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Working Document

Subject: Draft Mandate to CEPT to develop harmonised technical conditions in the Union for next-generation (5G) terrestrial wireless systems in EU-harmonised frequency bands and in frequency bands above 24 GHz

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MANDATE TO CEPT

TO DEVELOP HARMONISED TECHNICAL CONDITIONS IN THE UNION FOR NEXT-GENERATION (5G) TERRESTRIAL WIRELESS SYSTEMS IN EU-HARMONISED FREQUENCY BANDS AND IN FREQUENCY BANDS ABOVE 24 GHz

1. PURPOSE

This Mandate should deliver harmonised technical conditions, including sharing conditions wherever needed, for next-generation (5G) terrestrial wireless systems. These conditions should take into account relevant 5G usage scenarios related to wireless broadband and the Internet of Things, and meet the overarching purpose of ensuring efficient spectrum use. 5G wireless systems are likely to operate both, in existing EU-harmonised frequency bands such as for systems capable of providing electronic communications services or for RLAN/WAS¹, and in new high-frequency bands within the 24.25-86 GHz frequency range pursuant to ITU-level studies with regard to the World Radiocommunication Conference in 2019 (WRC-19). Timely availability of 5G spectrum in the Union is key to keeping the pace of 5G developments in other world regions (e.g. Korea, Japan or the USA) related to early identification of 5G spectrum and early deployments².

2. POLICY CONTEXT AND INPUTS

The ITU-R vision for the next-generation mobile telecommunications³ outlines three major 5G usage scenarios for the time frame of 2020 and beyond – enhanced mobile broadband (eMBB), massive machine type communications (mMTC), and ultra-reliable and low latency communications (URLLC).

The 5G Infrastructure Public Private Partnership (5G-PPP)⁴ was launched by the European Commission in 2013 with the goal to develop next-generation (5G) communication systems and services for the provision of ubiquitous super-fast connectivity and seamless service delivery and thus to foster European leadership in technology and standardisation. In its concept deliverables⁵, the 5G-PPP Infrastructure Association (IA) takes the view that 5G would offer both an evolution of mobile broadband networks ensuring continuous user experience, and new unique network and service capabilities. In particular, 5G would be a key enabler for the Internet of Things and mission-critical services requiring very high reliability, ubiquitous coverage and/or very low latency. In this regard, use cases originating from connectivity to 'verticals' (i.e. vertical sectors such as transport, healthcare

¹ RLAN/WAS denotes Radio Local Area Networks / Wireless Access Systems

² The US regulator (FCC) adopted on 14 July 2016 a Report and Order on 5G spectrum above 24 GHz, see http://transition.fcc.gov/Daily_Releases/Daily_Business/2016/db0714/FCC-16-89A1.pdf

³ In the ITU context of "International Mobile Telecommunications for 2020 (IMT2020)", s. ITU Recommendation: https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-I!!PDF-E.pdf

⁴ See <https://5g-ppp.eu/>

⁵ See 5G-PPP brochures "5G vision" at: <https://5g-ppp.eu/wp-content/uploads/2015/02/5G-Vision-Brochure-v1.pdf>, and "5G empowering vertical industries" at: https://5g-ppp.eu/wp-content/uploads/2016/02/BROCHURE_5PPP_BAT2_PL.pdf

or media) are considered as drivers of 5G requirements from the outset with high priority, in particular within frequency bands below 6 GHz. In terms of spectrum, the 5G-PPP IA emphasizes the need for very wide contiguous carrier bandwidths (e.g. hundreds of MHz up to several GHz) to be provided at a very high overall system capacity with focus on higher carrier frequencies above 6 GHz in line with the outcome of ITU World Radiocommunication Conference in 2015 (WRC-15). It is recommended to consider any new bands based on assessment and recognition of other services using, or planning to use, these bands.

