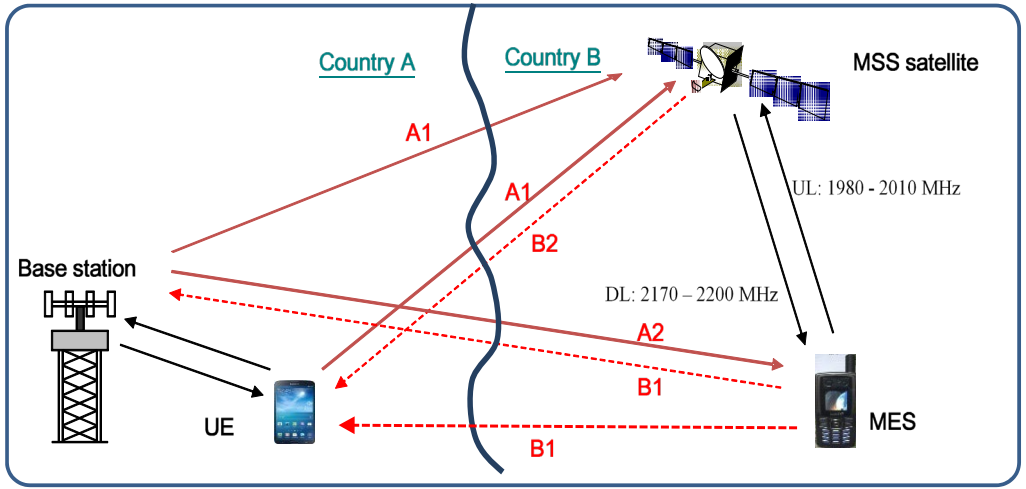
Interference scenarios studied at the ITU-R under AI 9.1.1

Scenario	From	To
A1	Terrestrial IMT base station or mobile station	Satellite IMT space station
A2	Terrestrial IMT base station	Satellite IMT MES
B1	Satellite IMT MES	Terrestrial IMT base station or UE
B2	Satellite IMT space station	Terrestrial IMT UE



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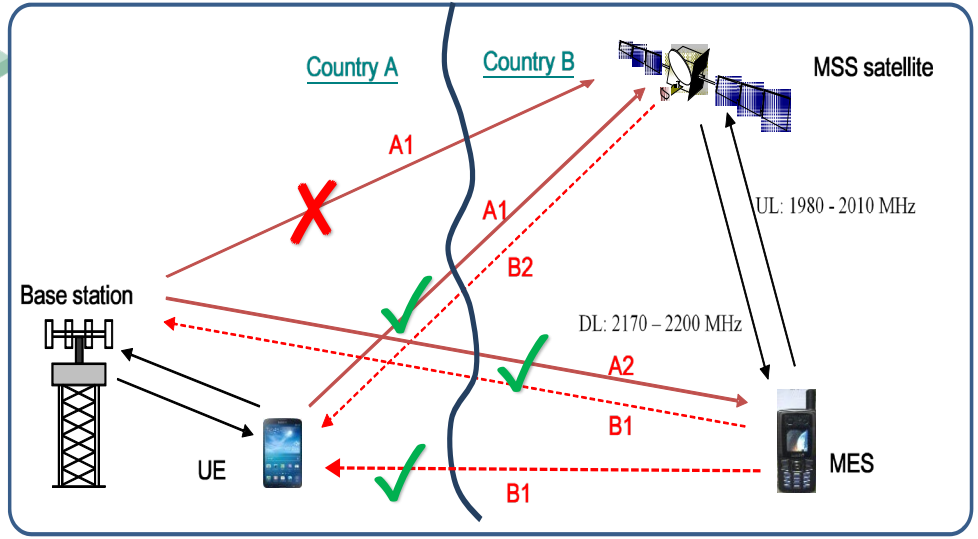
Interference scenarios studied by ITU-R and reported to CPM



