

# Implementation of **WRC-15** decisions for Space Services

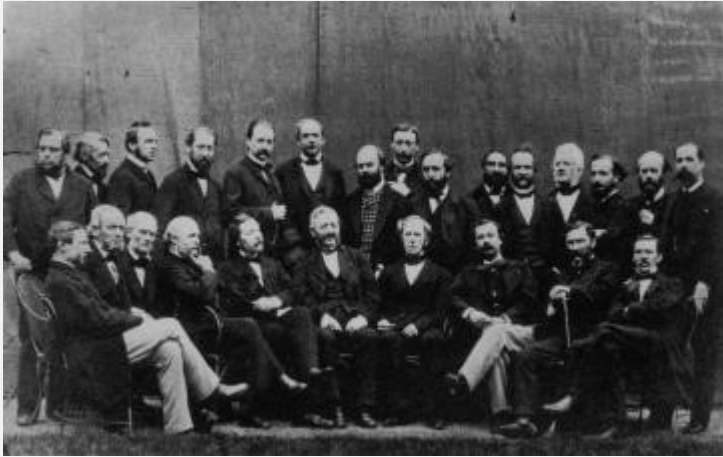
Timur Kadyrov

Hon-Fai Ng

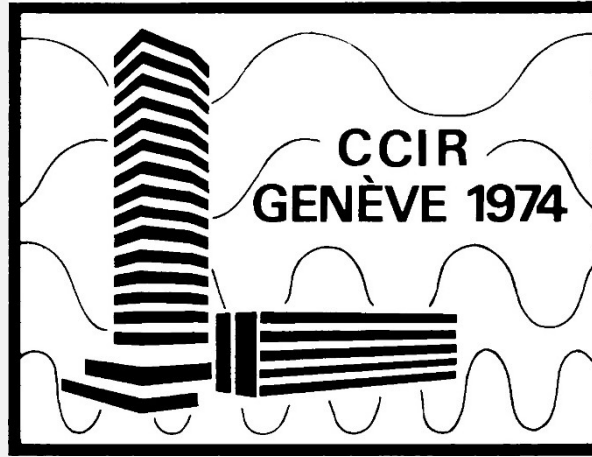
Space Services Department



150 years  
1865 International  
Telegraph Union



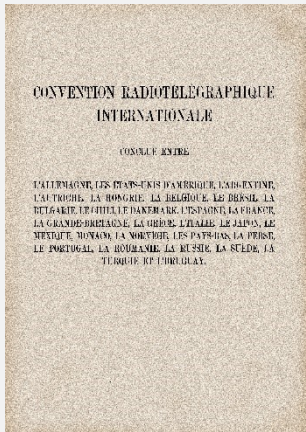
90 years  
1927 International Administrative  
Consultative Committee



70 years  
1947 International Frequency  
Registration Board (IFRB)



1906



International  
Radiotelegraph Conference,  
Berlin

2015



WRC-15





# World Radiocommunication Conference

Review or revise international treaty on radio-frequency spectrum and orbits

Harmonise global spectrum  
Create regulatory certainty (consensus)  
Maintain sustainable ecosystem