The 5G-PPP IA has provided a position paper to the Radio Spectrum Policy Group (RSPG)⁶, which sets out the following priority ('pioneer') bands: 3.4-3.8 GHz (for single digit Gb/s eMBB urban coverage and a channel bandwidth of at least 100 MHz), 24.25-27.5 GHz or 31.8-33.4 GHz (for double digit Gb/s eMBB and a channel bandwidth of at least 500 MHz), and 694-790 MHz (for mMTC and URLLC universal coverage). Furthermore, the 5G-PPP IA recommends a channel bandwidth of at least 1 GHz for 5G spectrum above 33 GHz.

In April 2016, the Commission adopted a package on the "Digitisation of the European Industry"⁷, which identified as a political priority for the Union use cases for next-generation wireless services in the context of the Internet of Things but also stressed the need to prepare the introduction of next-generation WBB services. In September 2016, the Commission adopted "5G for Europe: An Action Plan"⁸, which inter alia puts forward actions on the EU-level identification and harmonisation of 5G spectrum – pioneer frequency bands as well as additional bands – based on the opinion of the RSPG. The preparatory work for the 5G Action Plan drew on a major input from industry in the telecom and vertical sectors – the "5G Manifesto for timely deployment of 5G in Europe"⁹ – which includes recommendations on 5G pioneer bands in consistency with the 5G-PPP.

Therefore, next-generation (5G) terrestrial wireless systems should operate both, in existing EU-harmonised frequency bands and in new high-frequency bands above 24 GHz. In this regard, potential hybrid business models between terrestrial (fixed and mobile) and satellite platforms may impact spectrum use in the context of providing complementary or convergent services.

Relevant *EU-harmonised frequency bands* for terrestrial systems providing *electronic communications services*, which must be taken into account under this Mandate with view to *licensed* use, are the following:

- Below 1 GHz¹⁰: 694-790 MHz ('700 MHz band'), 790-862 MHz ('800 MHz band'), 880-915 and 925-960 MHz ('900 MHz band').
- Above 1 GHz¹¹: 1452-1492 MHz ('1.5 GHz band'), 1710-1785 MHz and 1805-1880 MHz ('1800 MHz band'), 1920-1980 MHz and 2110-2170 MHz ('paired

⁶ Document "Initiative on pioneer 5G bands" (8 July 2016) from the 5G-PPP to the RSPG public consultation on the Draft RSPG Opinion on spectrum related aspects for next-generation wireless systems (5G)

⁷ See <https://ec.europa.eu/digital-single-market/en/digitising-european-industry>

⁸ See: <https://ec.europa.eu/digital-single-market/en/5g-europe-action-plan>

⁹ Link: http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=16579

¹⁰ Subject to Commission Decisions (EU)2016/687 (700 MHz band), 2010/267/EU (800 MHz band), and 2009/766/EC amended by 2011/251/EC (900 MHz band)

terrestrial 2 GHz band'), 2500-2690 MHz ('2.6 GHz band'), 3400-3800 MHz ('3.6 GHz band').

- Potential extensions of the 1.5 GHz band in the frequency ranges 1427-1452 MHz and 1492-1518 MHz, pursuant to the outcome of WRC-15.

Further *EU-harmonised frequency bands* may be taken into account for 5G terrestrial wireless systems under this Mandate with view to their relevance for particular 5G usage scenarios:

- 5150-5350 MHz and 5470-5725 MHz ('5 GHz band'), which is designated for *unlicensed* use with *RLAN/WAS*¹². The Commission notes that technical studies by CEPT regarding the potential extension of the 5 GHz band in either of the ranges 5350-5470 MHz or 5725-5795 MHz have not concluded so far on their suitability for *RLAN/WAS* pending the identification of appropriate mitigation techniques and/or operational compatibility and sharing conditions to ensure relevant protection of incumbent uses¹³.
- 5875-5905 MHz ('5.9 GHz band')¹⁴ for safety-related applications of *intelligent transport systems* (ITS). In this regard, co-existence in terms of interference mitigation with existing and planned use of this band based on the ETSI ITS-G5 standard should be ensured in accordance with the EU-level C-ITS platform strategy¹⁵. A future extension of ITS spectrum (e.g. beyond 5905 MHz) is an option, which may only be considered upon due assessment of future capacity demand as well as the potential availability of alternative spectrum, subject to ongoing RSPG work on spectrum for ITS.
- Specific frequency bands for *short-range devices* (SRD)¹⁶, in alignment with the CEPT work under the permanent Commission Mandate on SRD. In this regard, particular attention must be paid to existing Transport and Traffic Telematics (TTT) applications in the 5.8 GHz frequency band pursuant to EU law (notably electronic toll collection and enforcement of road safety- and internal road transport market related rules).

