



# WRC-15 Outcome and update

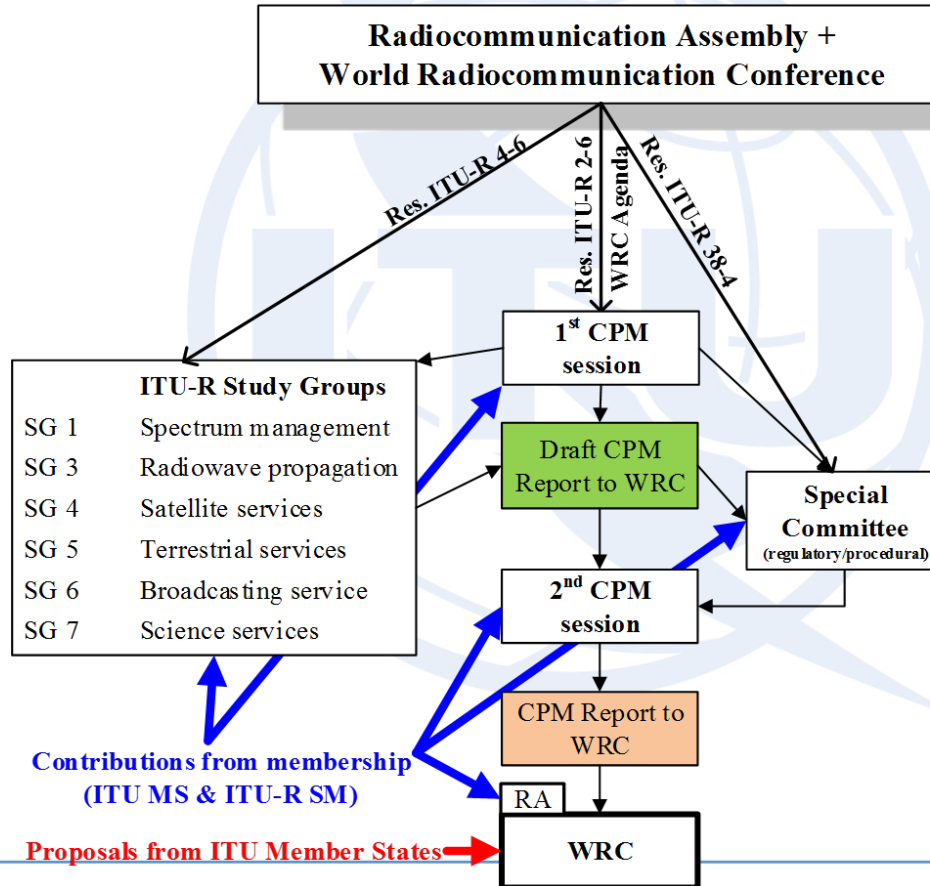


## ITU ASP COE TRAINING ON “WIRELESS BROADBAND ROADMAP DEVELOPMENT”

06-09 August 2016

Tehran, Islamic Republic of Iran

# Organization of the ITU-R Conference Preparatory Work



# WRC-15 Structure

<ul style="list-style-type: none"> <li>•ITU Resolution 807 (WRC-12) provides 10 agendas as: 1.1 to 1.5, 1.6.1, 1.6.2, 1.7 to 1.8, 1.9.1, 1.9.2, 1.10 to 1.18, 2 to 8, 9.1 to 9.3 and 10 (22 topics)</li> <li>•Held in Geneva from 2 to 27 November 2015</li> <li>•1008 documents</li> <li>•6047 proposals</li> </ul>	<b>Committee 1: Steering Committee</b>		
	<b>Committee 2: Credentials Committee</b>		
	<b>Committee 3: Budget Control Committee</b>		
	<b>Committee 4: Specified agenda items</b>		
	Committee 4B 1.4, 1.15, 1.16, 3*, 5*, 9.2*	Committee 4A 1.5, 1.17, 1.18, 3*, 5*, 9.2*, Flight Tracking	Committee 4C 1.1, 1.2, 1.3, 3*, 5*, 9.1.7, 9.2*
	<b>Committee 5: Specified agenda items</b>		
	Committee 5A 1.11, 1.12, 1.13, 1.14, 5*, 9.2.1, 9.2.2	Committee 5B 1.6 (1.6.1, 1.6.2), 1.7, 1.9 (1.9.1, 1.9.2), 1.10, 9.1.1	Committee 5C 1.8, 7, 9.1, 9.1.2, 9.1.3, 9.1.5, 9.1.8, 9.2*, 9.3
	<b>Committee 6: Specified agenda items</b>		
	Committee 6A: 2, 4, 8, 9.1.4, 9.1.6, 9.2*		Committee 6B: 10
	<b>Committee 7: Editorial</b>		

