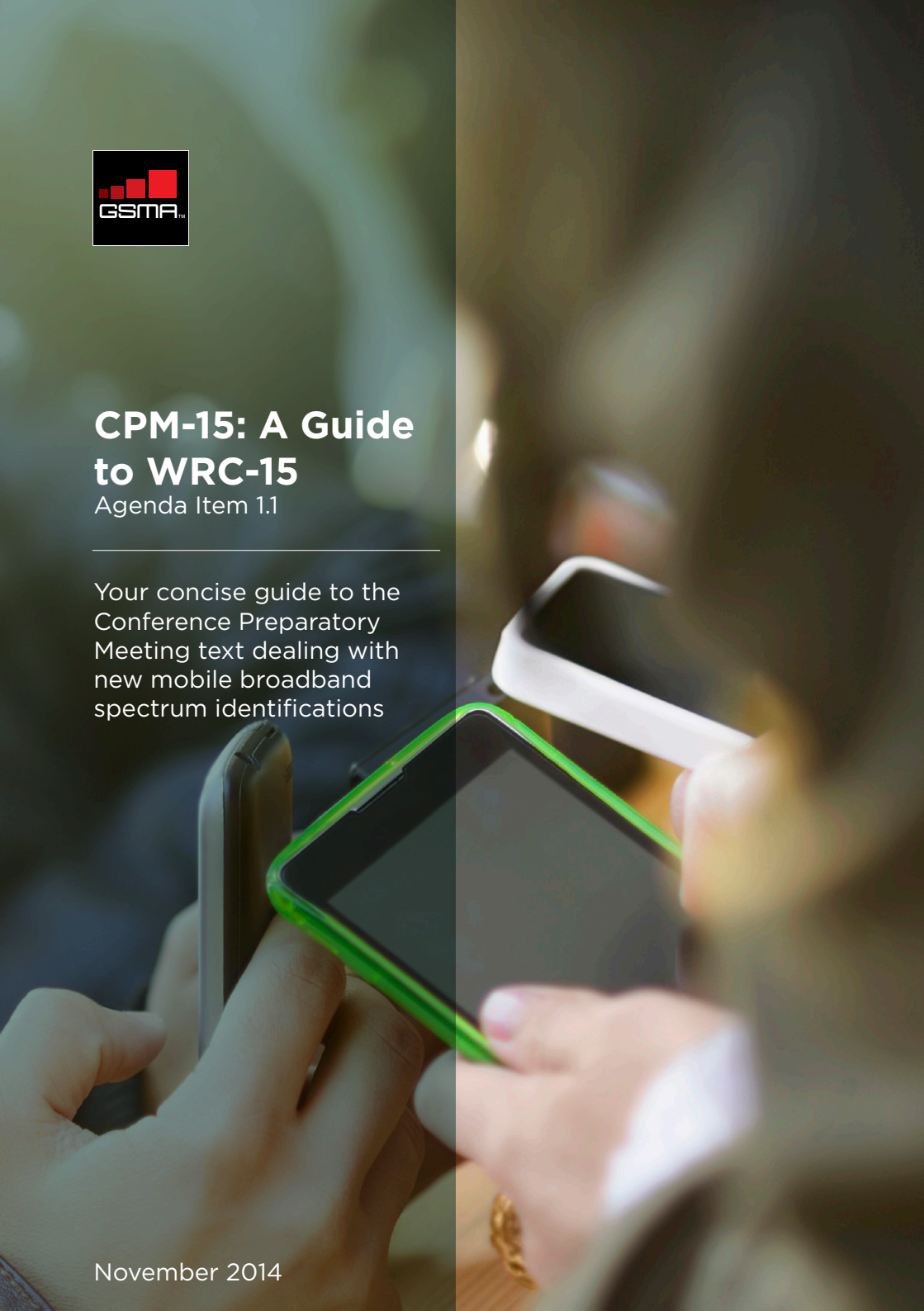


CPM-15: A Guide to WRC-15

Agenda Item 1.1

Your concise guide to the Conference Preparatory Meeting text dealing with new mobile broadband spectrum identifications