In addition, the frequency range at 60 GHz could be considered with view to *unlicensed* use (such as WiGig) as well as the frequency range 63-64 GHz for *ITS*.

Furthermore, the WRC-15 decided on studies on eleven potential additional frequency bands for next-generation (5G) terrestrial wireless systems¹⁷ within the 24.25-86 GHz frequency range, which should provide deliverables for a decision under agenda item 1.13

¹¹ Subject to Commission Decisions (EU)2015/750 (1.5 GHz band), 2009/766/EC amended by 2011/251/EC (1800 MHz band), 2012/688/EU (paired terrestrial 2 GHz band), 2008/477/EC (2.6 GHz band), 2008/411/EC amended by 2014/276/EU (3.6 GHz band)

¹² Subject to Commission Decision 2005/513/EC amended by 2007/90/EC (5 GHz band)

¹³ According to CEPT Reports 57 and 64 in response to a Mandate of the Commission

¹⁴ Subject to Commission Decision 2008/671/EC (5.9 GHz band)

¹⁵ Link: http://ec.europa.eu/transport/themes/its/c-its_en.htm

¹⁶ Subject to Commission Decision 2006/771/EC, last amended by 2013/752/EC (SRD Decision)

¹⁷ ITU-R Resolution 238 (WRC-15)

of WRC-19 with focus on global harmonisation. Both licensed and unlicensed use should be considered for spectrum in this range. Table 1 gives an (aggregated) overview of these frequency bands, which should be studied under this Mandate. The Commission services note that the CEPT's European Common Position on Agenda Item 10 of WRC-15 specifies priorities within these frequency bands¹⁸ which are also included in Table 1.

The status of ITU-level spectrum allocations and the current use of potential frequency bands for 5G, in particular above 24 GHz, necessitate studies on **shared spectrum use** between 5G terrestrial wireless systems and existing or prospective incumbent use as well as compatibility studies with respect to adjacent bands. Sharing scenarios seem of high relevance in particular with respect to terrestrial backhaul or fixed satellite links.

Frequency ranges under study for WRC-19	Bandwidth [GHz]	Major incumbent use in the EU Specific technical considerations ¹⁹	CEPT priority ²⁰ Mobile status ITU RR
24.25-27.5 GHz	3,25	Fixed satellite service (e.g. data relay ²¹), earth observation satellite service, space research, fixed links; short-range radars, NATO use Adjacent to 27.5-29.5 GHz ('28 GHz') band planned for use in the USA, Korea and Japan; nearly adjacent to a passive band (23.6-24 GHz),	24.5-27.5 GHz; <i>No mobile allocation in 24.25-25.25 GHz in Regions 1 and 2</i>
31.8-33.4 GHz	1,6	Fixed links Adjacent to a passive band (31.5-31.8 GHz)	full band <i>No mobile allocation</i>
37-43.5 GHz	6,5	Radio astronomy, fixed links, multimedia wireless systems, fixed satellite services Adjacent to a passive band (36-37 GHz)	40.5-43.5 GHz <i>No primary mobile allocation in 40.5-42.5 GHz (only secondary)</i>
45.5-52.6 GHz	7,1	Fixed service (including high-altitude platform stations), radio navigation, radio astronomy, fixed-satellite service	45.5-48.9 GHz <i>No mobile allocation in 47-47.2 GHz</i>

¹⁸ Link: <http://cept.org/ecc/groups/ecc/closed-groups/cpg15/client/introduction/cept-briefs-and-ecps-for-wrc-15/>