- **Scenario A1 (from WP 4C and 5D PDNR – Doc. 5D/TEMP/695(Rev.1)):**
  - Terrestrial downlink (DL): Interference from IMT base stations (BS) into IMT space stations uplinks (UL) is high and exceeds the MSS protection criterion by up to 52 dB (160,000 times the noise floor)
  - Terrestrial Uplink (UL): Interference from IMT user equipment (UE) is low and can be mitigated

Coordination Procedures in the Radio Regulations:

- ✗ A1: None
- ✓ A2: RR Nos. 9.16, 9.17, 9.18
- ✓ B1: RR Nos. 9.15, 9.17
- ✓ B2: RR No. 9.14

There is no ITU coordination procedure to address Scenario A1 DL interference, which is far more than an adjacent country issue (as far as 10,000 km from the source).

Some IMT satellite systems are already experiencing Scenario A1 interference in the lower part of the MSS uplink band from transmitting base stations in R2

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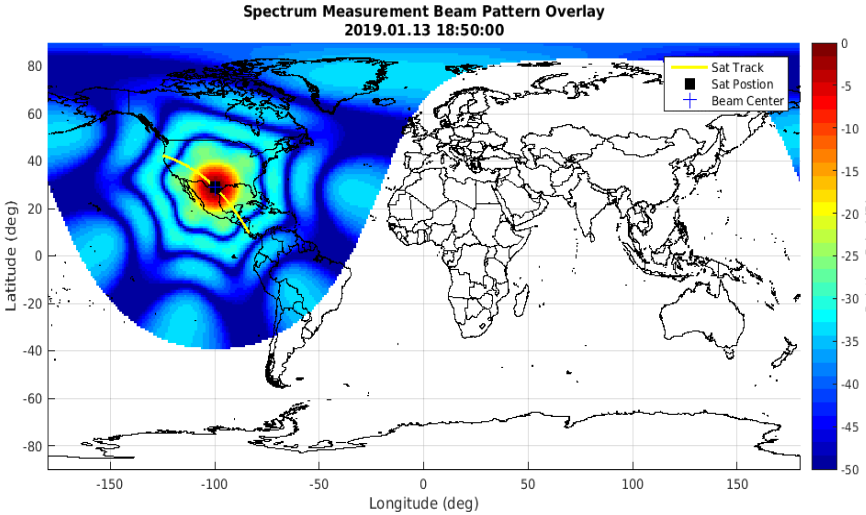
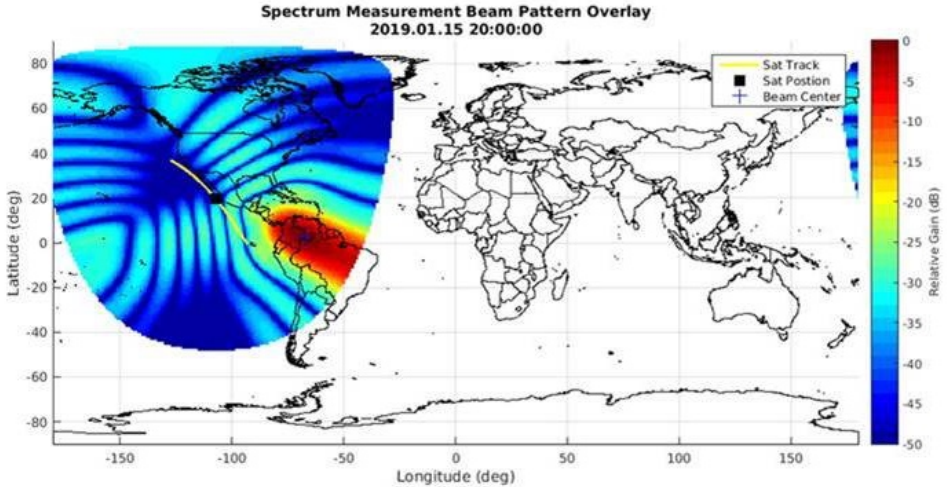
Interference measurements with Omnispace's F2 IMT/MSS Satellite

