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Implications of WRC-15 on spectrum and 5G

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Abstract

The last World Radiocommunication Conference of the International Telecommunications Union took place in Geneva in November 2015. This deliverable presents a summary of the decisions taken during the conference and how the decisions are linked to the most relevant European spectrum policies. It overviews the definition of the agenda items for the next WRC in 2019 and the frequency bands identified as candidates for the development of 5G systems.

1 Introduction

The World Radiocommunications Conference (WRC) of the International Telecommunications Union (ITU) took place in Geneva last November 2015.

More than 3200 representatives from 162 Member States of the ITU addressed about 33 Agenda Items on radio spectrum issues of worldwide interest. The revisions of the Radio Regulations have been compiled in the Final Acts [xx] signed by the ITU members including the 28 Member States of the European Union.

This concluded the nearly 4-year preparation process for the EU Member States within CEPT and ITU-R Working Groups. For a complete preparation of a WRC and to meet EU interests, it is essential for EU Member States to include the view and polices on spectrum issues with community relevance.

The Radio Spectrum Policy Programme (RSPP), established in 2012 by the European Union, defines key policy objectives and sets up general principles for managing radio spectrum in the internal European market[12].

This programme supports the goals and key actions of the Europe 2020 initiative and the Digital Single Market and in particular focuses on efficient use of spectrum; promoting investment, competition and innovation; eliminating the digital divide; and protecting general interest objectives such as cultural diversity and media pluralism.

The RSPP covers all types of radio spectrum use that affect the internal market and sets general regulatory principles, policy objectives and priorities. The programme aims to enhance the efficiency and flexibility of spectrum use, as well as preserving and promoting competition. By supporting specific spectrum needs (such as for wireless broadband communications, transport, environment protection, Earth surface monitoring or research and space exploration), the RSPP objectives are rooted in the overall goals of the EU's Radio Spectrum Policy.

In December 2013 the European Commission launched the 5G Infrastructure Public Private partnership (5G-PPP) to deliver solutions, architectures, technologies and standards for the ubiquitous next generation communication infrastructures thereby ensuring Union's leadership within the global context. In February 2015 the5G-PPP released its 5G vision [13], which also contains considerations on spectrum requirements for access and backhaul, including wireless broadband above 6GHz and spectrum management methods.

It is then crucial to represent EU spectrum interests at the WRC.

This document starts with a review of the ITU's structure and operation, followed by the aims of the WRC. European preparations for the WRC-15, and the links between agenda items and relevant EU policy objectives are described. The outputs of the WRC-15 and the new agenda items for the WRC-19 are analysed with respect to EU policies. Finally, the agenda items related to JRC E.2 Unit-Corsa Sector work programme are evaluated.

2 International Telecommunications Union

The International Telecommunications Union is the leading United Nations agency for information and communication technology and the global focal point for governments and the private sector in developing networks and services. ITU provides an international forum for over 190 Member States and more than 700 Sector Members and Associates from industry, international and regional organizations, and academia to collaborate for the worldwide improvement and rational use of telecommunications and radiocommunications.

ITU fulfills this fundamental mission through its three Sectors: the Radiocommunication Sector (ITU-R), the Telecommunication Standardization Sector (ITU-T) and the Telecommunication Development Sector (ITU-D).

ITU-R Sector works towards a worldwide consensus in the use of space and terrestrial radio-communication services and a vast and growing range of wireless services, including popular new mobile communication technologies.

ITU-R plays an essential custodian role in the management and coordination of the radio-frequency spectrum and satellite orbits, finite natural resources that are increasingly in demand for a growing number of services such as fixed, mobile, broadcasting, amateur, space research, meteorology, global positioning systems, monitoring and communication services that ensure safety of life on land, at sea and in the skies. In its role as global spectrum coordinator, the Radiocommunication Sector develops and adopts the “ITU Radio Regulations” – a voluminous set of rules that serve as a binding “international treaty” governing the use of the radio-frequency spectrum and the geostationary-satellite and non-geostationary-satellite orbits adopted by more than 190 Member States, and by some 40 different services around the world.

The Sector also operates, through its Radiocommunication Bureau, as a central registrar of international frequency use, maintaining the “Master International Frequency Register” (MIFR) that currently includes around 1265000 terrestrial frequency assignments, 325000 assignments servicing 1400 satellite networks and another 4265 assignments related to satellite earth stations.

In addition, ITU-R is responsible for coordinating efforts to ensure that the communication, broadcasting and meteorological satellites in the world's increasingly crowded skies can co-exist without causing harmful interference to one another's services. In this role, the ITU facilitates agreements between both operators and governments and provides practical tools and services to help national frequency spectrum managers carry out their day-to-day work.

3 World Radiocommunications Conference

The World Radiocommunication Conference (WRC) is held every three to four years. The job of WRC is to review and revise the Radio Regulations. Revisions are made on the basis of an agenda determined by the ITU Council, which takes into account recommendations made by previous world radiocommunication conferences.

The general scope of the agenda of world radiocommunication conferences is established four to six years in advance, with the final agenda set by the ITU Council two years before the conference, with the concurrence of a majority of Member States.

Under the terms of the ITU Constitution, a WRC can:

- revise the Radio Regulations and any associated Frequency assignment and allotment Plans;
- address any radiocommunication matter of worldwide character;
- instruct the Radio Regulations Board and the Radiocommunication Bureau, and review their activities;
- determine Questions for study by the Radiocommunication Assembly and its Study Groups in preparation for future Radiocommunication Conferences.