¹⁹ Based on deliverables of the FP7 METIS project: https://www.metis2020.com/wp-content/uploads/deliverables/METIS_D5.1_v1.pdf and https://www.metis2020.com/wp-content/uploads/deliverables/METIS_D5.3_v1.pdf, and Member States' data submitted to the RSPG

²⁰ Based on the European Common Position (CEPT) on Agenda Item 10 of WRC-15

²¹ The European Data Relay Satellite (EDRS) system in operation uses parts of this band (space-to-earth) with ESA Sentinel satellites as part of the Copernicus programme

66-76 GHz	10	Radars, satellite services	full band
81-86 GHz	5	Satellite services, fixed services, radio astronomy Adjacent to a passive band (86-92 GHz)	full band

Table 1: Overview of the frequency bands identified for Agenda Item 1.13 of WRC-19

In its [draft] "Strategic Roadmap towards 5G in Europe"²², the RSPG sets out its priorities for pioneer frequency bands for 5G terrestrial wireless systems in the Union as follows:

1. The frequency band **3400-3800 MHz** is considered as the primary one suitable for the introduction of 5G use in Europe even before 2020 which offers wide channel bandwidths. In this regard, the Commission notes that while the current technical conditions in this band²³ cater for wide channels (e.g. 100 MHz), the authorisation conditions at national level should also facilitate contiguous blocks of spectrum for users.
2. 5G will need to be deployed also in bands already harmonized below 1 GHz, including particularly **the 700 MHz band**, in order to enable nation-wide and indoor 5G coverage.
3. Considerations of frequency bands above 6 GHz shall be limited to the bands listed by WRC-15 (s. Table 1) in order to strengthen global harmonisation opportunities, in particular the bands **24.25-27.5 GHz**, **31.8-33.4 GHz** and **40.5-43.5 GHz**. The 24.25-27.5 GHz band is recommended as a pioneer band for Europe to be harmonised by 2020, while the 31.8-33.4 GHz band is considered another promising band, and the 40.5-43.5 GHz band – a viable option in the longer term.
4. There is a need to ensure that technical and regulatory conditions for **all bands already harmonized** for mobile networks are fit for 5G use; furthermore the need for European harmonisation measures in **bands above 24 GHz** before WRC-19 should be kept under review.

The aforementioned [draft] strategic roadmap of the RSPG aims to facilitate the launch of 5G on a large scale by 2020, thereby ensuring that the benefits of 5G-based services are available to all European citizens. The RSPG affirms a vision that 5G will drive industrial and societal transformation and economic growth in Europe from 2020 and beyond. It expects that initial major commercial deployments will be based on lower frequencies, one of the reasons being the possibility to reach rapidly sufficient coverage for enhanced wireless broadband and machine-type communications, which may require ubiquity, low latency and low complexity. A more comprehensive RSPG opinion on spectrum-related aspects for 5G terrestrial wireless systems is planned for February 2018 including further frequency bands and common licensing methods. The RSPG is also expected to issues deliverables on spectrum for ITS and the Internet of Things (IoT).

²² Document RSPG16-031 (subject to adoption)

²³ Subject to Commission Implementing Decision 2014/276/EU

In addition, major non-European countries (USA²⁴, Republic of Korea, Japan) have already earmarked regional spectrum bands, e.g. within the so-called 28 GHz band (27.5-29.5 GHz) for 5G services. Taking into account these developments, it is appropriate to explore scenarios and related technical conditions for flexible use (such as for early trials) of and co-existence with these bands to facilitate global interoperability and economies of scale of equipment.

Therefore, comprehensive technical studies on appropriate spectrum bands for 5G terrestrial wireless systems are necessary to enable evolving and new services/applications under unlicensed or licensed operation, in existing or new EU-harmonised frequency bands. These studies should be framed by the Union's policy strategy so as to provide an appropriate spectrum mix for various usage scenarios, to ensure co-existence with incumbent use and to develop a European approach benefiting to the extent possible from global harmonisation. In this regard, both CEPT and ITU-R have launched work for the preparation of the WRC-19 agenda item 1.13 on spectrum above 24 GHz²⁵ for IMT2020.