Diagrams below show antenna patterns for two beams

Nadir Beam over the US/Mexico Border



Tracked Beam Receiving along the Colombian-Venezuelan Border



The measurements performed by Omnispace, from December 2018 to January 2019, of the terrestrial emissions to the operating satellite that were presented to the ITU and to the CPM in Document CPM19-2/148 and to CITEL in Document 4890 confirm the theoretical studies conducted in ITU-R Working Parties 4C and 5D

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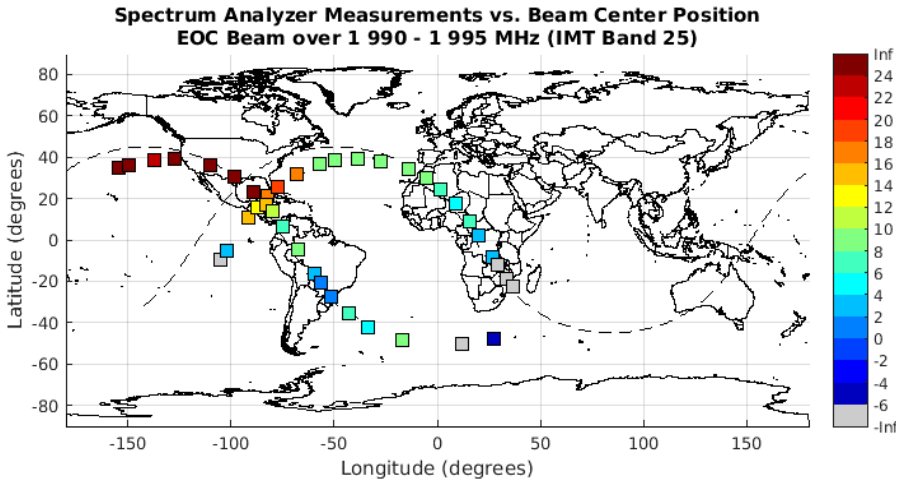
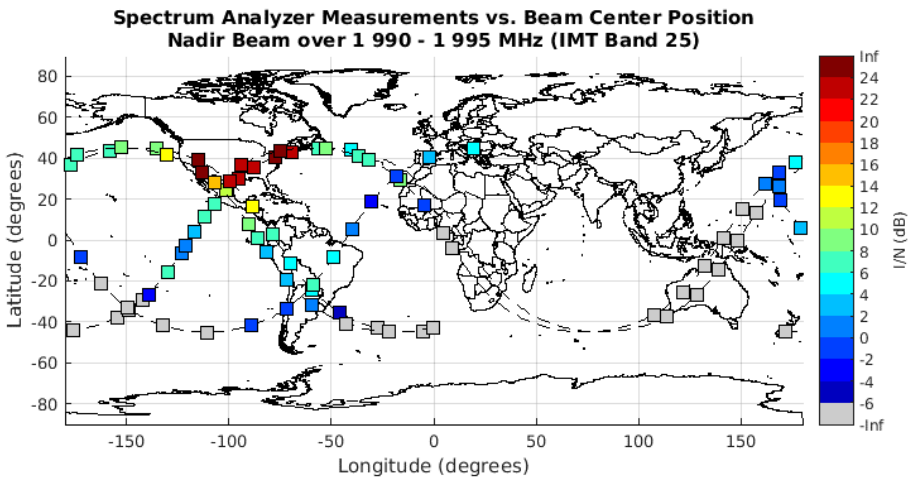
Interference measurements with Omnispace's F2 IMT/MSS Satellite

Diagrams below show a summary of the interference measurements in the band 1990-1995 MHz (featuring terrestrial IMT downlinks predominantly from one country in Region 2)

Recorded by global edge of coverage uplink receive beam



Recorded by global sweep nadir uplink receive beam



- Measurements performed by Omnispace, from December 2018 to January 2019, of the terrestrial emissions to the operating satellite have been presented to the ITU WP4C in Document WP4C-0230 and WP5D in Document WP5D-0722, as well as to CPM in Document CPM19-2/148
- Measurements confirm the theoretical studies conducted in ITU-R Working Parties 4C and 5D
- Interference is detectable as far as Southern Africa

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CPM Report: Views on Agenda Item 9.1.1