November 2014



About the GSMA Association

The GSMA represents the interests of mobile operators worldwide. Spanning more than 220 countries, the GSMA unites nearly 800 of the world's mobile operators with 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in industry sectors such as financial services, healthcare, media, transport and utilities. The GSMA also produces industry-leading events such as Mobile World Congress and Mobile Asia Expo. For more information, please visit the GSMA corporate website at **www.gsma.com**. Follow the GSMA on Twitter: **@GSMA**

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Executive Summary

In November 2015, the ITU's World Radiocommunication Conference (WRC) will determine access to additional future spectrum for mobile broadband for the coming decade. Before WRC-15 commences, a two-week Conference Preparatory Meeting (CPM) will be held, in March 2015, which will agree the scope of the discussion at the WRC itself.

At WRC-15, the most important issues for mobile broadband development will be discussed under two Agenda Items: 1.1 and 1.2[1]. This booklet concentrates on Agenda Item 1.1 which addresses the need to identify additional spectrum for IMT-based mobile broadband in harmonised global bands to meet rising data demands worldwide. It is important this spectrum is harmonized globally to lower equipment costs and maximise broadband growth.

The basis of the CPM meeting is the 650 page CPM text which is a compendium of the studies and reports by all the ITU-R groups that respond to the WRC Agenda Items.

This booklet serves as a summary of the key elements of the CPM text that deal with Agenda Item 1.1.

In line with the CPM text, this booklet addresses agenda item 1.1 by explaining the:

- Studies to highlight IMT spectrum demand
- Potential candidate bands to meet this demand
- Studies to assess the potential for spectrum sharing
- Methods to implement changes to the radio regulations

1. Agenda Item 1.2 focuses on finalising the use of the band 694-790 in Europe, the Middle East and Africa for IMT



The CPM text details the ITU studies which outline the importance of finding additional spectrum for IMT and concludes that countries will require 1340-1960 MHz for potential use by the year 2020. The GSMA's own separate study supports this finding and advises that, on average, 600-800MHz should be made available at WRC-15 so it can be ready for use by 2020.

In order to meet this spectrum demand, the CPM text offers 19 potential candidate bands, which include four core bands that the GSMA believes meet the requisite harmonization and sharing requirements. The text then details studies which show that sharing between IMT mobile broadband and incumbent services is possible in all of the 19 candidate bands.

Finally, the text gives Member State administrations three principle methods to satisfy Agenda Item 1.1 by delivering their view on the candidate band through changes (where necessary) to the ITU's radio regulations. The three main options are – no change to the existing radio regulations, allocation to the mobile service (either in the table itself or in a footnote) or identification for IMT.

GSMA CANDIDATE BANDS FOR MOBILE BROADBAND

- Sub-700MHz UHF (470-694/698 MHz)
- L-Band (1350-1400 & 1427-1518 MHz)
- 2.7-2.9 GHz
- C-Band (3.4-3.8 GHz & 3.8-4.2 GHz)

Studies to Highlight IMT Spectrum Demand

Access to mobile broadband spectrum for years to come will be agreed at the WRC in November 2015. Before that, the CPM must successfully agree the scope of the WRC-15 discussions to ensure the best possible outcome is achieved. Work starts now: the growth of mobile broadband will rely on a successful CPM.

WRC-12 defined WRC-15 Agenda Item 1.1 (AI 1.1) to address the identification of new bands for IMT-based mobile broadband. This was widely supported by Member States as it was accepted that growing mobile broadband traffic will urgently require additional spectrum in future.

In order to proceed with the Agenda Item, the ITU first needed to develop an estimate of the amount of future spectrum that might be needed. Previous research into the area had been carried out in 2006[2] - before the launch of the iPhone and the subsequent widespread use of smartphones. As such, a number of the assumptions were updated to accommodate the major changes in the mobile data market.