3. JUSTIFICATION

Pursuant to Article 4(2) of the Radio Spectrum Decision²⁶ the Commission may issue mandates to the CEPT for the development of technical implementing measures with a view to ensuring harmonised conditions for the availability and efficient use of radio spectrum necessary for the functioning of the internal market. Such mandates shall set the tasks to be performed and their timetable. Pursuant to Article 1 of the Radio Spectrum Decision, activities under the Decision must facilitate policy making with regard to the strategic planning and harmonisation of radio spectrum use as well as ensure the effective implementation of radio spectrum policy in the EU while serving the aim of coordination of policy approaches. Furthermore, they shall take due account of the work of international organisations related to spectrum management such as ITU or 3GPP.

The Radio Spectrum Policy Programme (RSPP) requires Member States, in cooperation with the Commission, to take all steps necessary to ensure that sufficient spectrum for coverage and capacity purposes is available within the Union, in order to enable the Union to have the fastest broadband speeds in the world, thereby making it possible for wireless applications and European leadership in new services to contribute effectively to economic growth, and to achieving the target for all citizens to have access to broadband speeds of not less than 30 Mbps by 2020. Furthermore, the RSPP calls on Member States and the Commission to ensure spectrum availability for the Internet of Things (IoT) and to foster the development of standards and the harmonisation of spectrum allocation for IoT communications. The RSPP also stipulates that Member States, in cooperation with the Commission, shall, where appropriate, foster shared use of spectrum²⁷. In terms of authorisation to support shared use of spectrum, the RSPG has adopted an Opinion on

²⁴ See FCC's Spectrum Frontier Report and Order and Further Notice of Proposed Rulemaking of 14 July 2016 available at: <https://www.fcc.gov/document/spectrum-frontiers-ro-and-fnprm>

²⁵ In this regard, CEPT has collected, through a questionnaire, information on use and future plans in relation to spectrum bands subject to studies for WRC-19 agenda item 1.13 (document ECC PT1(16)083_A13)

²⁶ Decision 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community, OJ L 108 of 24.4.2002

²⁷ See Articles 6(1), 4(1) and 8(6) of the RSPP

licensed shared access (LSA)²⁸ as a hybrid licensing mode which has potential applicability to shared spectrum use in different frequency bands.

Advances in international standardisation at 3GPP and ITU, as well as rapid international developments regarding 5G trials and spectrum use until 2020, call for a swift and coordinated EU-level process on delivering sufficient and appropriate 5G spectrum in the Union according to anticipated deployment of 5G usage scenarios. Therefore, urgent action is needed in time for WRC-19 to perform technical studies in order to develop harmonised technical conditions for spectrum use for 5G terrestrial wireless systems.

4. TASK ORDER AND SCHEDULE

CEPT is herewith mandated to develop harmonised technical conditions for *next-generation (5G) terrestrial wireless systems* in line with the usage scenarios and policy priorities set out in this Mandate and taking into account needs for shared spectrum use with existing or prospective incumbent uses as well as technically relevant aspects of spectrum authorisation (such as LSA). CEPT should give utmost consideration to overall EU spectrum policy objectives such as effective and efficient spectrum use and take utmost account of applicable principles established in EU law such as those relating to service and technological neutrality, non-discrimination and proportionality insofar as technically possible.

CEPT is requested to collaborate actively with the European Telecommunications Standardisation Institute (ETSI) which develops harmonised standards for conformity under the Radio Equipment Directive. In particular, CEPT should take into consideration emerging technologies and ETSI harmonised standards, which define 5G systems, facilitate shared spectrum use or foster economies of scale.