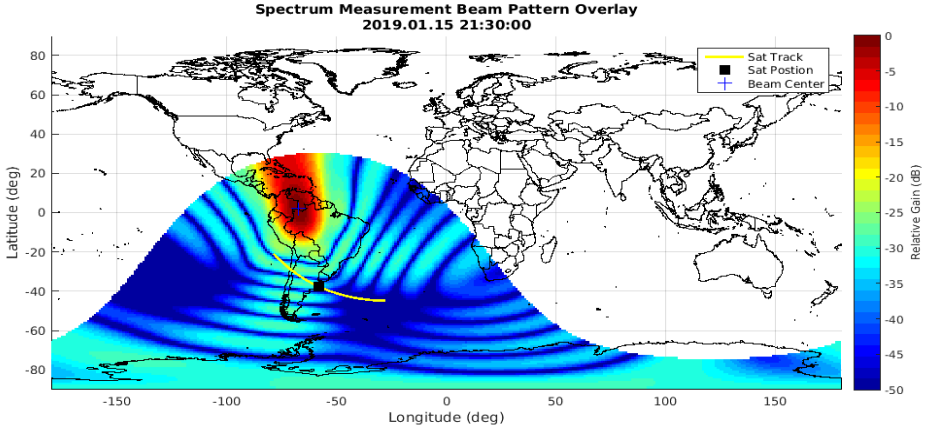
View 1

- Consider the problem of interference to be serious enough to require action at WRC-19
- Agree that the use of the MSS uplink band 1980-2010 MHz for terrestrial IMT downlink poses existential implications for satellite IMT
- Recognize that interference occurs in widely spaced geographical areas and is not limited to adjacent countries
- Acknowledge that while some ITU coordination procedures exist, there is no ITU coordination procedure to address interference from IMT base stations (BS) into IMT space station uplinks (Scenario A1)

View 2

- Consider that the scope of the agenda item is limited to study of possible technical and operational measures
- Argue that regulatory changes are outside the scope of the agenda item despite proof of interference in ITU-R studies
- Cast doubt on the results of ITU-R studies and the analysis of interference to non-adjacent countries
- Claim that bilateral/multilateral discussions are sufficient to ensure coexistence and compatibility between the terrestrial and satellite components of IMT

The WRC-19 Solution for Scenario A1



Issue: The use of the MSS uplink band 1980-2010 MHz for terrestrial IMT downlink poses existential implications for satellite IMT

- Not only for neighbouring countries, but up to 10,000 km from the nearest interference
- No ITU coordination procedure

Solution:

- **Both services use the frequency band 1980-2010 MHz as an uplink**
- **This can be achieved by modifying the Radio Regulations or Resolution 212 to:**
  - Establish an e.i.r.p. limit with the value 20 dBm/5 MHz on IMT terrestrial station
  - Based on 23 dBm maximum user terminal transmit power and -3 dBi antenna gain (see Report ITU-R M.2292 and 3GPP TS 25.101) in order to enable full use of the band by user terminals
- **In either case, an exception for the frequency band 1980-1990 MHz in Region 2 is needed due to existing PCS use as a terrestrial downlink**

Goal: The simultaneous availability of the satellite and terrestrial components of IMT to promote efficient use of the 2 GHz band

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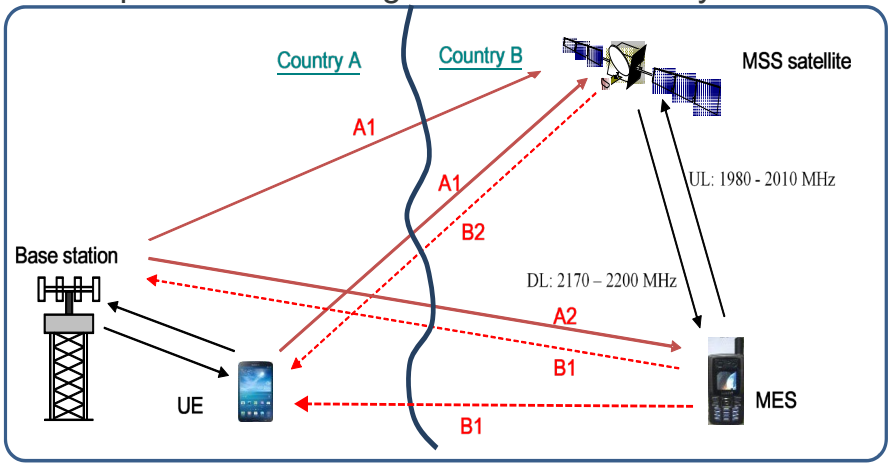
Other AI 9.1.1 Interference Scenarios

