



WRC-15

Key Results

World Radiocommunication Conference

WHY #WRC15 IS IMPORTANT?

- The World Radiocommunication Conference (WRC) is mandated to review the **Radio Regulations**, the international treaty governing the use of the radio-frequency spectrum and satellite orbit resources

WHY #WRC15 IS IMPORTANT?

- Radio spectrum plays a key role in most of today's technology (4G, Wi-Fi, Satellite, TV)
- Spectrum is a limited global resource and must be managed properly to ensure that all services and applications work in harmony
- In an era of rapid changes, there is a need for regular meetings between all nations to ensure that the international regulations on the use of spectrum are updated and improved uniformly

WHY #WRC15 IS IMPORTANT?

- Additional spectrum for the use of mobile broadband
- Ensure suitable spectrum for new developments in satellite communications, Unmanned Aircraft Systems, or drones, Earth exploration, emergency services or automotive radars
- Agreement on the allocation of radio-frequency spectrum for global flight tracking in civil aviation

WHY #WRC15 IS IMPORTANT?

- The new treaty which will result from the conference decisions. Consensus ensures that decisions are not challenged once adopted
- Build a sustainable ecosystem which enables new developments and investments in radiocommunications, while avoiding disruptions to the services provided to billions to users around the world.

General Information

- The conference was opened on the 2nd of November. Mr Festus Daudu for Nigeria has been elected as Chairman.
- Number of announced participants: 3800, 162 Member States, Sector members, Observers
- Documents submitted before WRC-15: 667, which include 2700 proposals

General Information

- Chairman of the Conference:
 - Mr Festus Yusufu Narai Daudu (Nigeria)
- Vice-Chairmen of the Conference:
 - Mr A. Jamieson (New Zealand)
 - Mr Y. Al-Bulushi (Oman)
 - Mr D. Obam (Kenya)
 - Mrs D. Tomimura (Brazil)
 - Mr A. Kühn (Germany)
 - Mr N. Nikiforov (Russian Federation)

General Information

- Committee 1: Steering Committee
- Committee 2: Credentials Committee
- Committee 3: Budget Control Committee
- Committee 4, 5 and 6: Specified Agenda Items Committees
- Committee 7: Editorial Committee

Committee 4 (mainly terrestrial issues)

- Working Group 4A (Aeronautical and Radiolocation)
 - Sub-Working Group to deal with Agenda item 1.5 (SWG 4A1 a.i. 1.5)
 - Sub-Working Group to deal with Agenda item 1.17 (SWG 4A2 a.i. 1.17)
 - Sub-Working Group to deal with Agenda item 1.18 (SWG 4A3 a.i. 1.18)
 - Sub-Working Group to deal with Agenda item on Global Flight Tracking (GFT) (SWG 4A4 - GFT)
- Working Group 4B (Maritime and Amateur)
 - Sub-Working Group to deal with Agenda item 1.4 (SWG 4B1 a.i. 1.4)
 - Sub-Working Group to deal with Agenda item 1.16 (SWG 4B2 a.i. 1.16)
 - Agenda item 1.15 (to consider spectrum demands for on-board communication stations in the maritime mobile service in accordance with Resolution 358 (WRC 12) will be treated directly at the working group level.
- Working Group 4C (Mobile and PPDR)
 - Sub-Working Group to deal with agenda item 1.1 (SWG 4C1 a.i. 1.1)
 - Sub-Working Group to deal with agenda item 1.2 (SWG 4C2 a.i. 1.2)
 - Sub-Working Group to deal with agenda items 1.3 and 9.1; 9.1.7 (SWG 4C3 a.i. 1.3, issue 9.1.7)

Committee 5 (mainly satellite issues)