The resulting ITU-R Report M.2290 was designed to give guidance to countries considering their own spectrum needs. It was the culmination of a significant amount of work from administrations and the mobile industry. Other ITU-R work was also updated to guide the report including the methodology[3], traffic growth[4] and assumed technical aspects of the radio network[5].

ITU-R Report M.2290 estimated that between 1340MHz-1960MHz should be identified for IMT worldwide by 2020 to accommodate potential future mobile data growth. These 'higher' and 'lower' figures are designed to take into account the varying topographies and market conditions in different countries all over the world.

2. ITU-R Report M.2078
3. ITU-R Recommendation M.1768-1
4. ITU-R Report M.2243
5. ITU-R Report M.2289

Total Spectrum requirements for IMT in 2020[6]

	Pre-IMT and IMT 2000	IMT Advanced	Total Spectrum Requirement
Lower user density	440MHz	900MHz	1340MHz
Higher user density	540MHz	1420MHz	1960MHz

The approach used to model spectrum demand in the report is backed up by several separate, and independent, country-level analyses[7]. These calculations also show an urgent need to find extra spectrum for IMT at WRC-15 and fall along similar lines to the estimates in Report ITU-R M.2290.

In addition to the findings of ITU-R Report M.2290, the draft CPM text also outlines some region-specific figures which compare already-identified spectrum against the total spectrum requirements for IMT to derive the additional spectrum required for IMT. It is important to point out in this respect, that the fact that spectrum is identified at the ITU, does not mean it is necessarily available for use nationally or regionally.

Estimated additional spectrum requirements for IMT by the year 2020

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

*** NB – the ranges indicate differing identifications in countries with the region**

These additional spectrum requirements for IMT based on forecasted data growth are similar to those found in a study commissioned by the **GSMA**[8], which concluded that, on average, 600-800 MHz of additional spectrum would be needed for IMT by the year 2020.

ITU-R Report M.2290 was approved at the end of 2013 and is referenced in the CPM text. When analysing the spectrum estimates, it is important that Member States consider the necessary lead times between identifying spectrum for IMT at the WRC and actual deployment of systems in the identified spectrum. This process can take up to a decade so Member States compiling proposals for WRC-15 need to consider their requirements for the 2020-2025 timeframe.

6. ITU-R Report M.2290 p. 14
7. Summarised in annex 4 of Report ITU-R M.2290
8. 'Coleago Report on Spectrum Demand Model Results' available from GSMA website

Candidate Bands

The CPM must consider how future mobile broadband demand can be met through candidate spectrum bands.

However, it is important to note that spectrum allocation is a national issue. While the WRC process attempts to encourage spectrum harmonisation, countries always have the flexibility to make their own decisions regarding spectrum usage. Agreeing new globally harmonised bands at WRC does not mean that countries have to allocate that spectrum today (or even in the future). However, the success of mobile broadband has been built on the cornerstone of harmonisation and inclusion in the 'IMT family' of bands is vital to ensure mobile broadband growth.

The GSMA believes that the most likely bands to accommodate global harmonisation for IMT are:

- Sub-700MHz UHF (470-694/698 MHz)
- L-Band (1350-1400 & 1427-1518 MHz)
- 2.7-2.9 GHz
- C-Band (3.4-3.8 GHz & 3.8-4.2 GHz)

Finding suitable spectrum for both capacity and coverage is an important issue. The mobile industry needs high frequency spectrum for densely populated areas and lower frequency spectrum to provide wide-area coverage especially for rural areas.

The potential candidate bands for IMT at WRC-15 were identified in the Joint Task Group 4-5-6-7 (JTG 4-5-6-7). This included participation from the ITU-R Study Groups 4, 5, 6 and 7. In short, it involved representation from everyone who uses radio frequencies. This has led to a very large number of frequency bands being included into the CPM text and will mean that discussions on which bands to use for IMT will be extensive.

The table below shows a comparison of the number (and frequencies) of the bands included in the CPM text for WRC-15 compared to those at WRC-07.