# Broadband Related Agendas

Highly Related	Agenda 1.1	<ul style="list-style-type: none"><li>to consider additional spectrum allocations to the mobile service on a primary basis and identification of additional frequency bands for IMT and related regulatory provisions, to facilitate the development of terrestrial mobile broadband applications, in accordance with Resolution <b>233 (WRC-12)</b>;</li></ul>
Overlapped	Agenda 1.2	<ul style="list-style-type: none"><li>to examine the results of ITU-R studies, in accordance with Resolution <b>232 (WRC-12)</b>, on the use of the frequency band 694-790 MHz by the mobile, except aeronautical mobile, service in Region 1 and take the appropriate measures;</li></ul>
Related	Agenda 1.3	<ul style="list-style-type: none"><li>to review and revise Resolution <b>646 (Rev.WRC-12) for broadband public protection</b> and disaster relief (PPDR), in accordance with Resolution <b>648 (WRC-12) (indirect relation)</b>;</li></ul>

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# Responsible ITU-R Study Group

- ITU-R Joint Task Group 4-5-6-7 (**JTG 4-5-6-7**) established for processing of agendas **1.1** and **1.2**
  - Divided into five **WGs**: Broadcasting and SAB/SAP, Terrestrial Services, Satellite Services, Science Services, and CPM text
  - Made conclusion after six meetings with more than 500 attendees
- Agenda 1.3 processed by ITU-R **WP5A**

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# Agenda 1.1

to consider additional spectrum allocations to the mobile service on a primary basis and identification of additional frequency bands for IMT and related regulatory provisions, to facilitate the development of terrestrial mobile broadband applications, in accordance with Resolution **233 (WRC-12)**;

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# *resolves* Part of ITU WRC Res.233

(condensed by presenter)

- 1 to study **additional spectrum requirements**, taking into account:
  - technical and operational characteristics of IMT systems, including the evolution of IMT through advances in technology and spectrally-efficient techniques, and their deployment;
  - the bands currently identified for IMT, the technical conditions of their use, and the possibility of optimizing the use of these bands with a view to increasing spectrum efficiency;
  - the evolving needs, including user demand for IMT and other terrestrial mobile broadband applications;
  - the time-frame in which spectrum would be needed;
- 2 to study **potential candidate frequency bands**, protection of existing services (include **sharing and compatibility studies** with services already having allocations in the potential candidate bands and in adjacent bands) and the need for harmonization,

# Resolve 1 of ITU WRC Res. 233

(to study additional [**global**] spectrum requirements)

- [The Report ITU-R M.2290](#)- “*Future spectrum requirements estimate for terrestrial IMT*” used for estimation and calculation is based on assumed traffic density figures intended to represent demand in the year 2020, taking into account the traffic off-loading from IMT networks to RLANs.
- The spectrum requirements are calculated using the updated methodology in Recommendation ITU-R M.1768-1. (for [the calculator](#) and [user guide](#) refer to the Report ITU-R M.2290)

User density settings	Total spectrum requirements (MHz)	Region 1		Region 2		Region 3	
		Already identified (MHz)	Additional spectrum requirements (MHz)	Already identified (MHz)	Additional spectrum requirements (MHz)	Already identified (MHz)*	Additional spectrum requirements (MHz)
<b>Low</b>	1 340	981-1 181	<b>159-359</b>	951	<b>389</b>	885-1 177	<b>163-455</b>
<b>High</b>	1 960	981-1 181	<b>779-979</b>	951	<b>1 009</b>	885-1 177	<b>783-1 075</b>



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# Resolve 2 of ITU WRC Res. 233

(Sharing and compatibility studies)

- **The frequency ranges as suitable for possible future deployment of IMT:**
  - 410-430 MHz, 470-790 MHz, 1 000-1 700 MHz, 2 025-2 110 MHz, 2 200-2 290 MHz, 2 700-5 000 MHz, 5 350-5 470 MHz and 5 850-6 425 MHz
- **administrations proposed to study the frequency bands:**
  - 470-694/698 MHz, 1 300-1 525 MHz, 1 695-1 710 MHz, 2 025-2 110 MHz and 2 200-2 290 MHz, 2 700-2 900 MHz, 2 900-3 100 MHz, 3 300-3 400 MHz, 3 400-3 600 MHz, 3 600-4 200 MHz, 4 400-4 900 MHz, 4 800-5 000 MHz, 5 350-5 470 MHz, 5 725-5 850 MHz, 5 925-6 425 MHz