- Working Group 5A (Space Science)
 - Plenary to deal with Agenda items 1.13, 5 (Resolution (Rev.WRC-03) 74) and relevant parts of 9.2
 - Sub-Working Group to deal with Agenda item 1.11 (SWG 5A1 a.i. 1.11)
 - Sub-Working Group to deal with Agenda item 1.12 (SWG 5A2 a.i. 1.12)
 - Sub-Working Group to deal with Agenda item 1.14 (SWG 5A3 a.i. 1.14)
- Working Group 5B (Satellite Allocation)
 - Sub-Working Group to deal with agenda item 1.6 (SWG 5B1 a.i. 1.6)
 - Sub-Working Group to deal with agenda item 1.7 (SWG 5B2 a.i. 1.7)
 - Sub-Working Group to deal with agenda item 1.9.1 (SWG 5B3 a.i. 1.9.1)
 - Sub-Working Group to deal with agenda item 1.9.2 (SWG 5B4 a.i. 1.9.2)
 - Sub-Working Group to deal with agenda item 1.10 (SWG 5B5 a.i. 1.10)
- Working Group 5C (Satellite Regulatory Issues)
 - Sub-Working Group to deal with agenda item 1.8 (SWG 5C1 a.i. 1.8)
 - Sub-Working Group to deal with agenda item 7 and related parts of agenda items 9.2 and 9.3 (SWG 5C2 a.i. 7)
 - Sub-Working Group to deal with agenda item 9.1.2 (SWG 5C3 a.i. 9.1.2)
 - Sub-Working Group to deal with agenda item 9.2 (SWG 5C4 a.i. 9.2)

Committee 6

- **Working Group 6A (WG 6A General Issues)**
 - Sub-Working Group 6A1 on WRC-15 agenda items 2 and 4 (SWG 6A1 a.i. 2, 4 (lB & Res. 95))
 - Sub-Working Group 6A2 on WRC-15 agenda item 9.2*, Issues not related to satellite (SWG 6A2 a.i. 9.2.NSat)
- **Working Group 6B (WG 6B Next WRC)**
 - Agenda of future conferences, a.i. 6, 10
 - 1 Ad-Hoc Group (AHG) 6B1
 - 2 Ad-Hoc Group (AHG) 6B2
 - 3 Ad-Hoc Group (AHG) 6B3
 - 4 Ad-Hoc Group (AHG) 6B4
- **Note: Contributions for WRC-23 agenda are proposed to be considered separately**