WRC-15 Potential Candidate Bands	WRC-07 Candidate Bands	WRC-07 Identified Bands
1. 470-694/698 MHz 2. 1350-1400 MHz 3. 1427-1452 MHz 4. 1452-1492 MHz 5. 1492-1518 MHz 6. 1518-1525 MHz 7. 1695-1710 MHz 8. 2700-2900 MHz 9. 3300-3400 MHz 10. 3400-3600 MHz 11. 3600-3700 MHz 12. 3700-3800 MHz 13. 3800-4200 MHz 14. 4400-45 00 MHz 15. 4500-4800 MHz 16. 4800-4990 MHz 17. 5350-5470 MHz 18. 5725-5850 MHz 19. 5925-6425 MHz	1. 410 - 430 MHz 2. 450 - 470 MHz 3. 470 - 862 MHz 4. 2300 - 2400 MHz 5. 2700 - 2900 MHz 6. 3400 - 3600 MHz 7. 3600 - 3800 MHz 8. 3800 - 4200 MHz 9. 4400 - 4990 MHz	1. 450-470 MHz 2. 698-806 MHz (Region 2 & parts of Region 3) 3. 790-862 MHz (Region 1 and parts of Region 3) 4. 2.3-2.4 GHz 5. Parts of 3.4-3.6 GHz in a large number of countries

Studies to Assess the Potential for Spectrum Sharing

The sharing studies conducted by the ITU are aimed at improving efficient spectrum usage by exploring the possibility of sharing the same frequencies between different services.

The JTG ratified some, but not all, sharing studies that were input into its programme of work. Studies have shown that sharing is possible in all target IMT bands, depending on the scenarios assumed. This may be on the basis of geographical separation, frequency separation and/or other mitigation techniques. Finding solutions to sharing is essential to satisfy Agenda Item 1.1 as there is a clear need to demonstrate that existing services can be protected.

Sharing studies on the principal candidate bands for IMT have been carried out by a number of countries and industry members. They conclude:



Sub-700MHz UHF (470-694/698 MHz)

There are various techniques which can mitigate co-channel interference in the UHF band. However, it needs careful planning, including mitigation techniques such as antenna pointing. Studies[9] into the measures needed to prevent cross-border interference have indicated that separation distances between an IMT network and DTT receivers could be less than 20km with IMT antennas pointing away from the DTT coverage area.

L-Band (1350-1400 and 1427-1518 MHz)

As the use of this band varies in different regions it has been important to ensure that sharing between different services has been addressed. Two important in-country sharing possibilities are within the parts of the band used by radar systems and those used by fixed links.

In the case of radar, studies[10] have shown that the 1350-1400 MHz band can be used for IMT uplink (i.e. mobile transmissions). In many

9. JTG Chairman's Report 4-5-6-7/715 Annex 5
10. JTG Chairman's Report 4-5-6-7/715 Annex 25

countries that band is not greatly used for radar but for those that do, sharing is possible under certain conditions. These include band frequency separation and/or geographical separation such as exclusion zones around radar antennas.

In the case of fixed links, which occupy parts of the 1350-1527 MHz band in certain countries, studies again show potential sharing is possible[11]. Geographical and frequency separation options exist making this band a strong possibility for IMT. In countries which use the band for fixed links in rural areas, it is relatively straightforward to simultaneously use the band for IMT deployments in the urban areas where additional IMT spectrum is most urgently required.



2.7-2.9 GHz

The band is currently used for some civil and military air traffic control radars at fixed locations on the ground. Previous studies conducted for the 2.7-2.9 GHz band have concentrated on sharing the same frequencies between IMT and radar systems. However, sharing is more feasible if radar systems operate more spectrally efficiently and only use part of this large spectrum band[12] leaving IMT systems to operate in the other portion. In most countries, the use of this band by radars is extremely limited making it a good option for providing additional urban mobile broadband capacity. Even taking into account the costs of refarming existing radars, there are still clear economic benefits to the use of this band for IMT systems.