# Frequency Bands Subdivisions Considered by JTG 4-5-6-7 Initially

410-430	1 427-1 452	2900-3100	4 800-5 000
470-698	1 427.9-1 462.9/ 1 475.9-1 510.9	3300-3400	5 350-5 470
470-790	1 452-1492	3400-3600	5 725-5 925
694-790	1 518-1559	3400-4200	5 850-6 725
1 300-1518	1 626.5-1 660.5	3600-3800	5 850-6 425
1 300-1527	1 668-1 675	3600-4200	5 925-6 425
1 300-1400	1695-1710	3700-4200	13400-14000
1 200-1600	2025-2110	3800-4200	18100-18600
1 429-1 518	2090-2110	4400-4500	27000-29500
1 427-1 525	2200-2215	4500-4800	38000-39500
1 375-1 400,	2700-2900	4400-4900	

# Frequency Bands Candidate by JTG 4-5-6-7 Finally

410-430	1 427-1 452	2900-3100	4 800-5 000
<b>470-694/698</b>	1 427.9-1 462.9/ 1 475.9-1 510.9	<b>3300-3400</b>	<b>5 350-5 470</b>
470-790	<b>1 452-1492</b>	<b>3400-3600</b>	<b>5 725-5 925</b>
694-790	<b>1 492-1525</b>	3400-4200	5 850-6 725
1 300-1518	1 626.5-1 660.5	<b>3600-3800</b>	5 850-6 425
1 300-1527	1 668-1 675	<b>3600-4200</b>	<b>5 925-6 425</b>
<b>1 300-1400</b>	<b>1695-1710</b>	3700-4200	13400-14000
1 200-1600	2025-2110	<b>3800-4200</b>	18100-18600
1 429-1 518	2090-2110	<b>4400-4500</b>	27000-29500
<b>1 427-1 525</b>	2200-2215	<b>4500-4800</b>	38000-39500
1 375-1 400,	<b>2700-2900</b>	<b>4400-4900</b>	

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# Method(s) to Satisfy the Agenda Item

- **Method A** – **No change**, which may be accompanied by reasons.
- **Method B** – **Make an allocation to the MS on a primary basis** (either by a new allocation or the upgrade of an existing secondary allocation) with a view to facilitate the development of terrestrial mobile broadband applications.
- **Method B – Table of Frequency Allocations (ToA)** - Make an allocation to the MS on a primary basis **in the Table of Frequency Allocations**.
- **Method B – Footnote (FN)** - Make an allocation to the MS on a primary basis **in a footnote**.
- **Method C** – **To identify the frequency band for IMT** either in a new or existing footnote. This Method can be applied individually if there is already a primary mobile allocation or in conjunction with Method B.

# Methods and options that may be applicable to the potential candidate frequency bands

<b>Number / Bands (MHz)</b>	<b>Method A</b>	<b>Method B-ToA</b>	<b>Method B-FN</b>	<b>Method C</b>
1 / 470-694/698	A1, A2, A3	B1, B2, B3	B4	C1, C2
2 / 1 350-1 400	A	B1	B1	C1a, C1b, C2
3 / 1 427-1 452	A			C1a, C1b, C2, C3
4 / 1 452-1 492	A			C1, C2, C3, C4
5 / 1 492-1 518	A			C1, C2, C3, C4
6 / 1 518-1 525	A			C1, C2, C3
7 / 1 695-1 710	A	B	B	C1
8 / 2 700-2 900	A	B1, B2	B1, B2	C1, C2
9 / 3 300-3 400	A	B1, B2	B1, B2	C1, C2
10 / 3 400-3 600	A	B1, B2, B3, B4, B5	B1, B2, B3, B4, B5	C1, C2, C3, C4, C5