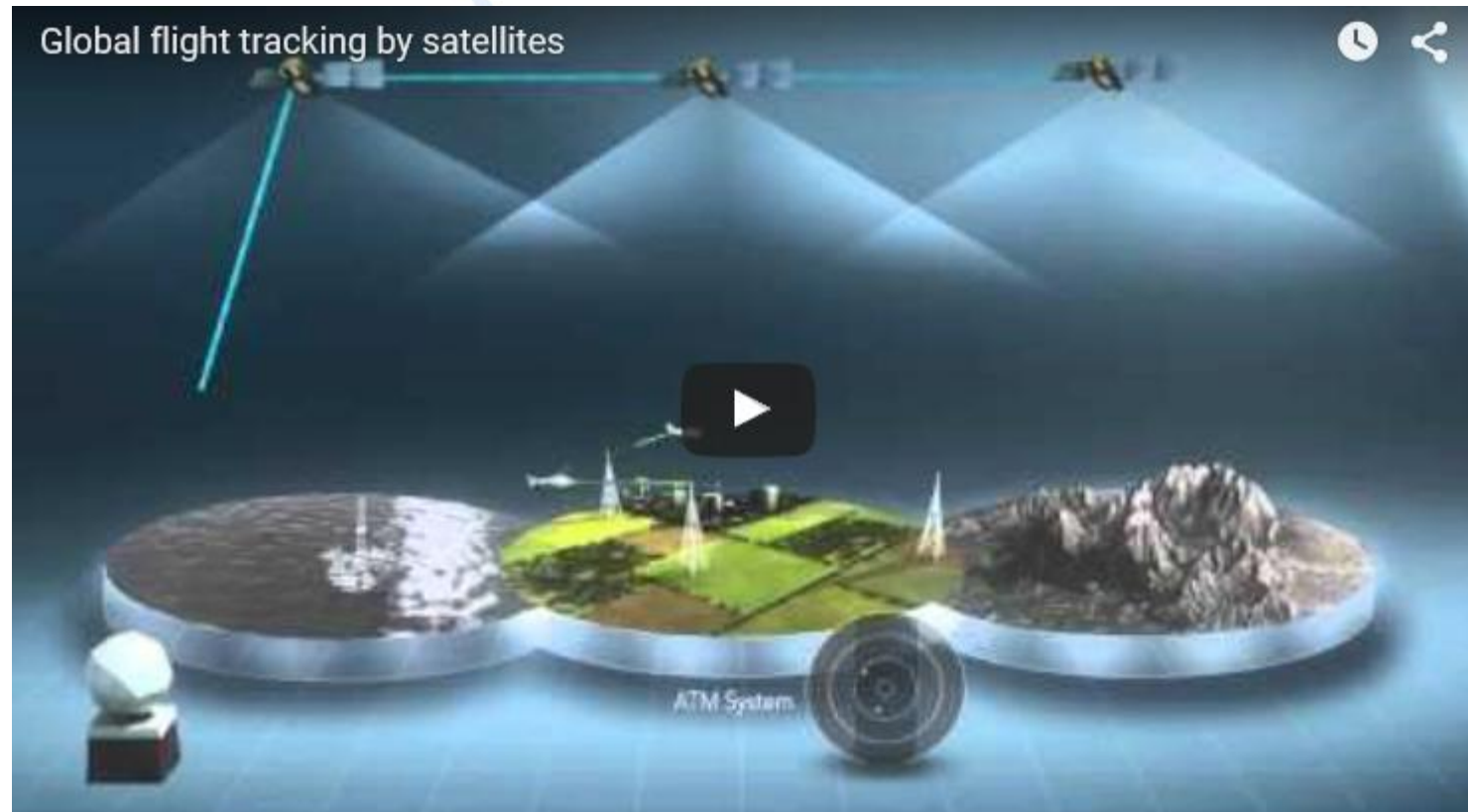


Key Results

global flight tracking

- Agreement was reached on the allocation of radio-frequency spectrum for global flight tracking in civil aviation for improved safety.
- The frequency band **1087.7-1092.3 MHz** has been allocated to the aeronautical mobile-satellite service (Earth-to-space) for reception by space stations of Automatic Dependent Surveillance-Broadcast (ADS-B) emissions from aircraft transmitters.

global flight tracking



emergency communications

- WRC-15 identified spectrum in the **694-894 MHz** frequency band to facilitate mobile broadband communications for robust and reliable mission critical emergency services in **public protection and disaster relief (PPDR)**, such as police, fire, ambulances and disaster response teams.

search and rescue

- WRC-15 reinforced protection to Search and Rescue beacons that transmit in the 406-406.1 MHz frequency band signals to uplink to search and rescue satellites
- Resolution 205 was modified to ensure that frequency drift characteristics of radiosondes are taken into account when operating above 405 MHz to avoid drifting close to 406 MHz
- Administrations are requested to avoid making new frequency assignments for the mobile and fixed services within the adjacent frequency bands to prevent interference in the frequency band 406-406.1 MHz

enhanced maritime comm. systems

- Enable new **Automatic Identification System (AIS)** applications and other possible new applications to improve maritime radiocommunication.
- New applications for data exchange, using AIS technology, are intended to improve the safety of navigation. New allocations were made in the bands 161.9375-161.9625 MHz and 161.9875-162.0125 MHz to the maritime mobile-satellite service.
- Studies will continue on the compatibility between maritime mobile-satellite service (MMSS) in the downlink in the band 161.7875-161.9375 MHz and incumbent services.

road safety

- Radio-frequency spectrum needed for the operation of short-range high-resolution automotive radar has been allocated in the **79 GHz frequency band**.
- This will provide a globally harmonized regulatory framework for automotive radar to prevent collisions and improve vehicular safety by reducing traffic accidents.
- According to UN data, more than 1.25 million fatalities occur each year on the roads around the world.

satellite & white spaces

- White space is still under discussion in ITU-R SG1, it was not subject of the conference.
- For satellite related issues there is a new allocation for earth-exploration satellite services and for broadband satellite systems the Earth Stations in Motion (ESIM) in order to provide global broadband connectivity for transportation.

satellite

- WRC-15 agreed to facilitate the global deployment of Earth Stations In Motion (ESIM) in the **19.7-20.2 and 29.5-30.0 GHz** frequency bands in the fixed-satellite service (FSS), paving the way for satellite systems to provide global broadband connectivity for the transportation community.
- Earth stations on-board moving platforms, such as ships, trains and aircraft, will be able to communicate with high power multiple spot beam satellites, allowing transmission rates in the order of 10-50 Mbits/s.