## WRC-15 in numbers

2 - 27 Nov 2015 in Geneva

3275 participants

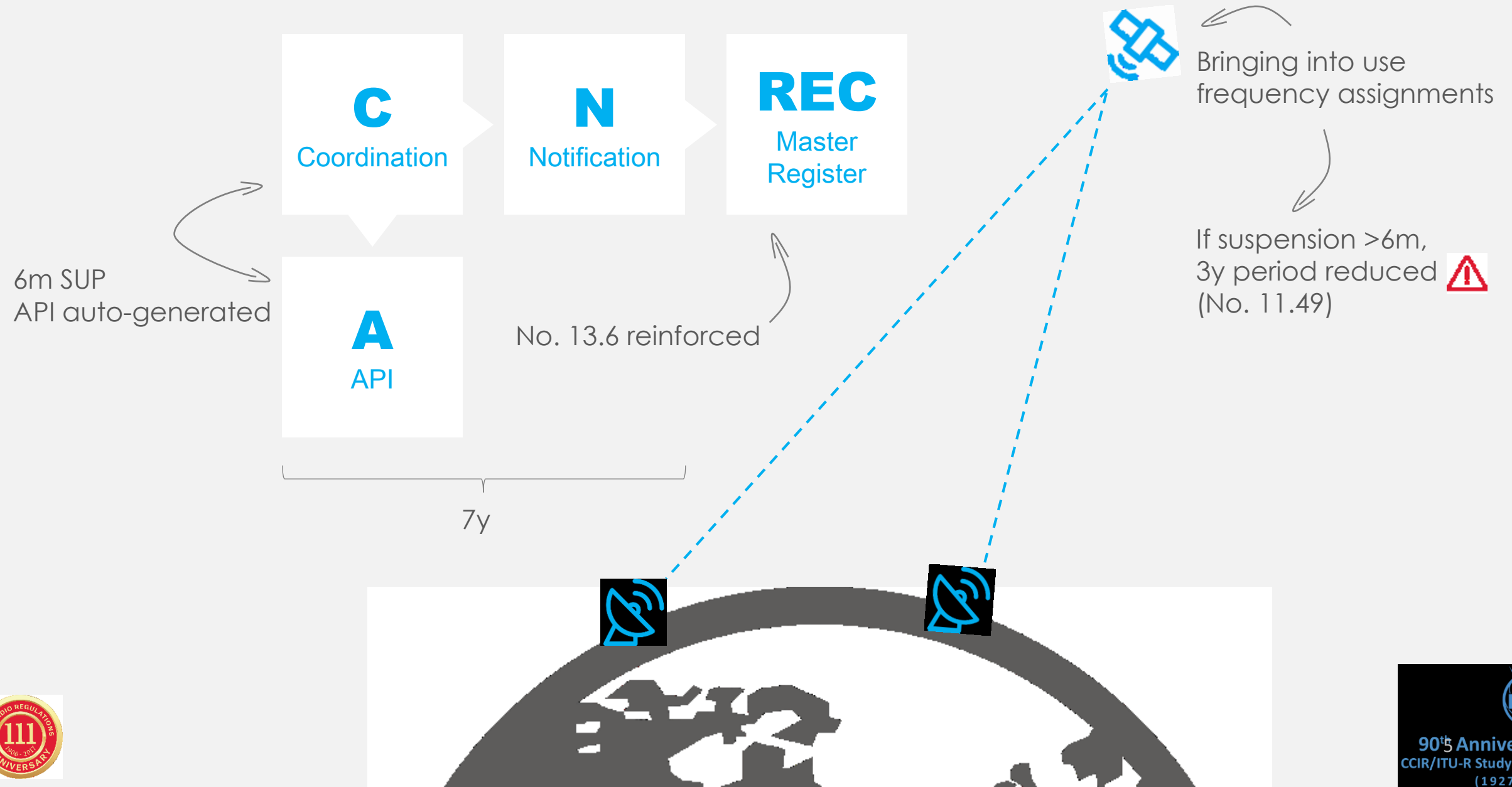
162 Member states

40 topics

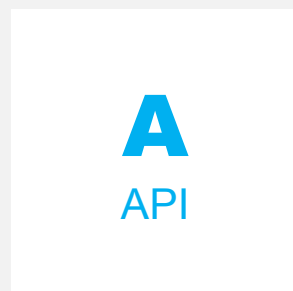
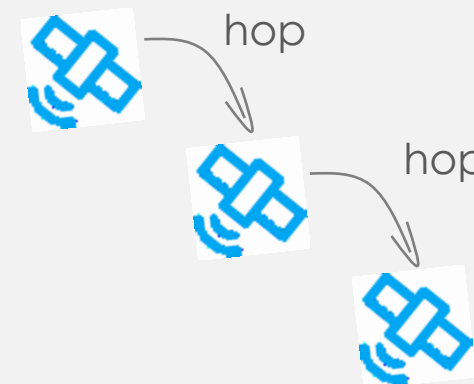
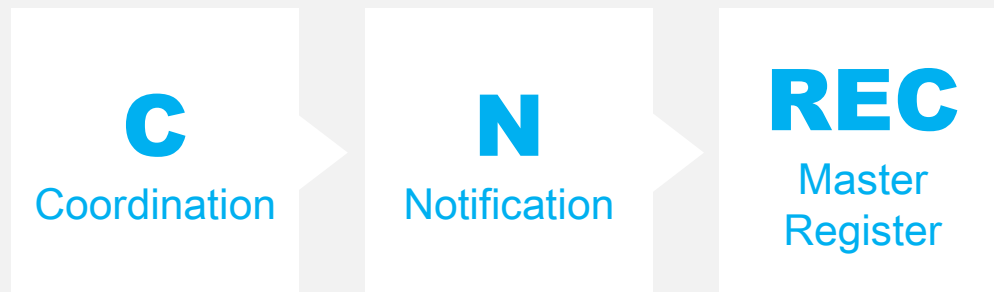
678 documents with 2888 proposals

Final Acts [www.itu.int/pub/R-ACT-WRC.12-2015](http://www.itu.int/pub/R-ACT-WRC.12-2015)

# After WRC-15



# After WRC-15



## Bring Into Use (BIU) at multiple locations

WRC-15 adopted Res 40 (WRC-15)

For BIU or BBIU, Adms to inform if using existing satellite (< 3 years)

From 1 Jan 2018, if not provided, considered not BIU or BBIU 

### BR

Prepared submission form

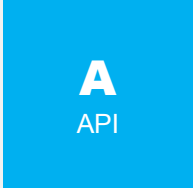
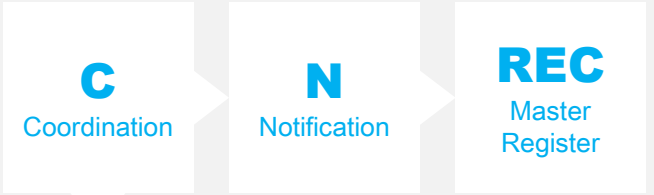
[www.itu.int/net/ITU-R/space/snl/sat\\_relocation/RES40\\_Form.pdf](http://www.itu.int/net/ITU-R/space/snl/sat_relocation/RES40_Form.pdf)

Developed webpage to publish information

[www.itu.int/net/ITU-R/space/snl/sat\\_relocation/index.asp](http://www.itu.int/net/ITU-R/space/snl/sat_relocation/index.asp)

Source: CR/396 of 31.03.2016, CR/403 of 05.07.2016





# No more API submissions

(subject to coordination)