On the basis of contributions from administrations, the Special Committee, the Radiocommunication Study Groups, and other sources concerning the regulatory, technical, operational and procedural matters to be considered by World and Regional Radiocommunication Conferences, the Conference Preparatory Meeting (CPM) shall prepare a consolidated report to be used in support of the work of such conferences.

4 European preparation for WRC

All EU Member States are members of the ITU and play an active part in the evolution of the Radio Regulations. The European Union is a Sector Member, a status similar to industry organizations.

A strategic and coherent EU spectrum policy is a key element of a modern information society and helps facilitate a wide range of policy objectives. The European Parliament and the Council have recognised the importance of radio spectrum in Directive 2002/21/EC of 7 March 2002 on a common regulatory framework for electronic communications networks and services [1] (hereinafter the "Framework Directive") and in Decision 243/2012/EU on establishing a multiannual Radio Spectrum Policy Programme to frame the development of spectrum policy within the European Union[2]. One salient provision in the Framework Directive [3] requires the Radio Regulations of the ITU (International Telecommunication Union) to be respected, which clearly makes it necessary for the EU to maintain close coordination in international forum on spectrum in order to promote its interests. In addition, the Radio Spectrum Decision 676/2002/EC requires that activities undertaken under that Decision take due account of the work in the ITU.

It is therefore essential that decisions made at WRC enable the Union to exercise its internal competence to implement the internal market and to develop appropriate policies. In that context, it is necessary for the Union to ensure that its interests are promoted and protected during the WRC negotiations.

EU Member States negotiate in the ITU as independent members of the organisation. In practice, they choose to develop their technical positions together within CEPT (*Conférence Européenne des Postes et Télécommunications)*, before negotiating with the rest of the world on the basis of consolidated European positions ('European Common Proposals').

The CEPT is an organization where policy makers and regulators from 48 countries across Europe collaborate to harmonise telecommunication, radio spectrum, and postal regulations to improve efficiency and coordination for the benefit of European society.

It seeks to deliver greater efficiency through the effective coordination of its work to create a dynamic market in the field of European posts and telecommunications.

While CEPT is effective in developing the detailed European negotiating positions required for a technical-regulatory conference like WRC, it must be recalled that Member States are bound by their obligations under the EU Treaties and by the *acquis*.

Inside CEPT, the Electronic Communications Committee's Conference Preparatory Group (ECC/CPG) is responsible for developing briefs, studies and European Common Proposals under each agenda item for submitting to the WRC.

Therefore, the development of technical positions in CEPT needs to be complemented by the consideration of overall EU interests in the negotiations. To support this, and in line with the provisions of the Framework Directive, the Commission has requested the Radio Spectrum Policy Group (RSPG), a high-level advisory body of Member States' representatives, to provide an Opinion advising the Commission on the European policy interests at stake at this conference. The RSPG adopted its Opinion on 19 February 2015 after a public consultation [4]. In addition, a workshop co-organised by CEPT and the Commission took place in Brussels on 10 December 2015 with wide participation from stakeholders [5].

Apart from the instances where a common position is determined in accordance with Article 218(9) TFEU, Member States should also develop common actions and closely cooperate regarding other agenda items, throughout the negotiation process in order to ensure that decisions are taken that support Union policies and initiatives.

For this purpose, the Commission ensures the coordination of EU positions following the Council Decision for a mandate and will support the coordination of policy approaches on the basis of the endorsement of EU policy objectives by Parliament and Council in advance of WRC-15 and will monitor Europe's involvement in the process.

Apart from CEPT, there are other five regional telecommunications organizations in the world:

- CITEL, Inter-American Telecommunication Commission
- ASMG, Arab Spectrum Management Group
- ATU, African Telecommunications Union
- RCC, Regional Commonwealth in the Field of Communications
- APT, Asia-Pacific Telecommunity

The aim of the regional groups is to study and review issues associated with each WRC agenda item, to then harmonize views and develop common proposals for the WRC. At regional level, the national spectrum authorities coordinate their positions. Inside each national delegation, there are participants from many sectors of industry and administration.

ITU-R Study Groups and Working Parties are the forum where international development and coordination takes place prior to the WRC. See Figure 1.