## Methods and options that may be applicable to the potential candidate frequency bands

Number / Bands (MHz)	Method A	Method B-ToA	Method B-FN	Method C
11 / 3 600-3 700	A	B1, B2, B3	B1, B2, B3	C1, C2, C3
12 / 3 700-3 800	A	B1, B2, B3	B1, B2, B3	C1, C2, C3
13 / 3 800-4 200	A	B1, B2, B3	B1, B2, B3	C2, C2, C3
14 / 4 400-4 500	A			C1, C2
15 / 4 500-4 800	A			C1, C2, C3, C4
16 / 4 800-4 990	A			C1, C2
17 / 5 350-5 470	A			
18 / 5 725-5 850	A			
19 / 5 925-6 425	A			C1, C2, C3, C4

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# Decision of WRC-15

## for the frequency band 470-694/698 MHz

- A new footnote **5.295** added to identify the frequency band 470-608 MHz for IMT in five administrations in **Region 2**, subject to **9.21**;
- A new footnote **5.308A** added to identify the frequency band 614-698 MHz for IMT in seven administrations in **Region 2**, subject to **9.21**;
- A new footnote **5.296A** added to identify the frequency band 470-698 MHz for IMT in three administrations (Micronesia, the Solomon Islands, Tuvalu and Vanuatu) and 610-698 MHz in three other administrations (Bangladesh, Maldives and New Zealand) in **Region 3**, subject to **9.21**;
- WRC-15 developed an agenda for **WRC-23**, as **Resolution 235 (WRC-15)** “*Review of the spectrum use of the frequency band 470-960 MHz in **Region 1***” to carry out studies on spectrum need and sharing studies between mobile and broadcasting after a very long debates from SWG to Plenary

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# Decision of WRC-15

## for the frequency band 1 427-1 518 MHz

- A new footnote **5.341A** added to identify the frequency bands 1427-1452 MHz and 1492-1518 MHz for IMT in **Region 1**, subject to **9.21** respect to aeronautical mobile service used for AMT in accordance with No. **5.342**;
- A new footnote **5.346** added to identify the frequency band 1452-1492 MHz for IMT in many African and Arab countries in **Region 1**, subject to **9.21** respect to aeronautical mobile service used for AMT in accordance with No. **5.342**;
- A new footnote **5.341B** added to identify the frequency band 1427-1518 MHz for IMT in **Region 2**;
- A new footnote **5.341C** added to identify the frequency bands 1427-1452 MHz and 1492-1518 MHz for IMT in **Region 3**, subject to **9.21** respect to aeronautical mobile service;
- A new footnote **5.346A** added to identify the frequency band 1452-1492 MHz for IMT in **Region 3**, subject to **9.21** respect to aeronautical mobile service and protection BSS in accordance with Resolution **761 (WRC-15)**;



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# Decision of WRC-15

## for the C-band 3 300 – 3 700 MHz(1)

- A new footnote 5.429B added to identify the frequency band 3300-3400 MHz for IMT in 33 African administrations in **Region 1**, subject to protection of radiolocation service;
- Number of administrations in footnote 5.429 increased , in which the frequency band 3300-3400 MHz allocated to primary fixed and mobile in some **Regions 1** and **3** administrations, but not clearly identified to IMT;
- A new footnote 5.429D added to identify the frequency band 3300-3400 MHz for IMT in six administrations in **Region 2**, subject to **9.21** and protection of radiolocation service;
- A new footnote 5.429F added to identify the frequency band 3300-3400 MHz for IMT in six administrations in **Region 3**, subject to **9.21** and protection of radiolocation service;
- A new footnote 5.431B added to identify the frequency band 3400-3600 MHz for IMT in **Region 2**, subject to **9.21** and other conditions;

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# Decision of WRC-15

## for the C-band 3 300 – 3 700 MHz(2)

- The identification the frequency band 3400-3600 MHz in footnote **5.430A** extended from to whole **Region 1** (from 80 administrations);
- Number of administrations in footnote **5.432B** increased , in which the frequency band 3400-3500 MHz allocated to IMT in some **Region 3** administrations, subject to **9.21**;
- Number of administrations in footnote **5.433A** increased , in which the frequency band 3500-3600 MHz allocated to IMT in some **Region 3** administrations, subject to **9.21**;
- The footnote **5.431A** which elevates secondary mobile to primary mobile (except aeronautical mobile) in the band 3400-3500 MHz extended to whole **Region 2** (from some administrations), but not clearly identified to IMT;
- A new footnote **5.434** added to identify the frequency band 3600-3700 MHz for IMT in four administrations in **Region 2**, subject to **9.21** and other conditions;

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# Decision of WRC-15 for the frequency band 4 800-4 990 MHz