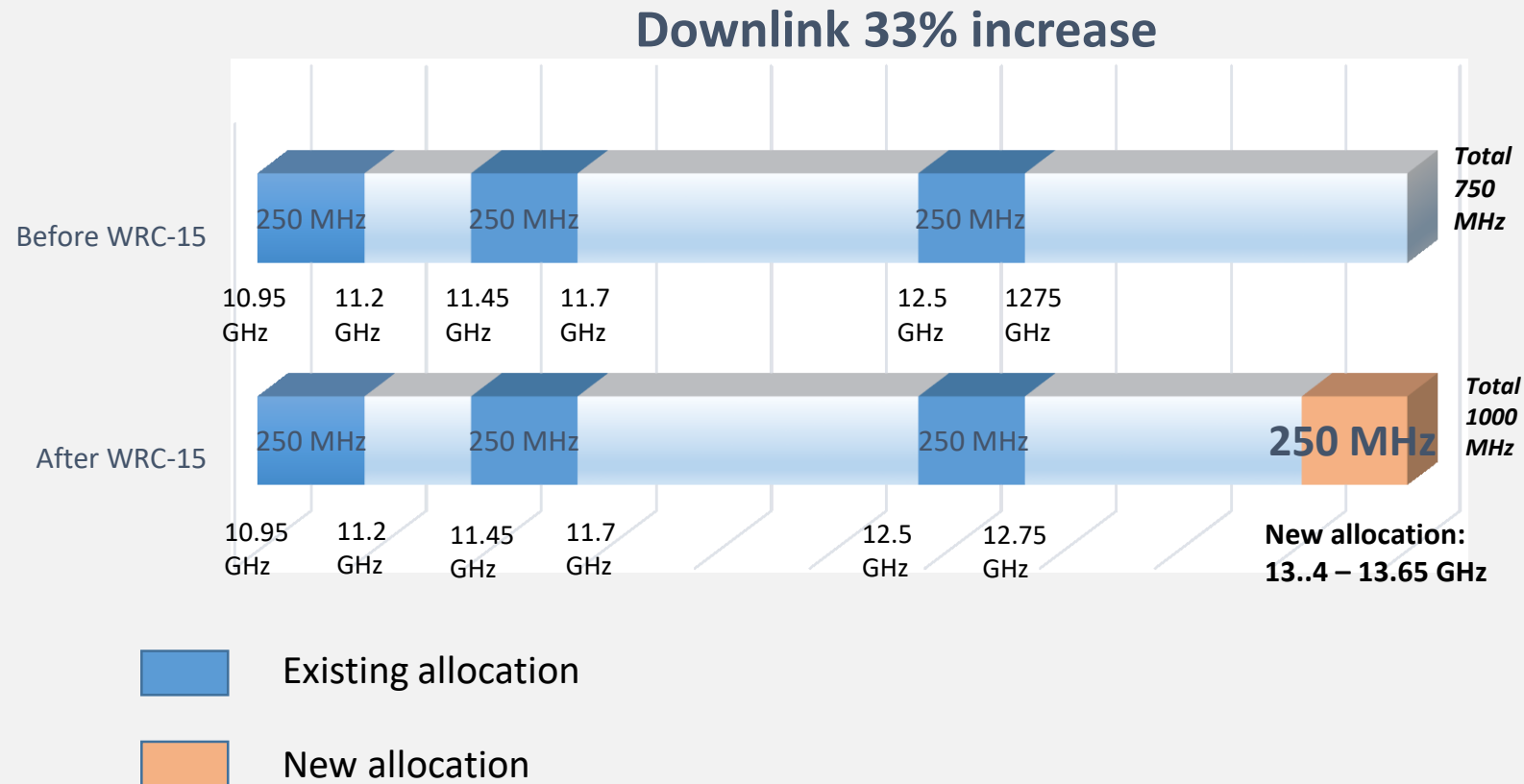
## BR

To publish API basic characteristics based on CR  
Developing secure electronic submission system

Source: CR/401 of 19.05.2016, Res 31 (WRC-15), Res 908 (Rev.WRC-15)