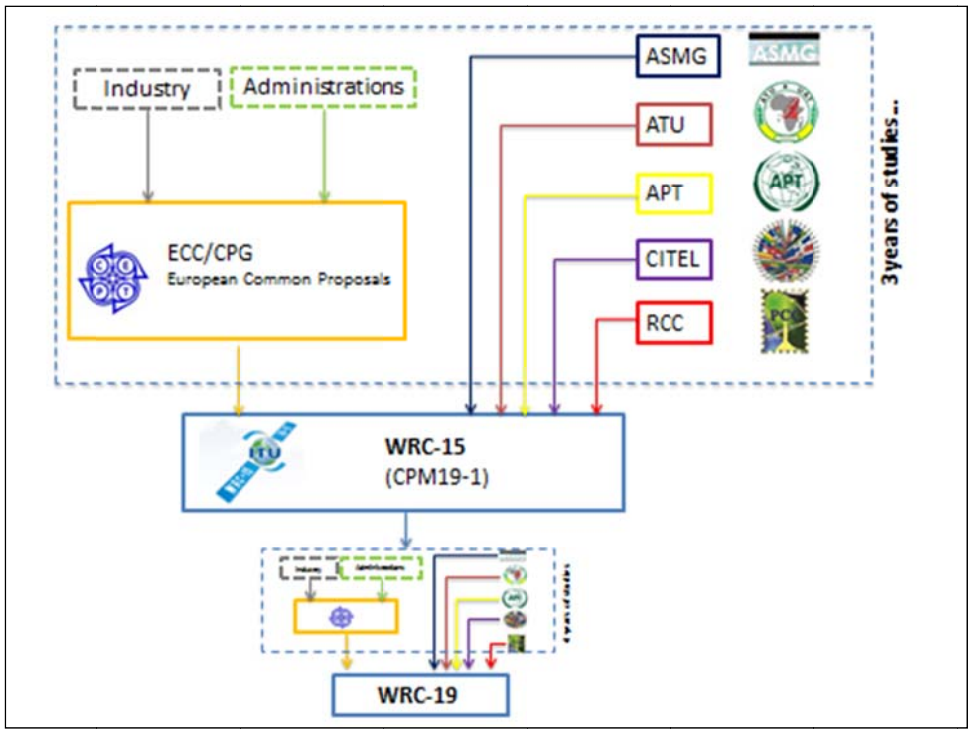

Figure 1 International coordination prior to WRC

5 WRC-15 Agenda Items and their importance for EU policies

Spectrum has a strong EU policy dimension, as it affects the internal market in general as well as research, transport, climate change or trans-European networks, areas that are subject to shared or concurrent competence. In all these areas, situations could arise where the Union has an exclusive competence in particular when common rules may be affected, which could be the case here because of the binding effect of the Radio Regulations.

In this section, the agenda items are linked to the relevant EU policy objectives, considering the advice from RSPG.

5.1 Agenda item 1.1: More spectrum for wireless broadband

EU Policy: Digital Single Market

In the Radio Spectrum Policy Programme of 2012, the Union established that a minimum bandwidth of 1200 MHz should be made available for wireless broadband. The ITU has a similar process where spectrum targets are identified and to this end certain spectrum bands are identified for International Mobile Telecommunications (IMT). There are bands harmonised for wireless broadband in the EU that are not at present IMT bands. There is also spectrum where the EU legislative process has started and where a technical harmonisation decision may be taken. Non-EU ITU Members are likely to propose that the band 470-694 MHz, used for broadcasting in Europe, should be made co-primary, meaning that mobile systems can also use the band. As was shown in the Report to the Commission by Mr Pascal Lamy on the work of the High Level Group on the UHF band, half of the households of the EU rely on terrestrial broadcasting in this band. The proposed position is in line with the Opinion of the RSPG.

EU policy objective

The band 3400-3800 MHz, already harmonised for wireless broadband in Europe, should be supported as a worldwide mobile allocation/identification for IMT.

The band 1427-1518 MHz, where the middle part (1452-1492) is intended for EU harmonisation should be supported as identification for IMT.

The band 5350-5470 MHz, where a possible technical harmonisation in the EU is under consideration, should not be supported for allocation to the mobile service at WRC-15, as the necessary conditions ensuring no interference with the Copernicus system have not yet been identified. The Union should however support retaining the issue for WRC-19, as there is a major research effort in motion aiming at successful coexistence and it is too early to discount the success of this process.

The band 5725-5850 MHz, where a possible technical harmonisation in the EU is under consideration, should not be supported for allocation to the mobile service at WRC-15.

The band 5850-5925 MHz, where a possible technical harmonisation in the EU is under consideration, should not be supported for identification to IMT at WRC-15.

For all three bands 5350-5470 MHz, 5725-5850 MHz and 5850-5925 MHz, technical compatibility studies are still not completed and a considered position will only be possible at WRC-19.

The Union should not support the co-primary allocation to the mobile service of the band 470-694 MHz.

The Union should not support the co-primary allocation to the mobile service of the band 3800-4200 MHz given the need to support the densification of satellite use of the band.

5.2 Agenda item 1.2: 700 MHz

EU Policy: Digital Single Market

The WRC-12 decided to allocate the 700 MHz band on a co-primary basis to both broadcasting and the mobile service, and identify it for IMT, taking effect after WRC-15. The remaining issues to resolve in the lead time until WRC-15 are setting the exact lower edge of the band and establishing the coexistence parameters where diverging uses have cross-border implications. The Union has started the legislative process to set the necessary technical parameters in Union law as well. This technical harmonisation process does not constitute a decision to change the use of the band. The proposed position is in line with the Opinion of the RSPG.

EU policy objective

The EU should support that the lower edge of the 700 MHz band be set at 694 MHz and that requirements for protection of the broadcasting service below the 694 MHz band edge are commensurate with the results of studies at Union level. The EU should also support regulatory provisions for the balanced coexistence between wireless broadband and the diminishing use of aeronautical radionavigation systems at its eastern border, with the aim of enabling wireless broadband to effectively cover the entire territory of the EU. All obligations to protect digital broadcasting under the GE-06 agreement should remain in force and no further obligations should be added at the conference.

5.3 Agenda item 1.3: Spectrum for Public Protection and Disaster Relief

EU policy: Digital Single Market (partial)

The WRC-12 established this agenda item as an attempt to harmonise the spectrum used by public services to deliver public protection and disaster relief (PPDR). This would be a massive undertaking given the baseline situation of extremely fragmented spectrum use, even within Europe. At the worldwide level, a modest approach is more realistic. The proposed policy objective is in line with the Opinion of the RSPG.

EU policy objective

The EU should support that relevant information be provided to the ITU on regional PPDR frequency ranges, with no obligation on use of a specific technology and specific frequency band.

5.4 Agenda item 1.5: unmanned aircraft systems, Agenda item 1.15: maritime onboard communication, Agenda item 1.16: maritime Automatic Identification Systems (AIS) and Agenda item 1.17: Wireless Avionics Intra Communication onboard aircraft.