More specifically, CEPT is mandated to perform the following tasks with view to creating sufficiently precise conditions for the development of EU-wide equipment:

1. Review the technical conditions applicable to EU-harmonised bands below 6 GHz (for electronic communications services as well as other use) with view to the use of these bands for 5G terrestrial wireless systems, and identify bands for which amendment of these conditions is necessary.
2. Develop relevant technical conditions for EU-harmonised bands identified under Task 1 in order to allow use of 5G terrestrial wireless systems based on the principles of technology and service neutrality, while safeguarding co-existence with existing or planned use within those bands in line with their regulatory status and EU-level spectrum priorities.
3. Study and identify frequency bands in the 24.25-86 GHz frequency range for use under relevant 5G usage scenarios, taking due account of the preparatory process and results of WRC-19 Agenda Item 1.13²⁹ and assessing the technical impact of

²⁸ Document RSPG13-538

²⁹ ITU-R WRC-19 Agenda Item 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 809 (WRC-15))

further harmonisation opportunities at international level. In this regard, study and identify harmonised *compatibility and sharing scenarios* with relevant incumbent radio services/applications, for which future demand has been identified (for example fixed backhaul links, either terrestrial or satellite).

4. Develop channelling arrangements and common and minimal (least restrictive) technical conditions³⁰ for 5G terrestrial wireless systems for the frequency bands identified under Task 3 in conjunction with relevant usage scenarios. In this regard, develop common technical conditions to ensure spectrum usage *on a shared basis* pursuant to the sharing scenarios identified under Task 3, in close cooperation with all concerned stakeholders. These conditions should be sufficient to mitigate interference and ensure co-existence with incumbent radio services/applications in the same band or in adjacent bands, in line with their regulatory status, including at the EU outer borders.
5. For each incumbent service/application identified as in need of protection under Task 4: define relevant *protection parameters and conditions* for facilitating coexistence with 5G terrestrial wireless systems within the same band and in adjacent bands, including at the EU outer borders.
6. Develop requirements for cross-border coordination, wherever relevant, including at the EU outer borders.

Regarding Tasks 4 to 6, the CEPT is invited to provide *early deliverables (well in advance of WRC-19)* on one or more 'pioneer' frequency bands, taking due account of the view of the RSPG, in order to facilitate their early harmonisation and availability.

Overall, the CEPT should provide deliverables under this Mandate according to the following schedule:

Delivery date	Deliverable	Subject
November 2017	Draft Report A from CEPT to the Commission ³¹	Description of the work undertaken and the results for Tasks 1 to 3, and for Tasks 4 to 6 regarding 'pioneer' bands.
March 2018 (s. also below)	Final Report A from CEPT to the Commission taking into account the outcome of the public consultation	Description of the work undertaken and the results for Tasks 1 to 3, and for Tasks 4 to 6 regarding 'pioneer' bands.
November 2018	Draft Report B from CEPT to the Commission taking into account the preparatory work for WRC-19 ³¹	Description of the work undertaken and the results for Tasks 4 to 6.
March 2019	Final Report B from CEPT to the Commission taking into account the outcome of	Description of the work undertaken and the results for Tasks 4 to 6.

³⁰ Such as the definition of appropriate Block Edge Masks (BEMs)

³¹ Subject to subsequent public consultation

	the public consultation	
July 2020	Final Report C from CEPT to the Commission taking into account the outcome of WRC-19.	Review of results and any amendments in view of the decisions of WRC-19.

With respect to Task 5, the CEPT is invited to deliver as early as possible (also prior to Final Report A) conclusions on existing EU-harmonised bands, which are suitable for use with 5G terrestrial wireless systems without any amendment of the harmonised technical conditions in force.

In preparing the deliverables, CEPT is requested to take into account relevant developments at ITU level with regard to the WRC-19, and to consider possible synergies with the work to be undertaken under this Mandate.

CEPT is requested to report on the progress of its work pursuant to this Mandate to all meetings of the Radio Spectrum Committee taking place during the course of the Mandate.

The Commission, with the assistance of the Radio Spectrum Committee and pursuant to the Radio Spectrum Decision, may consider applying the results of this mandate in the Union, pursuant to Article 4 of the Radio Spectrum Decision and subject to international developments regarding 5G standardisation and spectrum management, and any relevant guidance of the RSPG.