C-Band (3.4-3.8 / 3.8-4.2 GHz)

The use of the C-band (3.4-3.8 and 3.8-4.2 GHz) was studied at WRC-07 and an identification of part of this band for IMT was taken up by numerous countries but opposed by many others due to negative sharing studies. However, the previous sharing analysis between IMT and the Fixed Satellite Service (FSS) used pessimistic assumptions, and it is now clear that sharing is possible in this band[13] – and already happening in numerous countries – with geographic and/or frequency separation.

11. JTG Chairman's Report 4-5-6-7/715 Annex 10 & 26
12. JTG Chairman's Report 4-5-6-7/715 Annex 30
13. JTG Chairman's Report 4-5-6-7/715 Annex 17

Methods to Implement Changes to the Radio Regulations

The CPM and WRC will consider how to satisfy Agenda Items through revisions of the Radio Regulations. The manner in which a solution to revise the ITU's Radio Regulations is reached is referred to as a Method. This part of the CPM text is designed to help administrations develop their positions and proposals for the WRC which involves proposing or opposing changes to the Radio Regulations.

For Agenda Item 1.1, three methods were proposed by the JTG to allow Member States to represent their view on a candidate band. These are:

Method A: No change to the existing Radio Regulations

Method B: Allocation to the mobile service (either by)
- B1: Inclusion of allocation in table of allocations
- B2: Inclusion of allocation via footnote

Method C: Identification for IMT

For the **GSMA** target bands, an identification for IMT (Method C) is recommended and, if it does not already exist, an allocation to the mobile service (Method B).

There are specific guidelines within the CPM text[14] as to how these Methods could be implemented for each band.

14. CPM text Section 6

Conclusion

Before the CPM in March 2015, regulators and the IMT industry will meet at national and regional meetings to discuss the best path for advancing Agenda Item 1.1. ITU studies,[15] as well as a variety of other independent research, show that their plans need to ensure that around 1340-1960 MHz is identified for IMT by 2020 to meet mobile data demands.

Unless regulators work together to achieve this vital goal at WRC-15, they may find themselves powerless to prevent slowing mobile networks in future and all the negative socioeconomic impacts this will have on their countries.

This booklet, along with **GSMA**'s document on 'Mobile spectrum requirements and target bands for WRC-15'[16] underline the principal arguments and counter-arguments that will be discussed during the CPM, and ultimately at the WRC. If you require any further information please do not hesitate to get in touch on **spectrum4all@gsma.com**.

AGENDA ITEMS AT WRC-15

WRC-15 will address spectrum provisions for all types of wireless services under a large number of Agenda Items. The table overleaf provides a high level description of the Agenda Items which are considered in the CPM text and notes any impact on mobile (if any).