EU Policy: Transport

Agenda Item 1.5 concerns how to insert remotely piloted aircraft systems (RPAS) into non-segregated airspace, i.e. where normal air traffic control rules apply. This is necessary to enable these systems to be used efficiently for civilian purposes. These can include uses such as search and rescue and border patrol over the Mediterranean, identifying the extent of forest fires, when flying manned aircraft is too risky, delivering supplies in difficult terrain and establishing the effects of climate change. The specific issue at this conference is the possible use of certain bands allocated to the fixed satellite service for control and non-payload communications of RPAS beyond line-of-sight. Satellite communication is necessary to achieve the range required.

Agenda Item 1.15 addresses congestion in on-board communications in ships in ports. The proposed solution is to establish narrower channels in the existing spectrum.

Agenda Item 1.16 concerns the work done in cooperation with the International Maritime Organisation to facilitate new Automatic Identifications Systems in the context of the Global Maritime Distress and Safety System. A new concept, VHF Data Exchange Systems (VDES) is envisaged to enable this

Agenda Item 1.17 concerns using radio communications to replace wiring inside aircraft. This brings benefits in terms of weight, lowering fuel consumption and/or increasing the carrying capacity of the aircraft in question. For obvious reasons this allocation must have a worldwide basis and the band 4200-4400 MHz has been identified as a suitable candidate.

The proposed policy objectives are in line with the Opinion of the RSPG.

5.5 New Agenda item on Inflight Tracking Following the ITU Plenipotentiary Conference in 2014

Following the disappearance of the Malaysian Airlines Flight 370, there have been renewed calls for a worldwide inflight tracking systems, also covering the Oceans and the polar area. Several companies are promoting their solutions and would like a decision at WRC tailored to their design. It will be important to define the scope of an inflight tracking system before any decision is taken at the WRC level. It seems unlikely that this process can be accomplished before the Conference in November.

EU policy objective

For Agenda Item 1.5, the EU should support the use of the bands allocated to the fixed-satellite service for the control communications of unmanned aerial systems whilst not compromising the current coordination and notification procedure of other satellite networks in the band.

For Agenda Items 1.15 and 1.16 the EU should support the modifications necessary to enable the envisaged improvements is support of the maritime sector.

For Agenda Item 1.17, the EU should support the global harmonisation for WAIC in the 4200-4400 MHz band, while protecting radio altimeters operating in the band.

For new Agenda Item on inflight tracking, the EU should ensure that any future system is defined appropriately and should avoid a premature decision at this WRC unless this is accomplished.

5.6 Agenda item 1.18 Automotive Anti-Collision Radars

EU Policy: Transport

The Agenda Item envisages allocating the band 77.5-78 GHz to radiolocation (radar), creating a contiguous band usable for automotive anti-collision radars. In the EU, the band 76-81 GHz is already harmonised for this purpose.

EU policy objective

The EU should support the allocation of the band 77.5-78 GHz to the radiolocation service to facilitate the global deployment of automotive short-range radars.

5.7 Agenda item 1.6: More spectrum for the fixed satellite service, Agenda item 1.7: Reviewing the use of the bands 5091-5150 MHz by mobile satellite service feeder links, Agenda item 1.8: Review of the regulatory arrangements for earth stations on vessels

EU Policy: Space Policy

Under Agenda Item 1.7, the mobile satellite service feeder links (which operate in this context as a fixed satellite service) have used the band 5091-5150 MHz which has been intended as an extension band for microwave landing systems for aircraft. There has however been no need for using this band by the aeronautical sector.

Agenda Item 1.8 envisages relaxing some regulatory constraints applicable to Earth Stations onboard Vessels operating in the fixed satellite service in the bands 5925-6425 MHz and 14-14.5 GHz. Relaxing the requirements can support the European space and maritime industries.

EU policy objective

The EU should support the relaxation of the requirements under Agenda Item 1.7 enabling continuing use by the mobile satellite service and under Agenda Item 1.8 improving the conditions for Earth Stations on-board Vessels.

5.8 Agenda item 1.11 and Agenda item 1.12: More spectrum for Earth Exploration Satellites

EU Policy: Research and Climate Change

Agenda Item 1.11 considers a primary allocation for the Earth Exploration Satellite Service in the Earth to Space direction within the band 7-8 GHz, while Agenda Item 1.12 concerns extending the existing allocation for the Earth Exploration Satellite Service (active, i.e in both directions) in the band 9300-9900 MHz by up to 600 MHz. This latter Agenda Item is of interest to the European Copernicus programme.

EU policy objective

Under Agenda Item 1.11, the EU should support the requested allocation while ensuring adequate protection of the existing radio communications services in the band.

Under Agenda Item 1.12, the EU should support the primary allocation to the Earth Exploration Service in the band 9200-9300 MHz and 9900-10400 MHz, with the provision that this extension shall only be used for systems which need a bandwidth greater than 600 MHz.

5.9 Agenda item 10: Future WRC Agenda Items

Every WRC sets the agenda for the next conference. Two items stand out as of EU policy interest.

EU policy objective

The EU should support an agenda item at WRC-19 addressing the spectrum needs for 5G mobile systems with the focus above 6 GHz for new allocations.

The EU should also support the retention of an agenda item regarding the possible use of 5350-5470 MHz and the band 5725-5925 MHz for IMT, including Radio Local Area Networks (i.e. Wi-Fi), taking into account studies showing that protection of the Copernicus system can be ensured.