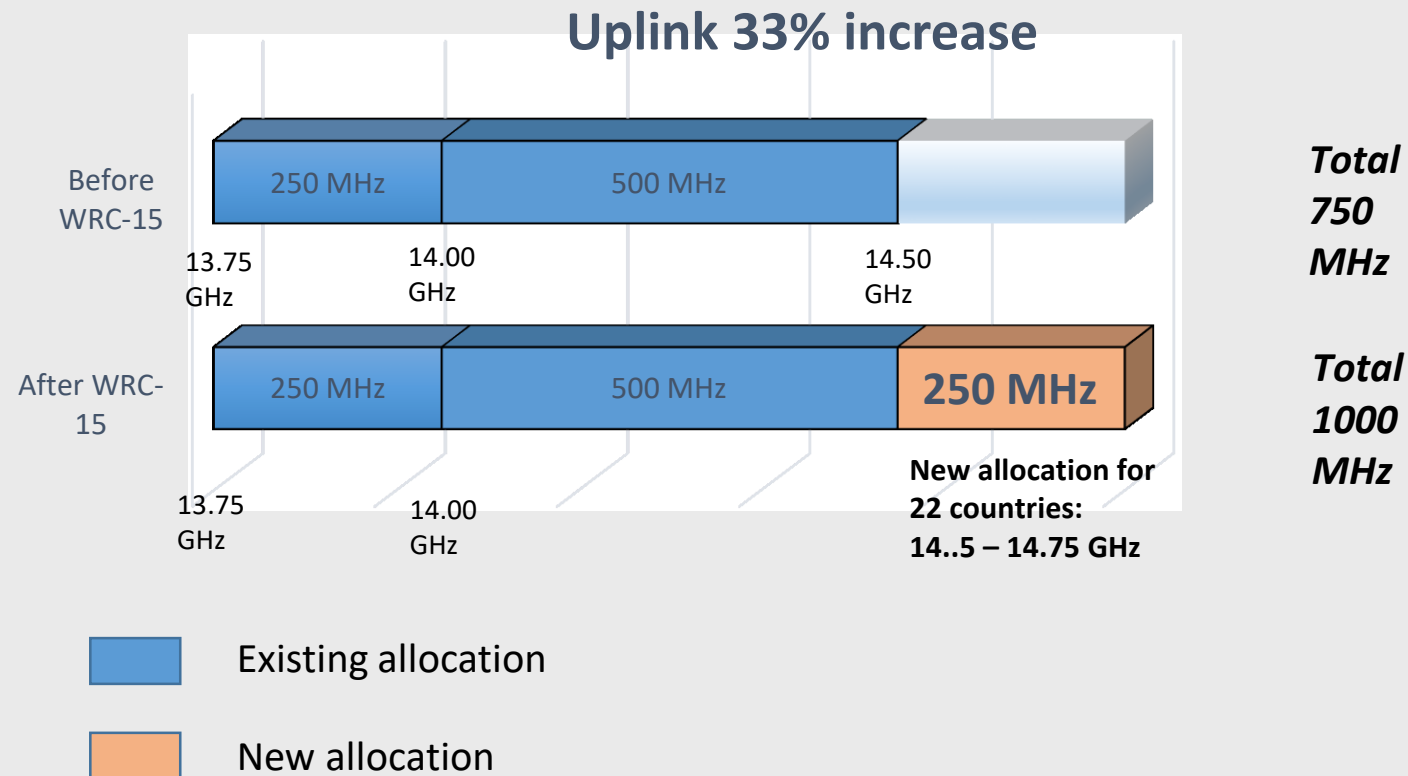


# Ku-band frequency allocation for unplanned FSS Downlink (R1)



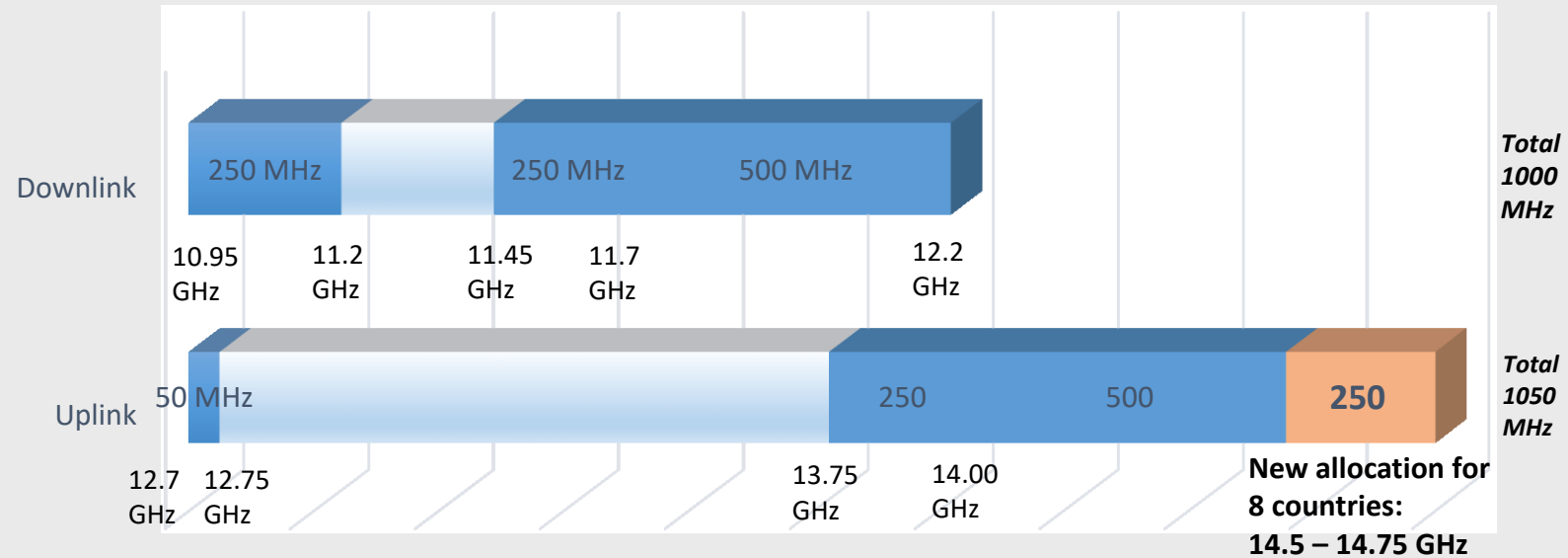


# Ku-band frequency allocation for unplanned FSS uplink (R1)



# Ku-band frequency allocation for unplanned FSS (Region 2)

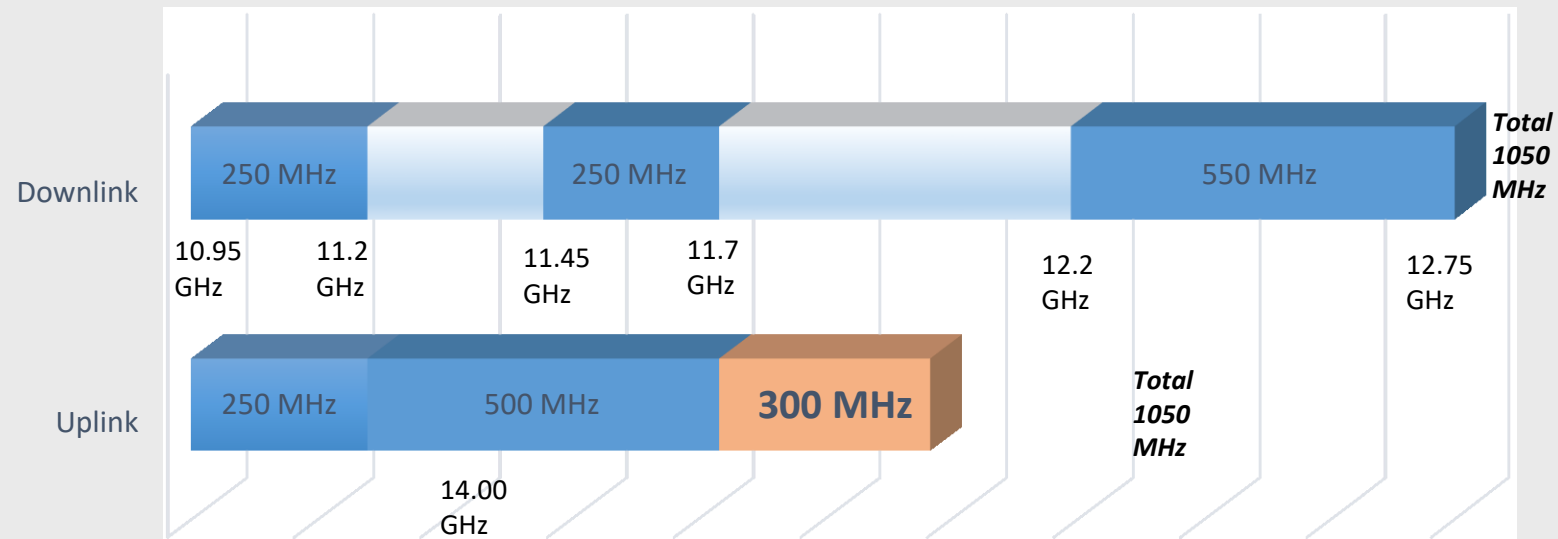
Improved balance between uplink and downlink