wi-fi

- Res. COM6/22: Studies concerning Wireless Access Systems including radio local area networks in the frequency bands between 5 150 MHz and 5 925 MHz
- ITU-R studies indicate that the minimum spectrum need for WAS/RLAN in the **5 GHz frequency range in the year 2018** is estimated at **880 MHz** (includes 455-580 MHz already utilized by non-IMT mobile broadband applications operating within the 5 GHz range resulting in 300-425 MHz additional spectrum being required)
- Invite the 2019 WRC to consider the results of the ITU-R studies and take appropriate actions

C Band & FSS

- **Standard C Band (3.7GHz-4.2GHz):**
 - **NOC** it keeps its allocation to FSS

FSS: fixed-satellite service

C Band & FSS

- Extended C Band (3.3GHz-3.7GHz)
 - **3.3GHz-3.4GHz**: new Band; Identification from some countries (into all Regions; it could be expected a global harmonization in WRC-23: **same frequency band cannot be revised in consecutive conferences**)
 - **3.4GHz-3.6GHz**: partially identified before WRC-15, now globally harmonized identification for IMT
 - **3.6GHz-3.7GHz**: new Band; only few countries in Region 2 (Americas) identified for IMT (quite unlikely a global allocation in WRC-23)

C Band & FSS

- **L-Band (1427MHz-1518MHz)** (all new Bands)
 - 1427MHz-1452MHz: Global identification
 - 1452MHz-1492MHz: fully for R2 and R3, partially for R1 (it could be expected a global harmonization in WRC-23)
 - 1492MHz-1518MHz: Global identification

IMT

- IMT encompasses all its generations:
 - IMT-2000,
 - IMT-Advanced, and now
 - IMT-2020

IMT

- Related to IMT-2000:
 - Technical Specifications are defined on Recommendation ITU-R M.1457, first release dated from May 2000: ITU-R M.1457-0 (05/2000), since then twelve revisions were made, and most recent version is: ITU-R M.1457-12 (02/2015)
 - 6 Families of Technologies were recognized as IMT-2000 compliance
- Related to IMT-Advanced:
 - Technical Specifications are defined on Recommendation ITU-R M.2012, first release dated from 2012: ITU-R M.2012-0 (01/2012), since then two revisions were made, and most recent version is: ITU-R M.2012-2 (09/2015)
 - 2 Families of Technologies were recognized as IMT-Advanced compliance

IMT & xG

- Consensus was achieved about IMT-2000 Specs and 3G Concept
- Consensus was not reached achieved about IMT-Advanced Specifications and 4G Concept:
 - Some regulators demand that the Term “4G” can be used only by services offered through Networks compliant with ITM-Advanced specifications. Then, operators make appeal to brands as: 3.25G, 3.5G, etc. (any number > 3 but < 4), to name their networks with performance larger than IMT-2000 but lower than IMT-Advanced
 - Some regulators permit that the Term “4G” be used by services offered through any kind of Network to which its performances exceed the ITM-2000 specifications. Then, in those countries, same services listed above, are named “4G”

IMT 2020

- Since early 2012, ITU-R embarked on a programme to develop “IMT for 2020 and beyond”, setting the stage for ‘5G’ research activities emerging worldwide; involved parties have in mind a consensus about the “5G” Definitions and “IMT-2020” Technical Specifications
- Roadmap for IMT-2020 has been defined on the recent Recommendation ITU-R M.2083-0 (09/2015) : IMT Vision - "Framework and overall objectives of the future development of IMT for 2020 and beyond"

Recent ITU Outcomes related to IMT

- Recommendation **ITU-R M.1579-2** (03/2015): Global circulation of IMT-2000 terrestrial terminals
- Recommendation **ITU-R M.1036-5** (10/2015): Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR)
- Recommendation **ITU-R M.2012-2** (09/2015): Detailed specifications of the terrestrial radio interfaces of International Mobile Tele communications Advanced (IMT-Advanced)
- Recommendation **ITU-R M.2083-0** (09/2015): Framework and overall objectives of the future development of IMT for 2020 and beyond

Recent ITU Outcomes related to IMT

- Report ITU-R M.2370 (07/2015): IMT Traffic estimates for the years 2020 to 2030
- ITU-R Handbook on “Global trends in IMT” (05/2015)
- ITU-R WP 5D: Work plan, timeline, process and deliverables for the future development of IMT