5.10 Council conclusions on the European positions for the WRC15

In case of WRC-15, "*the Council of the European Union expressed its broad support for the following objectives to be achieved at the conference in view of the successful implementation for relevant Union policies [6]:*

a) Under agenda item 1.1:

i. To identify the band 1452-1492 MHz, and adjacent bands 1427-1452 MHz and 1492-1518 MHz for International Mobile Telecommunications (IMT) while protecting passive services below 1427 MHz. This identification does not preclude the use of these bands by any applications, including defence, of the services to which they are allocated, nor establish priority in the Radio Regulations;

ii. To allocate the band 3400-3800 MHz on a co-primary basis to the mobile service and identify it for IMT, taking into account that the band plays an important role for satellite communications ;

iii. To support no change to allocations in the band 470-694 MHz in Europe.

iv. To neither add the co-primary allocation to the mobile service of the bands 5350-5470 MHz and 5725-5850 MHz nor identify for IMT those bands as well as the band 5850-5925 MHz, while studying these three bands further with a view to consider their use for radio local area networks and ensuring that primary use is protected in all cases.

b) Under agenda item 1.2:

i. To set the lower band edge at 694 MHz and support ITU-R recommendations for protection levels for the broadcasting service below 694 MHz commensurate with the results of the studies performed by the European Conference of Postal and Telecommunications Administrations;

ii. To ensure balanced coexistence between wireless broadband and broadcasting, based on the GE-06 agreement, and not add additional constraints for the protection of broadcasting in the band 694-790 MHz;

iii. To ensure balanced access between mobile service and aeronautical radionavigation services (ARNS) at the borders of the eastern Member States, so as to facilitate the deployment of mobile services in all EU countries through appropriate regulatory provisions of the radio regulations, while favouring the smallest effective separation distances between ARNS and IMT and supporting the rights of the EU eastern Member States in this regard.

c) Under agenda item 1.18, to allocate the band 77.5-78 GHz to radiolocation service to facilitate the deployment of automotive radars without introducing excessive restrictions, and to recognise that radio astronomy stations should continue to benefit from protection;

d) Under agenda item 10, to support an agenda item for WRC-19 addressing the spectrum needs for 5G mobile systems, with the focus above 6 GHz for new allocations and a common approach to launch related compatibility studies ahead of WRC-19;"

6 WRC-15 outputs regarding EU common policy objectives

This section summarises the outputs of the WRC-15 regarding the Council conclusions [10].

6.1 Agenda item 1.1.

"to consider additional spectrum allocations to the mobile service on a primary basis and identification of additional frequency bands for International Mobile Telecommunications (IMT) and related regulatory provisions, to facilitate the development of terrestrial mobile broadband applications, in accordance with Resolution 233 (WRC 12)". It focused on possible new mobile service allocation and identification of bands for IMT and relevant updates of the RR:

A total of 19 frequency bands had been identified as possible candidate bands for IMT. None of these bands (ie. 1350-1400 MHz, 2025-2110 MHz, 2700-2900 MHz, 4400-4990 MHz, 5350-5470 MHz, 5725-5850 MHz), nor any of those addressed by the Council conclusions (ie. 5350-5470 MHz, 5725-5850 MHz, 5850-5925 MHz), have been allocated to the mobile service or identified for IMT.

No change in the band 470-694 MHz as invited by the Council conclusions. WRC-15 concluded that a review of the wider UHF band (470 – 960 MHz), to assess broadcasting and mobile usage, should be done for consideration at WRC-23. This is completely in line with the European strategy regarding the future of the UHF band as developed and recommended by the Lamy report to the European Commission and in the RSPG opinion on the UHF band [7].

The frequency bands 3400-3800 MHz and 1452-1492 MHz are already harmonised in the EU under the Radio Spectrum Decision7. These harmonisation measures setting the technical conditions for the usage of these spectrum bands within Member States were not affected by the results of WRC-15. Furthermore the bands 1427-1452 MHz and 1492-1518 MHz were proposed by the Council Conclusions as candidate bands, extending the band 1452-1492 MHz already harmonised in the EU.

In all of these bands the overall objective was to reach common agreement for global identification for IMT. This was successful with regards to the bands 1427-1452 MHz, 1492-1518 MHz and 3400-3600 MHz as a mobile allocation in the table of frequency allocations and identification for IMT were reached. For the band 1452-1492 MHz, this result was not completely reachable due to opposition from countries outside the EU using this band for Aeronautical telemetry.

For the band 3600-3800 MHz, there was no worldwide identification for IMT due to opposition from countries outside Europe taking into account the intensive satellite use outside Europe in this frequency band.

6.2 Agenda item 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". It considered the use of the band 694-790 MHz by the mobile service in relevant updates needed in the RR.

WRC-15 confirmed the primary mobile allocation, except aeronautical mobile, in the band 694-790 MHz band in Region 1. The decision allocates this band to the mobile service and identifies it for International Mobile Telecommunications (IMT) in ITU Region-1

The provisions adopted by WRC-15 provide full protection to television broadcasting, as well as to the aeronautical radionavigation systems operating in this frequency band.

Protection criteria for broadcasting resulted in the full achievement of the European objectives, i.e. setting of the lower edge at 694 MHz, ensuring balanced coexisting between wireless broadband and broadcasting.

6.3 Agenda item 1.18

"*to consider a primary allocation to the radiolocation service for automotive applications in the 77.5-78.0 GHz frequency band in accordance with Resolution 654 (WRC-12)".*

The band 77.5-78.0 GHz was harmonized for automotive radar

One other issue was the worldwide extension of the allocation and an extension of this allocation to other radar usage such as by aircraft when taxiing and consequential impact on the coexistence with the Radioastronomy service. The new allocation was limited to short-range radars for ground-based applications and concerns regarding the protection of the Radioastronomy Service against possible interference by radar usage during flights in the whole frequency band 76-81 GHz have been addressed in a corresponding Resolution of the conference.