- A new footnote **5.441A** added to identify the frequency band 4800-4900 MHz for IMT in Uruguay only in **Region 2**, subject to agreement of neighbors;
- A new footnote **5.441B** added to identify the frequency band 4800-4990 MHz for IMT in Cambodia, Lao P.D.R. and Viet Nam in **Region 3**, subject to **9.21** and PFD limit;

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# Summary of WRC-15 Decision for Agenda 1.1

# WRC-15 Decision Changed Following Frequency Bands, nationally/Regionally

Number / Bands (MHz)	Method A	Method B-ToA	Method B-FN	Method C
1 / 470-694/698				C
2 / 1 350-1 400				
3 / 1 427-1 452				C
4 / 1 452-1 492				C
5 / 1 492-1 518				C
6 / 1 518-1 525				
7 / 1 695-1 710				
8 / 2 700-2 900				
9 / 3 300-3 400				C
10 / 3 400-3 600			B	C

# WRC-15 Decision Changed Following Frequency Bands, nationally/Regionally

Number / Bands (MHz)	Method A	Method B-ToA	Method B-FN	Method C
11 / 3 600-3 700				C
12 / 3 700-3 800				
13 / 3 800-4 200				
14 / 4 400-4 500				
15 / 4 500-4 800				
16 / 4 800-4 990				C
17 / 5 350-5 470				
18 / 5 725-5 850				
19 / 5 925-6 425				

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## Agenda 1.2

to examine the results of ITU-R studies, in accordance with Resolution **232 (WRC-12)**, on the use of the frequency band 694-790 MHz by the mobile, except aeronautical mobile, service in Region 1 and take the appropriate measures;

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# *resolves* Part ITU WRC Res.232

- 1 **to allocate the frequency band 694-790 MHz in Region 1** to the mobile, except aeronautical mobile, service on a co-primary basis with other services to which this band is allocated on a primary basis and to identify it for IMT;
- 2 that the allocation in *resolves* 1 is effective **immediately** after WRC-15;
- 3 that use of the allocation in *resolves* 1 is subject to agreement obtained under No. **9.21** with respect to the aeronautical radionavigation service in countries listed in No. **5.312**;
- 4 that **the lower edge of the allocation is subject to refinement at WRC-15**, taking into account the ITU-R studies referred to in *invites ITU-R* below and the needs of countries in Region 1, in particular developing countries;
- 5 that WRC-15 will **specify the technical and regulatory conditions** applicable to the mobile service allocation referred to in *resolves* 1, taking into account the ITU-R studies referred to in *invites ITU-R* below,



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# Issues Related to the Agenda 1.2

- **Issue A:** Option for the refinement of the lower edge
- **Issue B:** Technical and regulatory conditions applicable to the mobile service concerning the compatibility between MS and BS
- **Issue C:** Technical and regulatory conditions applicable to the mobile service concerning the compatibility between MS and ARNS for the countries listed in the footnote **5.312**
- **Issue D:** Solutions for accommodating applications ancillary to broadcasting requirements

# What JTG 4-5-6-7 Did?

- Revision of Recommendation ITU-R **M.1036** to include a 2×30 MHz FDD channelling arrangement (uplink (UL): 703-733 MHz, and downlink (DL): 758-788 MHz). This arrangement improved further before the conference to **A11** in recommendation
- Spectrum requirements for the DTTB broadcasting service in the band 470-862 MHz (in Report ITU-R BT.2302-0)
- The result of studies indicates that **the lower edge** of the frequency band **should be set at 694 MHz**

470 to 694

470 to 790

Spectrum requirement (MHz)	< 224	= 224	> 224 and < 320	= 320	> 320	Still to be determined
Required band IV/V 8 MHz TV channels	Fewer than 28	28	Between 28 and 40	40	More than 40	–
Number of administrations	4	39	8	16	3	16

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# Method(s) to Satisfy the Agenda Item

- **Issue A: Method A:** The refinement of the lower edge to 694 MHz
  - Option 1: Modification of Resolution **232 (WRC-12)** by WRC-15
  - Option 2: Addition of a new Resolution **XXX (WRC-15)**, Suppression of Resolution **232 (WRC-12)**
- **Issue B:** Conditions applicable to MS to protect BS
  - Methods **B1** (No change and GE06 is enough), **B2** (reference to ITU-R Recommendation by footnote for OOBE), **B3** (reference to a Resolution for OOBE) and **B4** (operation MS subject to **9.21** and providing OOBE and GB)
- **Issue C:** Conditions applicable to MS to protect ARNS for footnote **5.312**
  - Methods **C1** to **C5** for different studies and conditions by use of coordination distances or coordination trigger value
- **Issue D:** accommodating applications ancillary to broadcasting
  - Methods **D3** to **D1** (simple modification of 5.296 or with new footnote or with new Resolution)