RA-15 Outcomes related to IMT

- RA15: new Resolutions:
 - Resolution ITU-R 65 - Principles for the process of future development of IMT for 2020 and beyond
 - Internet of Things (IoT)

WRC-15 Outcomes related to IMT

- Revised Resolution related to IMT: 3 Resolutions were revised
 - **Resolution 212** (Rev.WRC-15): Implementation of International Mobile Telecommunications in the frequency bands 1 885-2 025 MHz and 2 110-2 200 MHz
 - **Resolution 223** (Rev.WRC-15): Additional frequency bands identified for International Mobile Telecommunications
 - **Resolution 224** (Rev.WRC-15): Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz

WRC-15 Outcomes related to IMT

- New Resolutions related to IMT:
 - **Resolution COM4/6** (WRC-15): Review of the spectrum use of the frequency band 470-960 MHz in Region 1
 - **Resolution COM4/7** (WRC-15): Compatibility of International Mobile Telecommunications and broadcasting-satellite service (sound) in the frequency band 1 452-1 492 MHz in Regions 1 and 3

WRC-15 Outcomes related to IMT

- New Resolutions related to IMT:
 - **Resolution COM6/20** (WRC-15): Studies on frequency-related matters for International Mobile Telecommunications identification including possible additional allocations to the mobile services on a primary basis in portion(s) of the frequency range between 24.25 and 86 GHz for the future development of International Mobile Telecommunications for 2020 and beyond

WRC-15 Outcomes related to IMT

- Revised Recommendations related to IMT:
 - 1 Recommendation was revised
 - **Recommendation 207** (Rev.WRC-15): Future IMT systems

IMT Frequency Bands before WRC-15

As in WRC 12		
Band (MHz)	Bandwidth (MHz)	Radio Rules Footnotes identifying the band for IMT
450-470	20	5.286AA
698-960	262	5.313A, 5.317A
1710-2025	315	5.384A, 5.388
2110-2200	90	5.388
2300-2400	100	5.384A
2500-2690	190	5.384A
3400-3600	200	5.430A, 5.432A, 5.432B, 5.433A
7 Bands	1,177	

New IMT Frequency Bands in WRC-15

- Following the growing demand for spectrum for mobile broadband services, WRC-15 identified frequency bands in the **L-band (1427-1518 MHz)** and in the lower part of the **C-band (3.4 - 3.6 MHz)**

New IMT Frequency Bands in WRC-15

- **L-Band (1427MHz-1518MHz)** (all new Bands)
 - 1427MHz-1452MHz: Global identification
 - 1452MHz-1492MHz: fully for R2 and R3, partially for R1 (it could be expected a global harmonization in WRC-23)
 - 1492MHz-1518MHz: Global identification

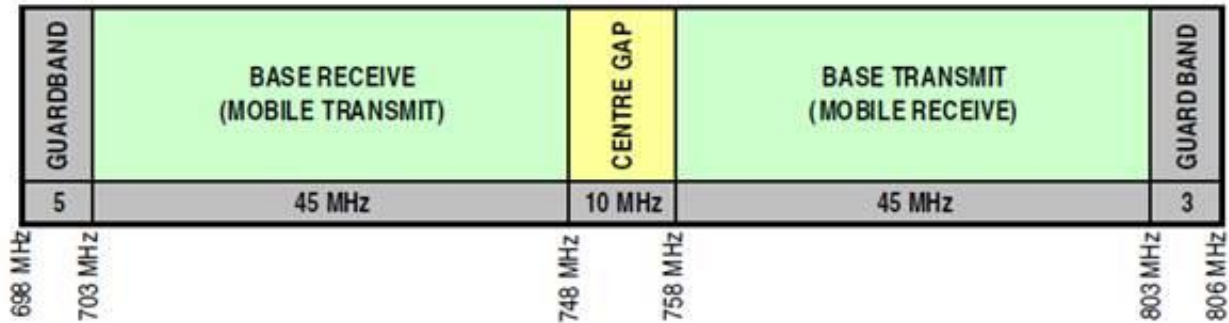
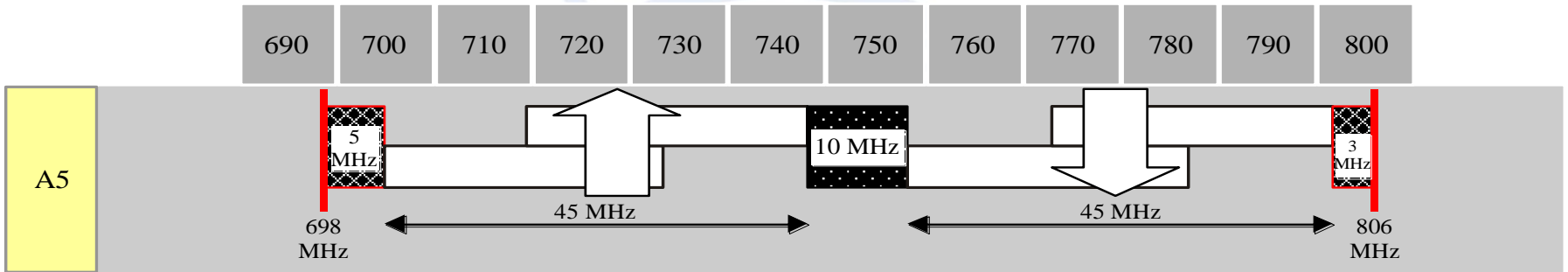
New IMT Frequency Bands in WRC-15