6.4 Agenda item 10

"to recommend to the Council items for inclusion in the agenda for the next WRC, and to give its views on the preliminary agenda for the subsequent conference and on possible agenda items for future conferences, in accordance with Article 7 of the Convention"

The following items have been included in the WRC-19 agenda, which were in line with the Council conclusions:

-inclusion of an agenda item relating to mobile broadband (5G) to address a common approach to launch related compatibility studies in frequencies above 6 GHz, where a list of frequencies are proposed for studies, included those frequency bands proposed by Europe.

-supported further studies for radio local area networks in the 5GHz range including the bands 5350-5470 MHz, 5725-5850 MHz and 5850-5925 MHz while achieving the protection of the primary use in all cases.

6.5 Other agenda items

Several other main common policy objectives proposed in the RSPG opinion have also been achieved [10], such as:

- A revision of the relevant Resolution 646 addressing information on PPDR spectrum has been adopted with no obligation on specific technologies or specific frequencies;

- The operation of the global satellite search and rescue system COSPAS SARSAT have been further protected by new adequate protection criteria;
- The communication on manned space missions between space vehicle have been eased by removing unnecessary distance limitations;
- Spectrum allocations of 600 MHz bandwidth in total for new Earth exploration satellite systems (active) in the 9-10 GHz range have been adopted;
- Provisions for maritime on-board communications were reviewed and new regulations for maritime VHF data exchange systems have been adopted.
- A new Resolution addresses the conditions for the use of the fixed satellite service by satellite links for unmanned aeronautical systems.
- A spectrum allocation was made for the aeronautical mobile service allowing the use of the band 4200-4400 MHz by wireless avionics intra-communication;
- The provisions of coordination, notification and publication for space systems have been successfully updated.

7 Agenda for WRC-19

The WRC-15 defined and agenda for WRC- 2019 and a preliminary agenda for the WRC in 2023.

Agenda for WRC-19 [8]:

A.I. 1 on the basis of proposals from administrations, taking account of the results of WRC-15 and the Report of the Conference Preparatory Meeting, and with due regard to the requirements of existing and future services in the frequency bands under consideration, to consider and take appropriate action in respect of the following items:

A.I. 1.1 to consider an allocation of the frequency band 50-54 MHz to the amateur service in Region 1, in accordance with Resolution 658 [COM6/6] (WRC-15);

A.I. 1.2 to consider in-band power limits for earth stations operating in the mobile-satellite service, meteorological-satellite service and Earth exploration-satellite service in the frequency bands 401-403 MHz and 399.9-400.05 MHz, in accordance with Resolution 765 [COM6/7] (WRC-15);

A.I. 1.3 to consider possible upgrading of the secondary allocation to the meteorological-satellite service (space-to-Earth) to primary status and a possible primary allocation to the Earth exploration satellite service (space-to-Earth) in the frequency band 460-470 MHz, in accordance with Resolution 766 [COM6/8] (WRC-15);

A.I. 1.4 to consider the results of studies in accordance with Resolution 557 [COM6/9] (WRC-15), and review, and revise if necessary, the limitations mentioned in Annex 7 to Appendix 30 (Rev.WRC-12), while ensuring the protection of, and without imposing additional constraints on, assignments in the Plan and the List and the future development of the broadcasting-satellite service within the Plan, and existing and planned fixed-satellite service networks;

A.I. 1.5 to consider the use of the frequency bands 17.7-19.7 GHz (space-to-Earth) and 27.5-29.5 GHz (Earth-to-space) by earth stations in motion communicating with geostationary space stations in the fixed-satellite service and take appropriate action, in accordance with Resolution 158 [COM6/17] (WRC-15);

A.I. 1.6 to consider the development of a regulatory framework for non-GSO FSS satellite systems that may operate in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to- Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), in accordance with Resolution 159 [COM6/18] (WRC-15);

A.I. 1.7 to study the spectrum needs for telemetry, tracking and command in the space operation service for non-GSO satellites with short duration missions, to assess the suitability of existing allocations to the space operation service and, if necessary, to consider new allocations, in accordance with Resolution 659 [COM6/19] (WRC-15);

A.I. 1.8 to consider possible regulatory actions to support Global Maritime Distress Safety Systems (GMDSS) modernization and to support the introduction of additional satellite systems into the GMDSS, in accordance with Resolution 359 (Rev.WRC-15);

A.I. 1.9 to consider, based on the results of ITU-R studies:

A.I. 1.9.1 regulatory actions within the frequency band 156-162.05 MHz for autonomous maritime radio devices to protect the GMDSS and automatic identifications system (AIS), in accordance with Resolution 362 [COM6/10] (WRC-15);

A.I. 1.9.2 modifications of the Radio Regulations, including new spectrum allocations to the maritime mobile-satellite service (Earth-to-space and space-to-Earth), preferably within the frequency bands 156.0125-157.4375 MHz and 160.6125-162.0375 MHz of Appendix 18, to enable a new VHF data exchange system (VDES) satellite component, while ensuring that this component will not degrade the current terrestrial VDES components, applications specific messages (ASM) and AIS operations and not impose any additional constraints on existing services in these and adjacent frequency bands as stated in recognizing d) and e) of Resolution 360 (Rev.WRC-15);

A.I. 1.10 to consider spectrum needs and regulatory provisions for the introduction and use of the Global Aeronautical Distress and Safety System (GADSS), in accordance with Resolution 426 [COM6/11] (WRC-15);

A.I. 1.11 to take necessary actions, as appropriate, to facilitate global or regional harmonized frequency bands to support railway radiocommunication systems between train and trackside within existing mobile service allocations, in accordance with Resolution 236 [COM6/12] (WRC-15);