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# WRC-15 Decision

- JTG 4-5-6-7 could not finalize OOBE and accumulated interference of MS UE on BS study
- consider the need of revising Resolution **224 (WRC-12)**.
- Method **A** option 2 selected that suppress Resolution **232** and adds a new Resolution **760 (WRC-15)**
- The new Resolution **760 (WRC-15)** provide protection of ARNS in 5.312 by use of coordination distance
- Footnotes **5.312** and **5.317A** modified to include 694-790 MHz and new Resolution
- For Issued **D**, the footnote **5.296** modified (Method **D3**)

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# Summary of WRC-15 Decision for Agenda 1.2

- The frequency band 694-790 MHz allocated to primary mobile service and identified for use by IMT in the new Resolution **760 (WRC-15)** in Region 1

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## Agenda Item 1.3 (broadband PPDR)

to review and revise Resolution **646 (Rev.WRC-12)** for **broadband public protection** and disaster relief (PPDR), in accordance with Resolution **648 (WRC-12)** (*indirect relation*);

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# *resolves* Part ITU WRC Res.646

(Title of Resolution: **Public protection and disaster relief**)

- 1 to strongly recommend to use **regionally harmonized bands** for PPDR;
- 2 to encourage, to consider the **following identified frequency bands/ranges or parts** thereof when undertaking their national planning:
  - in **Region 1**: 380-470 MHz as the frequency range within which the band 380-385/ 390-395 MHz is a preferred core harmonized band within certain countries of Region 1 which have given their agreement;
  - in **Region 2**: 746-806 MHz, 806-869 MHz, 4 940-4 990 MHz (except Venezuela);
  - in **Region 3**: 406.1-430 MHz, 440-470 MHz, 806-824/851-869 MHz, 4 940-4 990 MHz and 5 850-5 925 MHz (except some countries that use 380-400 MHz and 746-806 MHz);
- 7 to encourage to facilitate cross-border circulation of radiocommunication equipment intended for use in emergency/disaster relief through mutual cooperation and consultation without hindering national legislation;

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# Method(s) to Satisfy the Agenda Item

- **Method A:** No change to the Resolution **646 (Rev.WRC-12)**, except some editorial
- **Method B:** Revise the Resolution **646 (Rev.WRC-12)** to propose the requirements of broadband PPDR
- **Method C:** Revise the Resolution **646 (Rev.WRC-12)** to remove all referenced frequency bands/ranges for PPDR operations from to the latest version of the Recommendation ITU-R **M.2015**
- **Method D:** Resolution **646 (Rev.WRC-12)** to include a global tuning range and regional ranges and requirements of broadband PPDR. The details would be moved to the latest version of the Recommendation ITU-R **M.2015**



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## Result of ITU-R Studies (WP5A)

- ECC Report 199, APT/AWG/Report 38 Appendix 4 and Report ITU-R M.[PPDR] studies indicate a need for a spectrum bandwidth of 20 MHz (e.g. 10+10 MHz) or more in some countries for broadband PPDR.

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# WRC-15 Decision on agenda 1.3

- Combining the best of all methods. The resolves section of modified Resolution 646 says:
  - 1 Provides a worldwide frequency range **694-894 MHz**;
  - 2 Provides more harmonized regional frequency ranges:
    - in Region 1: 380-470 MHz
    - in Region 3: 406.1-430 MHz, 440-470 MHz and 4 940-4 990 MHz;
  - 3 Refers to the Recommendation ITU-R **M.2015** for further details
  - 4 Keeps other general *resolves* of former resolution intact
- The two Resolutions **644** and **648** were suppressed by embedding their elements into the new revision of Resolution **646**

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# Future Agenda Related to the Broadband (Resolution 809 (WRC-15))

- 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 **238 (WRC-15)**;
- Resolution **238 (WRC-15)**: Studies on frequency-related matters for **IMT 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 IMT for 2020 and **beyond**

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# ***resolves* Part ITU WRC Res.238**