- Scenario A2: Potential interference in the 2170-2200 MHz band can be addressed by the current ITU RR coordination provisions in Nos. 9.16, 9.17, and 9.18

- Scenario B1: Potential interference in the 1980-2010 MHz band can be addressed by the current coordination provisions in Nos. 9.15 and 9.17
  - MODs to Appendix 7 are desirable to add parameters for digital terrestrial IMT systems



- Scenario B2: Potential interference in the frequency band 2170-2200 MHz is addressed by the pfd coordination threshold in Table 5-2 of Appendix 5
  - Since Table 5-2 coordination thresholds do not apply to IMT terrestrial systems, MODs are needed to add a pfd threshold to protect IMT terrestrial systems of -108.8 dB(W/m^2) in 1 MHz
  - -108.8 dB(W/m^2) in 1 MHz is based on the threshold interference level of -171 dBm/Hz (applicable for I/N of -6 dB) and takes into account the UE antenna gain of -3 dBi and a body loss of 1 dB (see PDNR – Doc. 5D/TEMP/695(Rev.1))
  - Using -108.8 dB(W/m^2) in 1 MHz as a trigger provides a rational basis for coordination with IMT whereas simply extending the trigger of -128 dB(W/m^2) for GSO and -123 dB(W/m^2) for non-GSOs to IMT would result in unnecessary coordination

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Why View 1?

Resolve a problem

Improve the Radio Regulations by adopting an e.i.r.p. limit to address the scenario A1 downlink interference, which is far more than an adjacent country issue

Ensure co-existence of both terrestrial and satellite IMT and their long term development

Inaction will unintentionally favor one primary service over the other due to interference and could make the 1980-2010 MHz uplink band for MSS unusable around the world

Provide certainty to administrations, irrespective of their chosen use of the band

Continue to benefit from the advantages of a hybrid platform

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What WRC-19 actions are needed on Agenda Item 9.1.1?

Scenario A1

Modify Resolution 212 to establish an e.i.r.p. limit with the value 20 dBm/5 MHz on land stations in the mobile service

Scenario A2 and B1

Modify Appendix 7 of the Radio Regulations to add parameters for digital terrestrial IMT systems (only analogue parameters currently exist)

Scenario B2

Modify Table 5-2 of Appendix 5 of the Radio Regulations to establish a pfd threshold to protect IMT terrestrial systems of -108.8 dB(W/m^2) in 1 MHz (none currently exists)

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Inter-American Proposals (IAP)

OAS | CITEL

- **34th Meeting of PCC.II**: August 12-16, 2019 in Ottawa, Canada
- Draft IAP is based on original US proposal:
  - 6 countries supported NOC Volumes 1 and 2 of the Radio Regulations
  - 2 countries supported MOD Resolution 212
- New US proposal to Monterey meeting proposed suppressing Resolution 212
  - Status of this proposal is unclear

- Taking no action at WRC-19 to prevent terrestrial DL in the MSS UL band 1980-2010 MHz poses an existential threat to the MSS
- Deleting/diluting Resolution 212 removes the underlying recognition of the importance of both services and is inconsistent with No. 5.388, which states "The frequency bands should be made available for IMT in accordance with Resolution **212 (Rev.WRC-15)**"
- Amending Resolution 212 to protect MSS uplinks from terrestrial downlink interference is consistent with DIAP NOC for Volumes 1 and 2
- The solution is for WRC-19 to take action to ensure both services use the frequency band 1980-2010 MHz (1990-2010 MHz in Region 2) as an uplink

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Thank you

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