- Existing allocation
- New allocation

# Ku-band Frequency allocation for unplanned FSS (Region 3)

Improved balance between uplink and downlink

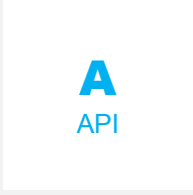
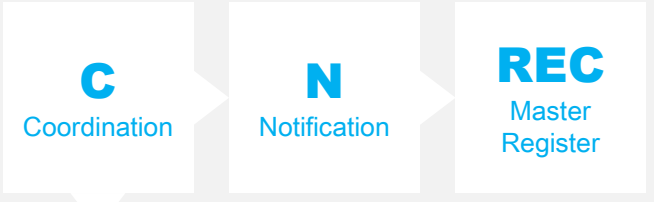


13.75 GHz

New allocation for 10 countries:  
14.5 – 14.8 GHz

- Existing allocation
- New allocation



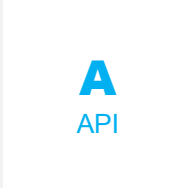
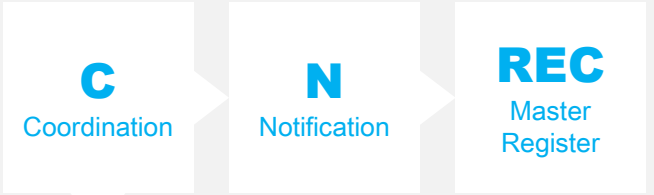


# New Frequency Allocation

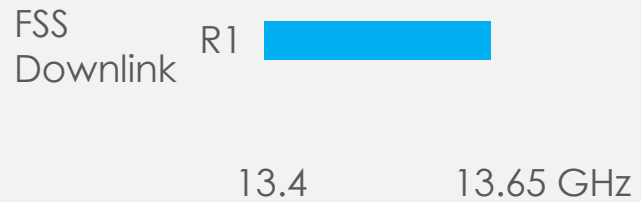
## Conditions

1. Limited to GSO (5.499A)
2. Meet PFD limits (Table 21-4)
3. Coordinate under No. 9.7
4. Not claim protection from EESS (5.499E)
5. Seek agreement under No. 9.21 with SR (5.499A)





# New Frequency Allocation



|            |    |                            |
|------------|----|----------------------------|
| FSS Uplink | R1 | 22 ctry                    |
|            | R2 | 8 ctry                     |
|            | R3 | 9 ctry                     |
|            |    | 14.5      14.75 / 14.8 GHz |

## Conditions

1. Limited to GSO (No. 5.509B)
2. Commit (A16c of Ap4) to meet 500 km from other countries (No. 5.509E)
3. Commit to meet PFD limits at certain altitude & distance (No. 5.509D)
4. Provide antenna diameter (C.10.d.7 of Ap4)
5. Meet minimum 6m antenna diameter & max PSD (No. 5.509C)
6. Meet PFD limits at GSO (No. 22.40)
7. Coordinate under No. 9.7 & Ap30A#7.1
8. For R3, limited to AUS, CBG, CHN, J, LAO, PAK, PNG, THA, VTN





# New Frequency Allocations for other services

Maritime-Mobile Satellite Service

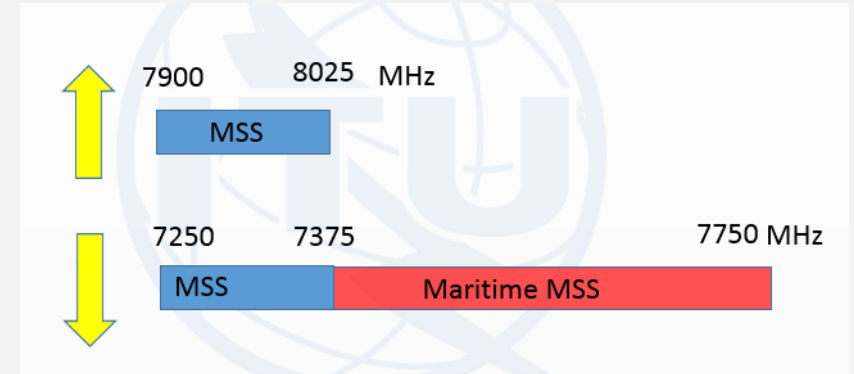
7375–7750 MHz

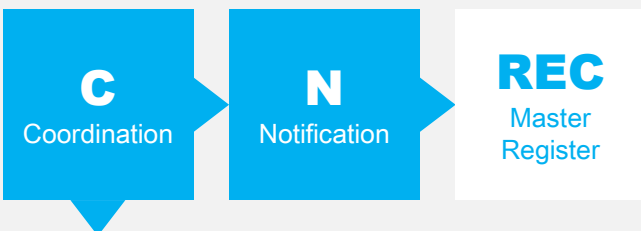
Earth-Exploration Satellite Service

7190-7250 MHz

Earth-Exploration Satellite Service (active)