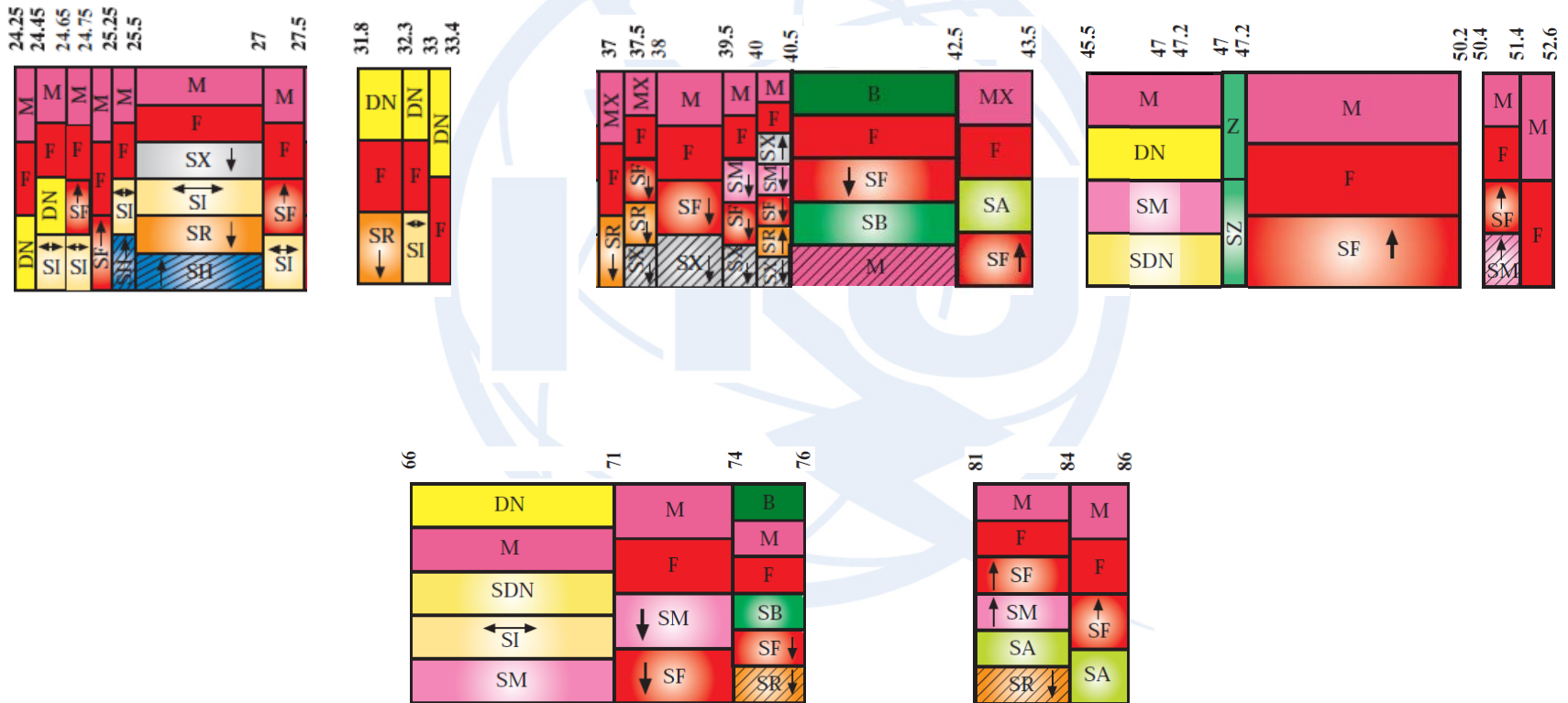
*(condensed by presenter)*

***resolves 1:*** to determine the spectrum needs for the terrestrial component of IMT in the frequency range between 24.25 GHz and 86 GHz

***resolves 2:*** to complete the appropriate sharing and compatibility studies, for the frequency bands:

- 24.25-27.5 GHz, 37-40.5 GHz, 42.5-43.5 GHz, 45.5-47 GHz, 47.2-50.2 GHz, 50.4-52.6 GHz, 66-76 GHz and 81-86 GHz, which have allocations to the mobile service on a primary basis; and
- 31.8-33.4 GHz, 40.5-42.5 GHz and 47-47.2 GHz, which may require additional allocations to the mobile service on a primary basis,

# Resolves 1 and 2 Spectrums



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**Thank You**