A.I. 1.12 to consider possible global or regional harmonized frequency bands, to the maximum extent possible, for the implementation of evolving Intelligent Transport Systems (ITS) under existing mobile-service allocations, in accordance with Resolution 237 [COM6/13] (WRC-15);

A.I. 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 [COM6/20] (WRC-15);

A.I. 1.14 to consider, on the basis of ITU-R studies in accordance with Resolution 160 [COM6/21] (WRC-15), appropriate regulatory actions for high-altitude platform stations (HAPS), within existing fixed-service allocations;

A.I. 1.15 to consider identification of frequency bands for use by administrations for the land-mobile and fixed services applications operating in the frequency range 275-450 GHz, in accordance with Resolution 767 [COM6/14] (WRC-15);

A.I. 1.16 to consider issues related to wireless access systems, including radio local area networks (WAS/RLAN), in the frequency bands between 5 150 MHz and 5 925 MHz, and take the

appropriate regulatory actions, including additional spectrum allocations to the mobile service, in accordance with Resolution 239 [COM6/22] (WRC-15);

A.I. 2 to examine the revised ITU-R Recommendations incorporated by reference in the Radio Regulations communicated by the Radiocommunication Assembly, in accordance with Resolution 28 (Rev.WRC-15), and to decide whether or not to update the corresponding references in the Radio Regulations, in accordance with the principles contained in Annex 1 to Resolution 27 (Rev.WRC-12);

A.I. 3 to consider such consequential changes and amendments to the Radio Regulations as may be necessitated by the decisions of the conference;

A.I. 4 in accordance with Resolution 95 (Rev.WRC-07), to review the resolutions and recommendations of previous conferences with a view to their possible revision, replacement or abrogation;

A.I. 5 to review, and take appropriate action on, the Report from the Radiocommunication Assembly submitted in accordance with Nos. 135 and 136 of the Convention;

A.I. 6 to identify those items requiring urgent action by the radiocommunication study groups in preparation for the next world radiocommunication conference;

A.I. 7 to consider possible changes, and other options, in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference, an advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks, in accordance with Resolution 86 (Rev.WRC-07), in order to facilitate rational, efficient and economical use of radio frequencies and any associated orbits, including the geostationary-satellite orbit;

A.I. 8 to consider and take appropriate action on requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, taking into account Resolution 26 (Rev.WRC-07);

A.I. 9 to consider and approve the Report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the Convention:

A.I. 9.1 on the activities of the Radiocommunication Sector since WRC-15;

A.I. 9.2 on any difficulties or inconsistencies encountered in the application of the RadioRegulations; and

A.I. 9.3 on action in response to Resolution 80 (Rev.WRC-07);

A.I. 10 to recommend to the Council items for inclusion in the agenda for the next WRC, and to give its views on the preliminary agenda for the subsequent conference and on possible agenda items for future conferences,

8 WRC-19 agenda items concerning CORSA Sector Work Programme

There are a few agenda items directly related with Corsa sector work packages.

8.1 Identification of frequency bands for IMT-2020

Agenda item 1.13: The frequency bands shown in Table 1 have been identified to determine the spectrum needs for the terrestrial component of IMT-2020 in the frequency range between 24.25 GHz and 86 GHz.

Studies on these frequency bands with regards to spectrum needs, technical and operational characteristics including protection criteria, propagation models for sharing and interference studies should be completed by March 2017.

Table 1 Frequency bands identified for IMT-2020

Frequency [GHz]
24.25 – 27.5
31.8 - 33.4
37 - 43.5
45.5 -50.2
50.4 – 52.6
66 -76
81 - 86

These higher frequency bands provide a wide bandwidth for high data rate communications over short distances of the order of a few hundred meters. However, they suffer from high attenuation, penetration loss, and human shadowing. This has generated a great deal of interest in radio propagation studies at millimetre wave frequencies to estimate suitable path loss models, and wideband channel parameters.

This agenda item falls into Work Package 5G Communications. JRC is involved in the channel propagation characterization at these frequency bands. Together with University of Durham, UK, Fondazione Ugo Bordoni and University of Bologna, IT, we foresee several colaborations and publications.

8.2 Overlap of frequency bands identified for IMT-2020

Agenda item 1.6: Studies of technical, operational issues and regulatory provisions for nongeostationary fixed-satellite services satellite systems in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space).

Several overlaps of frequency bands have been identified under the different agenda items of WRC-19 [8]. This has to be taken into account when doing studies to coordinate the compatibility and sharing feasibility among the services for which allocation is

envisaged under the corresponding resolutions relating to agenda items in the overlapping frequency bands.

Particularly for IMT-2020 systems, four of the five bands identified overlap with frequency bands identified for satellite services. See Table 2.

Table 2 Overlapping of IMT-2020 identified frequency bands with other services

A.I. 1.6 NGSO FSS [GHz]	**A.I. 1.13 IMT** [GHz]	**1.14 HAPS** [GHz]	**A.I 9.1** [GHz]
	24.25-27.25	24.25-27.25 (Region 2)	
37.5 – 39.5 (s-E)	37-40.5	38-39.5	
39.5-42.5 (s-E)	40.5-42.5		
47.2-50.2 (E-s)	47.2-50.2		
50.4-51.4 (E-s)	50.4-52.6		51.4-52.4 (E-s)
E-s: Earth-to-space; s-E: space-to-Earth			

This agenda item falls into work package 5G Communications, where spectrum needs for 5G systems have to be evaluated.

8.3 5GHz RLAN Studies

Agenda item 1.16: Sharing and compatibility studies, with a particular focus on interference mitigation techniques, in the frequency bands between 5150 GHz and 5925 GHz to facilitate sharing with incumbent systems while ensuring the protections of incumbent services.