9.2-9.3, 9.9-10, 10.-10.4GHz





**A**  
API

# Update database & software

New frequency allocation  
(BR Soft)

Separation of affected networks  
(same or opposite direction of  
transmission) (GIBC/AP8)

Detailed provision of No. 11.41/9.7  
etc. (SRS)

Update of No. 11.41 following SUP  
of existing networks  
(NOTEX system)  
[www.itu.int/net4/ITU-R/space/noq/](http://www.itu.int/net4/ITU-R/space/noq/)



Reduction in coordination arc for  
C (7 deg) and Ku-band (6 deg)  
(GIBC/AP8)

Calculation of PFD outside of  
coordination arc for C (uplink only)  
and Ku-band (Probability of harmful  
interference under No. 11.32A)

Source: Appendix 5 (Rev.WRC-15), Resolution 762 (WRC-15), CR/397 of 08.04.2015



**C**  
Coordination

**N**  
Notification

**REC**  
Master  
Register

**A**  
API


# Request for clarification (No. 13.6)

Are notified/recorded assignments in use or continuous use?

## BR

To provide reason

To provide conclusion within 3m

-  To request additional / alternative info, if Adms provide partial evidence
- To only accept direct reference to Art. 48 of Constitution (military radio installations)

Source: CR/389 of 29.01.2016, RR No. 13.6, CCRR/57 Draft RoP



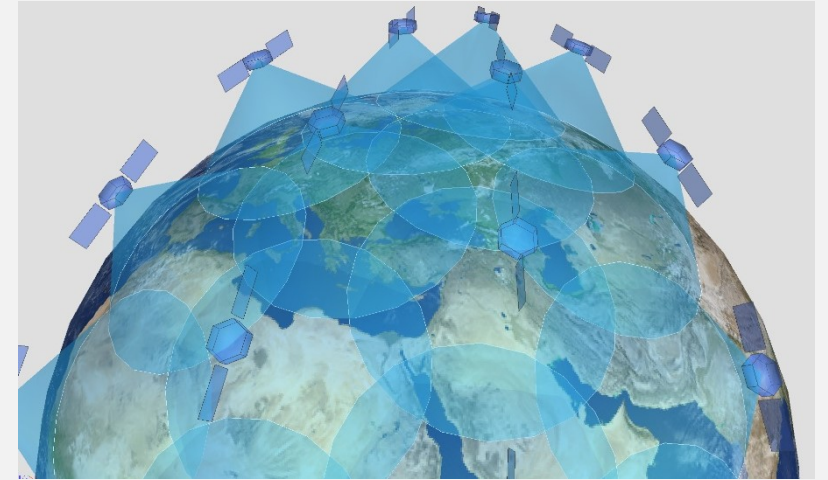
# Non-GSO issues

Bringing into use of non-GSO FSS/MSS systems

- ITU-R to examine under WRC agenda item 7 and develop possible additional milestones beyond RR Nos. 11.25 and 11.44
- To consider implications on non-GSO systems BIU after WRC-15  
Source: **RRB-73 RoP on No. 11.44**

Coordination among non-GSO FSS systems

- Administrations may mutually agree on multilateral coordination meetings
- ITU-R can further study / submit under WRC agenda item 7





## WRC-15 adopted Resolution 156 (WRC-15)

Not claim protection & not cause interference to primary Fixed/Mobile in 5.524 countries (§1.2)

Commit to cease / reduce interference to 2ndary fixed/mobile in 5.542 countries (§1.4, 1.5)

Not for safety of life applications (§1.7)

Network Control & Monitoring Centre to disable (§1.6)

Employ tracking techniques to associated GSO FSS (§2)

## BR



Introduced new class of station for FSS, **UF**, for ESIM as of 28 Nov 2015

To discontinue previous symbol, UC, from 1 Jan 2017 (No. 5.526)

To request for commitment to cease harmful interference (§1.5)

## Earth Station In Motion (ESIM)

ESIM communicating with GSO FSS in 19.7-20.2 GHz and 29.5-30.0 GHz (No. 5.527A)



Source: CR/393 of 18.03.2016, CR/403 of 05.07.2016, No. 5.527A, Res 156 (WRC-15), Draft RoP CCRR/57







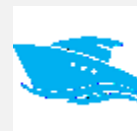
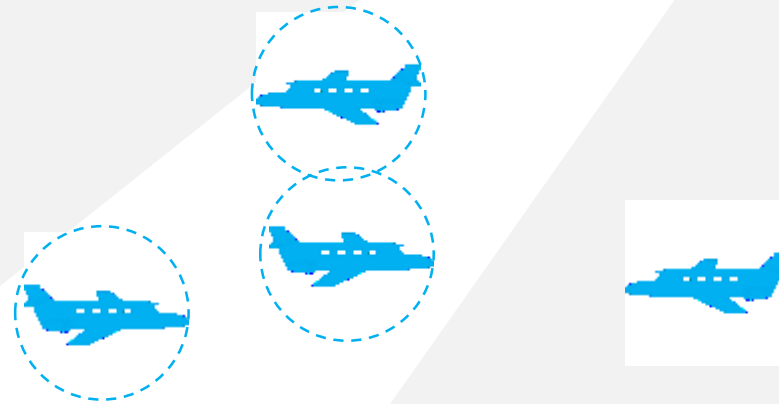
# Global Flight Tracking

WRC-15 allocated 1 087.7-1 092.3 MHz to Aeronautical Mobile-Satellite Service (Route) (AMS(R)S) for Automatic Dependent Surveillance-Broadcast (ADS-B)

## BR

Introduced new classes of station, **E5/T5 & E6/T6**, for AMS(R)S & (OR), respectively  
To update SRS database with new symbols