- WRC-15 took a key decision that will provide enhanced capacity for mobile broadband in the **694-790 MHz** frequency band in ITU Region-1 and a globally harmonized solution for the implementation of the digital dividend.
- Full protection has been given to television broadcasting as well as to the aeronautical radio navigation systems operating in this frequency band.

New IMT Frequency Bands in WRC-15

- UHF Band:
 - 470MHz-698MHz: TV in R1 and R3, some countries from R2 identified for IMT (still a big discussion)
 - 698MHz-806MHz: partially identified before WRC-15, now globally harmonized identification for IMT

Digital Dividend - Brazil



M.1036-04-Ann2

Allocation A5 M.1036-4

New IMT Frequency Bands in WRC-15

- WRC-15 achieved agreement on some additional portions in other bands that were also allocated to mobile broadband services in order to be used in regions where there was no interference with other services.

New IMT Frequency Bands in WRC-15

- On the WRC-15 8 new Bands were identified, with a total of additional 603 MHz, i.e. 51% more bandwidth
 - Classified by Radio Regulations Region;
 - **any** means no restriction into that Region;
 - **some** means that a specific list of countries was indicated; these new identifications will be added on the next RR (Ed. 2016)

New IMT Frequency Bands in WRC-15

WRC15				
Band (MHz)	Bandwidth (MHz)	R1	R2	R3
470-608	38		some	
614-698	84		some	
1427-1452	25	any	any	any
1452-1492	40	some	any	any
1492-1518	26	any	any	any
3300-3400	100	some	some	some
3600-3700	100		some	
4800-4990	190		some	some
8 Bands	603			

All IMT Frequency Bands

- In respect to all Bands identified for IMT, when merging the current ones (up to WRC-12; 7 Bands, 1,177 MHz) and new ones (during WRC-15; 8 Bands, 603 MHz), we obtain a Total amount of:
 - **15 Bands** and **1,780 MHz**
 - Next Table depicts it (in blue those arisen at WRC15)

All IMT Frequency Bands

Band (MHz)	Bandwidth (MHz)
450-470	20
470-608	38
614-698	84
698-960	262
1427-1452	25
1452-1492	40
1492-1518	26
1710-2025	315
2110-2200	90
2300-2400	100
2500-2690	190
3300-3400	100
3400-3600	200
3600-3700	100
4800-4990	190
15 Bands	1,780

IMT on the Agenda of WRC-19

- Resolution COM6/16 (WRC-15): Agenda for the 2019 World Radiocommunication Conference
 - 1.13. to consider identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution COM6/20 (WRC-15)
 - As indicated on Resolution COM6/20 (WRC-15) the frequency range to be revised during WRC-19 is from 24.25 to 86 GHz, having in mind mainly the future development of International Mobile Telecommunications for 2020 and beyond

THANK YOU



Bruno Ramos
Regional Director
Americas Region