This agenda item falls into the work package RSPP-2015, to support the Radio Spectrum Policy Programme. Particularly in the coexistence studies between wireless access systems including radio local area networks (WAS/RLAN) with COPERNICUS Earth Exploration Satellite Service in the frequency band 5350 -5470 GHz.

8.4 Railway radiocommunication systems

Agenda item 1.11: To study the spectrum needs, technical and operational characteristics and implementation of railway communications systems between train and trackside.

This agenda item is related to the Work package GSM-R on the evolution of the mobile communications systems between trains and railway tracks and control centres towards the development of the next generation of railway communications systems.

9 Conclusion

The World Radiocommunications Conference took place in Geneva in November 2015.

WRC-15 addressed over 40 topics related to frequency allocation and frequency sharing for the efficient use of spectrum and orbital resources. The outcomes ensure high quality radiocommunication services for mobile and satellite communications, maritime and aeronautical transport, air and road safety,and scientific purposes related to the environment, meteorology and climatology, disaster prediction, mitigation and relief.

The ITU Radiocommunication Sector has set the agenda for next WRC-19 with an ambitious programme of studies for the next four years covering a wide range of services from amateur radio to broadcasting, mobile broadband, mobile satellite, fixed satellite, earth stations on mobile platforms, and space exploration services.

The main decisions taken during the conference and the agenda items proposed for next WRC-19 [9] are aligned with the European Council objectives [6].

Concerning 5G communications: Work on 5G specifications has gained global momentum within the ITU, on standards and spectum regulation, and the 3GPP, on wireless/mobile standards, with the participation of Member States and 5G-PPP. The agenda of WRC-15 addressed spectrum for IMT-2020 systems, and the follow-up activity leading up to WRC-19 is expected to assess spectrurm needs and identify appropriate frequency bands on a global scale.

Following the growing demand for spectrum for mobile broadband services, WRC-15 identified frequency bands in the L-band and in the lower part of the C. The band 694-790 MHz has been allocated for mobile broadband in Region 1, giving full protection to television broadcasting as well as to the aeronautical radionavigation systems operating in this frequency band.

To counteract the difficulties encountered in finding additional spectrum for IMT in bands below 6 GHz, WRC-15 decided to include studies in the agenda for the next WRC in 2019 for the identification of bands above 6 GHz that will allow technology to meet demand for greater capacity. Administrations and industry can now concentrate on the development of necessary technologies in line with the schedule for the implementation of 5G**.**

In order to facilitate the launch of 5G on a large scale in Europe by 2020, RSPG has set up a strategic roadmap towards 5G [11] to assess spectrum related aspects such as spectrum sharing, usage and licence conditions, rural areas, policy implementation, incentive regulation and to assess appropriate frequency bands for 5G, in particular bands above 6 GHz.

Concerning 5GHz RLAN: The allocation of additional spectrum in the 5 GHz band to RLAN has been discussed in ITU-R since WRC-2003. Even if some members continued to object, WRC-15 finally decided to support further coexistence studies for RLAN in the 5 GHz range, i.e. from 5150 MHz and 5925 MHz while assuring the protection of the primary incumbent services in all cases. The incumbent services affected are: Earth Exploration Satellite and Space Research Systems, such as the Copernicus Programme, in the range 5350-5470 MHz, radiolocation and weather radars in the range 5725-5850 MHz and Intelligent Transport Systems (ITS) in the range 5850-5925 MHz.

Concerning Railway communications systems: WRC-15 decided to study the spectrum needs, technical and operational characteristics and implementation of railway radiocommunication systems between train and trackside. These studies will be very important for the development of the next generation of railway communications system in Europe.

References

[1] OJ L 108, 24.4.2002, amended by Directive 2009/140/EC, OJ L337, 18/12/2009.

[2] OJ L81, 21.3.2012

[3] Ibid, Article 9(1)

[4] Doc. RSPG15-592, February 2015

[5] EC and CEPT Workshop on the European preparations for the WRC-15. https://ec.europa.eu/digital-single-market/en/news/summary-workshop-jointly-organised-ec-and-cept-european-preparations-itu-world

[6] Doc. 13460/15, Council conclusions on WRC-15

[7] Doc. RSPG16-017 FINAL

[8] Doc. ITU-R Administrative Circular CA/226

[9] Doc. ITU-R Final Acts WRC-15

[10] Doc. RSPG16-017 FINAL

[11] Doc. RSPG16-031

[12] Decision No 243/2012/EU of the European Parliament and the Council

[13] Doc. 5G Vision, The 5G Infrastructure Public Private Partnership: the next generation of communication networks and services.

List of abbreviations and definitions

ITU	International Telecommunications Union
ITU-R	International Telecommunications Union, Radiocommunictions Sector
ITU-T	International Telecommunications Union, Telecommunication Standardization Sector
ITU-D	International Telecommunications Union, Telecommunication Development Sector
MIFR	Master International Frequency Register
WRC	World Radiocommunications Conference
CPM	Conference Preparatory Meeting
CEPT	Conférence Européenne des Postes et Télécommunications
ECC	Electronic Communications Committee
CPG	Conference Preparatory Group
RSPG	Radio Spectrum Policy Group
IMT	International Mobile Telecommunications
PPDR	Public Protection and Disaster Relief
RPAS	Remotely Piloted Aircraft Systems
VDES	VHF Data Exchange Systems
EESS	Earth Exploration Satellite Services
GMDSS	Global Maritime Distress and Safety System
ARNS	Aeronautical Radionavigation Services
ITS	Intelligent Transport Systems
HAPS	High Altitude Platform Stations
5G	5th Generation of mobile networks
RLAN	Radio Local Area Networks

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