15. M.2290
16. Available from the GSMA website

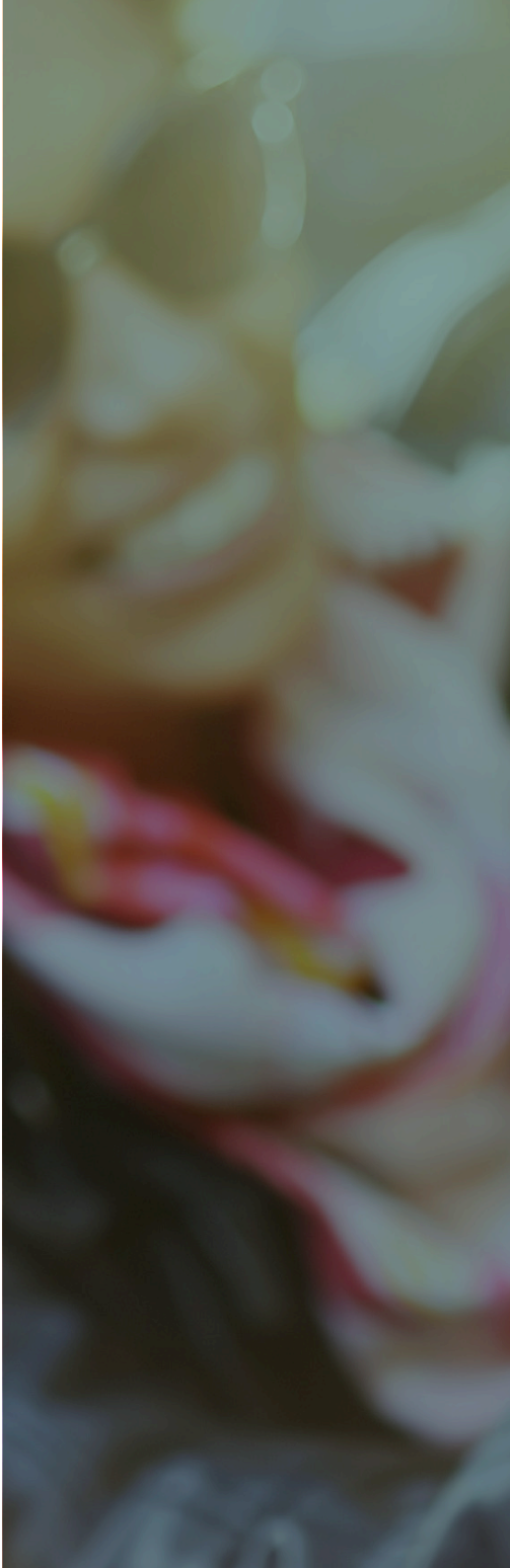
This table gives a brief breakdown of all the Agenda Items.

Brief breakdown of Agenda Items at WRC-15

AI	Outline	Considerations for mobile
1.1	To agree new spectrum for mobile and IMT	The most important Agenda Item for mobile globally
1.2	To allow Region 1 allocation of 694-790MHz for mobile	The allocation will improve the overall quality of mobile services and support the growth of mobile broadband in region 1 especially in developing markets, rural areas and deep inside buildings. It will also establish a globally harmonized LTE 700MHz band
1.3	To consider changes to the resolution specifying spectrum for Public Protection and Disaster Relief (PPDR)	Proposals expected to specify additional frequencies for PPDR. This is a valuable service but it is important it does not interfere with harmonised IMT spectrum
1.4	To look at new spectrum for amateur radio in the 5 GHz band	
1.5	To look at using some fixed satellite bands for unmanned aircraft	
1.6.1	To consider 250MHz more spectrum for fixed satellite in 10-17GHz in Region 1	This spectrum is currently used for cellular backhaul
1.6.2	To consider 250MHz more spectrum for fixed satellite in Region 2 & 3 in 13-17GHz	This spectrum is currently used for cellular backhaul
1.7	To review spectrum use at 5GHz by fixed satellite service	
1.8	To review regulations of earth stations on vessels	
1.9.1	To consider new fixed satellite service allocations in the 7 & 8GHz bands	This spectrum is currently used for cellular backhaul
1.9.2	To consider more spectrum for maritime mobile in the 7 & 8 GHz bands	This spectrum is currently used for cellular backhaul

1.10	To consider more mobile satellite spectrum in 22-26GHz	This spectrum is currently used for cellular backhaul
1.11	To consider more earth exploration satellite service at 7-8 GHz	
1.12	To consider 600 MHz more spectrum for earth exploration satellites at 8-9 GHz	
1.13	To consider changing regulations for space research service	
1.14	To consider achieving a universal time reference or 'universal clock'	
1.15	To consider spectrum demands for maritime mobile	
1.16	To consider regulations and spectrum for Automatic Identification System (AIS)	
1.17	To consider spectrum for wireless avionics	
1.18	To consider the 77 GHz band for automotive	
2-9	Stock Agenda Items which deal with regulatory provisions and are at all WRCs	9.1.5: Addresses regulatory provisions for the Fixed Satellite Service (FSS) which may significantly impact IMT by potentially giving satellite services in the C-band protected status on safety-of-life grounds
10	To recommend future WRC Agenda Items	A perennial Agenda Item but will be important to the growth of future communications services. It was keenly contested at WRC-12

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