Source: CR/394 of 18.03.2016, CR/403 of 05.07.2016, Res 425 (WRC-15), 5.328AA





## WRC-15 adopted Resolution 155 (WRC-15)

- GSO FSS satellites in Ku and Ka-bands (§1)
- Not cause more interference/constraints to others (§6,8,14)
- To withstand interference from others (§11,12)
- Ensure safety of flight of UAS, use favourable recorded assignments (§13)
- Used after adoption of ICAO SARPs (§3)

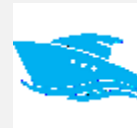
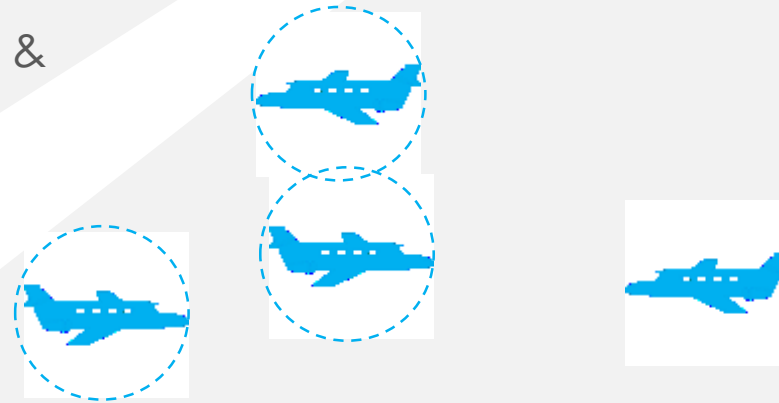
## BR

- Introduced new classes of station, **UG**, for ES on UA
- To post on web “as-received” UAS submissions, for info & assist ITU-R studies [www.itu.int/net4/ITU-R/space/UAS-submissions](http://www.itu.int/net4/ITU-R/space/UAS-submissions)
- Not to process submissions until Res 155 implemented
- To present progress report in next WRC

Source: CR/407 of 05.07.2016, CR/389 of 29.01.2016, Resolution 155 (WRC-15)

## Unmanned Aircraft System (UAS)

Control of unmanned aircraft systems by remote pilot in non-segregated airspace





## Typical FSS ES

Notification of typical earth stations (ES) in fixed-satellite service (FSS) for possible international recognition

### WRC-15 concluded

WRC-15 concluded further ITU-R studies needed before any regulatory decision

- Administration can submit typical earth station, for information purposes
- Information to assist technical and regulatory studies – possible international recognition of millions of typical ES

### BR

Developed web platform for submission  
<https://www.itu.int/net4/ITU-R/space/TypicalESinFSS/>  
To publish information received

Source: CR/389 of 29.01.2016, CR/404 23.05.2016



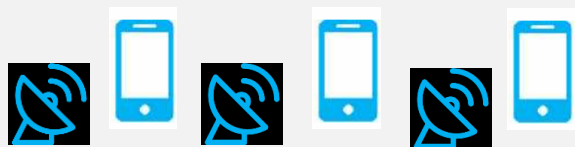


# Mobile Broadband vs Satellites

Everybody is in favor of spectrum harmonization

But Everybody wants it to be his own way

- The success of mobile broadband and its ubiquitous nature represents a threat of disruption to other services if IMT is identified in the same band, even though technical solutions may exist to share it between countries
- The main success of WRC-15 was to continue global harmonization for IMT **and** to secure future access to spectrum by other services



## WRC-15 decisions

**3 300 – 3 400 MHz:** allocation to, or upgrade of MS in 36 countries worldwide. IMT identification in 33 R1, 6 R2 and 6 R3 countries

**3 400 – 3 600 MHz:** upgrade of MS and identification for entire R.1, 2 and for **11 R3** countries (subject to 9.17, 9.18, 9.21 and pfd limit)

**3 600 – 3 700 MHz:** IMT identification in 4 Region 2 countries subject to coordination under 9.17, 9.18, 9.21 and a pfd limit

**4800–4990 MHz** IMT identification in 1 Region 2 and 3 Region 3 countries

**Subject to conditions to secure protection of incumbent services, e.g. non-interference basis, pfd limits, 9.21**



# How to provide international recognition to fixed earth stations and typical earth stations in C-band

## Importance of C-band for FSS:

- High availability even in areas with severe rain fade e.g. Asia Pacific
- Wide satellite coverage - enables services to sparsely populated areas over large distances
- One satellite every second degree around GSO has C-band on-board

TO NOTIFY THE EARTH STATIONS FOR RECORDING INTO THE MIFR

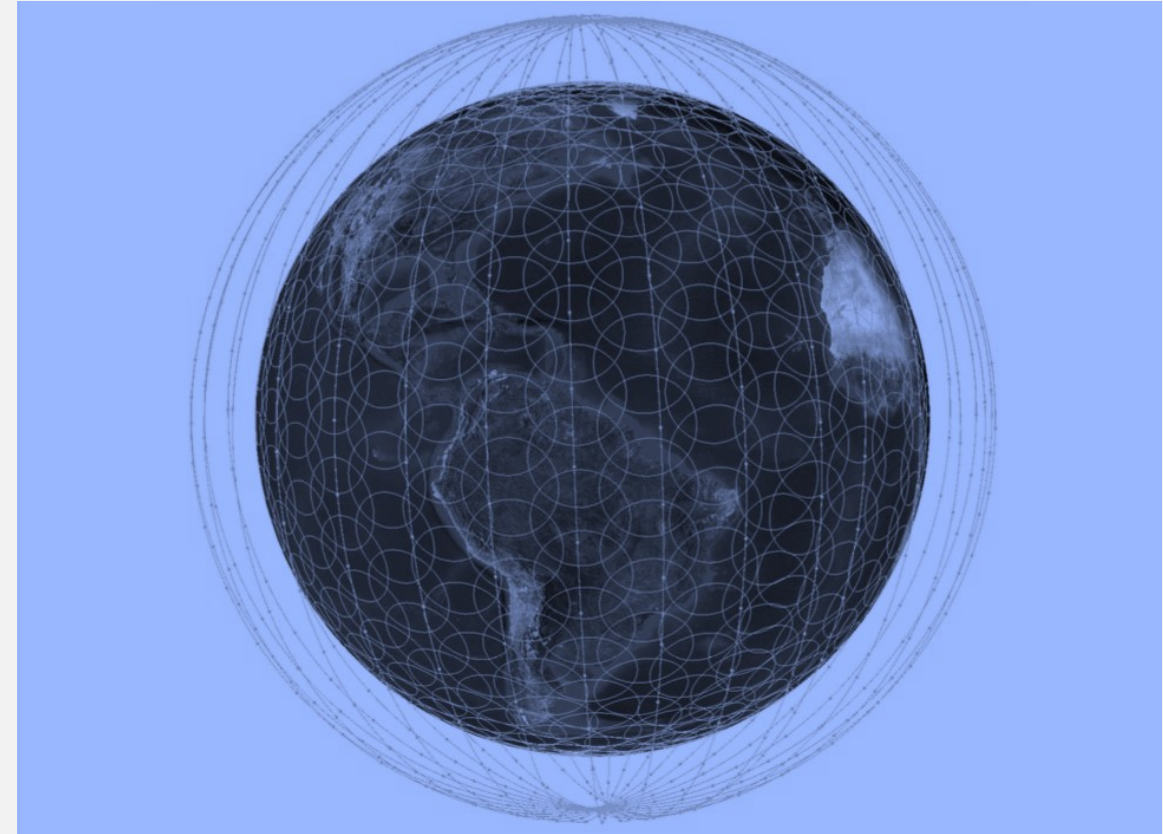






# Satellite issues in WRC-19 agenda

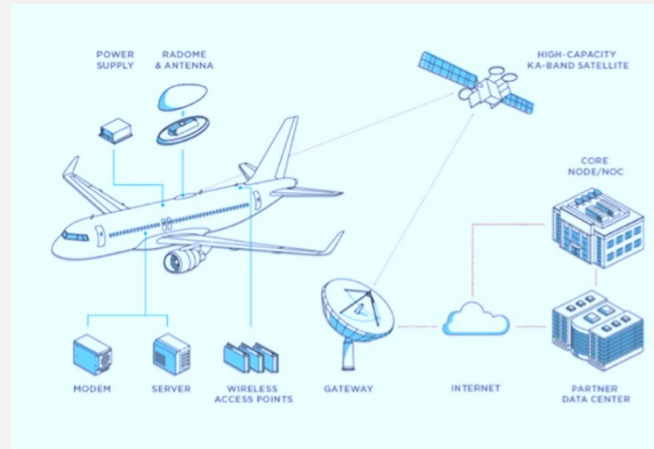
- V-band NGSO (Agenda Item 1.6)
  - 37.5-39.5 GHz (s-E)
  - 39.5-42.5 GHz (s-E)
  - 47.2-50.2 GHz (E-s)
  - 50.4-51.4 GHz (E-s)
- C-Band NGSO (Agenda Item 9.1, Issue 9.1.3)  
Study provisions for NGSO in C-Band for circular orbit systems





# Satellite issues in WRC-19 agenda

- Studies to consider the **use of the bands 17.7-19.7 GHz (s-E) and 27.5 29.5 GHz (E-s)** by **earth stations in motion** communicating with GSO space stations **in the FSS** and take appropriate action (**Resolution 158, WRC-15**)
- Study spectrum needs for **TT&C in the SOS** for nonGSO satellites with short duration missions & consider, if necessary, new SOS allocations



# Satellite regulatory issues (identified so far)



- A. Factors related to the BiU of frequency assignments of non-GSO systems subject to coordination
- B. Application of coordination arc in the Ka-band, to determine coordination requirements between the FSS and other satellite services
- C. Issues for which consensus was readily achieved in ITU-R ( )
- D. Identification of those specific satellite networks and systems with which coordination needs to be effected under RR Nos. 9.12, 9.12A and 9.13 [or 9.21]
- E. Harmonization of RR Appendix 30B with RR Appendices 30 and 30A
- F. Concerns with the lack of implementation of certain provisions of the Radio Regulations that can lead to difficulties during the process of entering an assignment into the RR Appendix 30B List
- G. Updating ref. sit. for networks in RR App. 30 & 30A after conversion into definitive of provisionally recorded assign
- H. Modifications to RR Appendix 4 data elements to be provided for non-geostationary satellite networks/systems





**C**  
Coordination

**N**  
Notification

**REC**  
Master  
Register

**A**  
API

# What's next?

WRC-15 Final Acts [www.itu.int/pub/R-ACT-WRC.12-2015](http://www.itu.int/pub/R-ACT-WRC.12-2015)

Circular Letters 389 to 407 [www.itu.int/md/R00-CR-CIR](http://www.itu.int/md/R00-CR-CIR)

Draft Rules of Procedure on WRC-15 decisions [www.itu.int/md/R00-CCRR-CIR-0057](http://www.itu.int/md/R00-CCRR-CIR-0057)

BR Software updates [www.itu.int/en/ITU-R/software/Pages/space-network-software.aspx](http://www.itu.int/en/ITU-R/software/Pages/space-network-software.aspx)

**WRC-19 Preparatory Studies** [www.itu.int/en/ITU-R/study-groups/rcpm/Pages/wrc-19-studies.aspx](http://www.itu.int/en/ITU-R/study-groups/rcpm/Pages/wrc-19-studies.aspx)

