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Working Document

Subject: **Mandate to CEPT to study and identify harmonised compatibility and sharing conditions for Wireless Access Systems including Radio Local Area Networks in the bands 5350-5470 MHz and 5725-5925 MHz ('WAS/RLAN extension bands') for the provision of wireless broadband services**

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MANDATE TO CEPT

TO STUDY AND IDENTIFY HARMONISED COMPATIBILITY AND SHARING CONDITIONS FOR WIRELESS ACCESS SYSTEMS INCLUDING RADIO LOCAL AREA NETWORKS IN THE BANDS 5350-5470 MHZ AND 5725-5925 MHZ ('WAS/RLAN EXTENSION BANDS') FOR THE PROVISION OF WIRELESS BROADBAND SERVICES

1. PURPOSE

To mandate CEPT to study and identify harmonised compatibility and sharing conditions for a sustainable and efficient use on a shared basis of the frequency bands 5350-5470 MHz and 5725-5925 MHz ('WAS/RLAN extension bands') for wireless access systems including radio local area networks (WAS/RLANs). Based on the results of the necessary coexistence studies, the operational sharing conditions for WAS/RLANs should in particular ensure that protection is guaranteed for priority systems supporting EU policies, such as GMES (Global Monitoring for Environment and Security) and ITS (Intelligent Transport Systems) and that coexistence with other systems in these and adjacent frequency bands is safeguarded.

2. BACKGROUND

Commission Decision 2005/513/EC as amended by Decision 2007/90/EC harmonises the use of radio spectrum in the 5 GHz frequency band (5150-5350 MHz and 5470-5725 MHz) for the implementation of wireless access systems including radio local area networks (WAS/RLANs)[1]. The Commission Recommendation 2003/203/EC on the harmonisation of the provision of public RLAN access to public electronic communications networks and services in the Community invites Member States to allow the provision of such services in the available 2.4 GHz and 5 GHz bands to the extent possible without sector specific conditions. In this regard, the use of the bands for the operation of WAS/RLAN systems shall be subject only to general authorisation and not to the grant of any individual right.

The value of this regulatory framework for WAS/RLAN systems has become evident in recent years through the success of Wi-Fi based wireless broadband usage which is based on bottom-up private infrastructure investments of citizens and the free availability in the internal market of a nearly-globally harmonised spectrum resource that underpins large economies of scale for equipment manufacturers. The low spectrum access barrier has led to a very widespread deployment of interoperable Wi-Fi-capable devices and access points. In addition to the private use of Wi-Fi, wireless broadband access provided via publicly accessible Wi-Fi access points has to be recognised as increasingly important internet connectivity infrastructure that is largely complementary to mobile internet services. Given the inherent limitation of coverage, mainly related to power limits and backhaul needs, such WAS/RLAN-based infrastructures can be considered as an essential competitive element in wireless broadband markets to the extent that such services are used in either nomadic or static situations.

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1 The parts of the 5 GHz range that are currently used in the EU for WAS/RLAN systems are subject to different usage conditions which reflect the results of previous coexistence studies. These conditions include the restriction of the use to indoor use only as well as the implementation of mitigation techniques, such as Transmitter Power Control (TPC) and Dynamic Frequency Selection (DFS). Pursuant to Art. 4(5) of Decision 2005/513/EC Member States shall keep mitigation techniques under regular review and report to the Commission thereupon. In this regard the Commission services are monitoring the investigations that are on-going in CEPT on the current status of DFS in the 5 GHz frequency range.

At the same time, they add to the utility of cellular mobile internet services by serving to ease congestion and increasing the attractiveness of smart devices also used for such mobile services, thus also sustaining the demand case for additional cellular network investment. A study[2] funded by the European Commission shows that most smartphone use in fact occurs at home, while relatively little is truly mobile and that the UK, France and Germany have among the highest household penetration of Wi-Fi in the world. The growing proliferation of Wi-Fi hotspots in private homes as well as the increased importance of publicly accessible Wi-Fi access points in Europe for public institutions (libraries, tourist bodies, etc.) and businesses underlines the socio-economic benefits of WAS/RLAN bands. Based on measured smart phone and tablet usage patterns[3], it can be observed that in 2012 71% of all wireless data traffic was delivered over Wi-Fi and estimated that this figure will grow to 78% by 2016. In the same period, Wi-Fi traffic is estimated to grow by more than 850% to close to over 1900 PB/month. As such Wi-Fi traffic is supported by fixed line broadband connections to end users' premises, the convenience of such wireless consumption of online content and services with constantly expanding capacity requirements also serves as a major demand "pull" factor for the upgrading of such fixed-line broadband connections.

The socio-economic value of these bands can be compared to the cost for providing the same amount of data capacity with cellular technologies alone. While cellular traffic will itself continue to grow by an annual rate of 66% until 2016, it is estimated that delivering all the 2012 Wi-Fi data traffic in the EU via mobile networks would have required infrastructure investments of € 35bn, while in 2016 around € 200bn would be necessary to cope with the projected demand[4]. In reality, given that such costs would be likely to be passed on to consumers, that demand is probably rather elastic. In the absence of Wi-Fi-based connectivity it must be assumed that a significant part of the measured or projected traffic would either not occur or be delivered through fixed line broadband connections – hence the description of WAS/RLANs as a largely complementary technology. None the less, these estimates of the cost of provision of the same level of wireless connectivity and convenience through cellular technology alone can serve as an indicator of the scale of the direct benefits to citizens and other end users accruing through the availability of Wi-Fi based networks and of sufficient spectrum to sustain them.

In view of the Digital Agenda for Europe and considering the magnitude of the traffic delivered, the Commission is of the view that WAS/RLAN bands for wireless broadband appear to be an essential spectrum resource for the provision and uptake of internet-based services. It is therefore necessary to ensure that sufficient spectrum resources are available on a harmonised basis to support a long-term future for new generations of WAS/RLAN technologies that will provide increasing data capacity and speed, thereby supporting the convenient and ubiquitous use of high-speed broadband access and thus ultimately the achievement of the infrastructure targets set by the Digital Agenda which also depend on user demand.

However, such an additional harmonised spectrum resource would have to be made available on a shared basis with various other applications which are currently operating in the 5 GHz frequency range. Among these are EU priority uses such as safety-related ITS systems and GMES/Copernicus satellite systems that support EU policies and require protection. ITS systems will facilitate real-time vehicle-to-vehicle as well as vehicle-to-infrastructure communication in order to improve road safety, enhance traffic flows and

2 Study on the "Impact of traffic off-loading and related technological trends on the demand for wireless broadband spectrum", WIK/Aegis, 2013 (SMART 2012/0015).

3 Based on the use of Android phones and tablet computers in France, Germany, Italy and the UK, see ibid.

4 Annualised savings in network cost due to off-load, see ibid.

reduce fuel consumption. The European Earth monitoring programme (GMES), now known as Copernicus, is an EU-lead initiative to provide satellite-based information services, inter alia, as a key tool to support biodiversity, ecosystem management, and climate change mitigation and adaptation. Moreover, there is also a need to ensure coexistence between WAS/RLAN and existing operations of military applications and meteorological radars as well as other primary services.

3. JUSTIFICATION

Pursuant to Article 4(2) of the Radio Spectrum Decision[5], 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 6 of the Radio Spectrum Policy Programme[6], the Commission shall, in cooperation with Member States, assess the justification and feasibility of extending the allocations of unlicensed spectrum for wireless access systems, including radio local area networks. In 2012 the Commission has announced its intention to consider the designation of additional harmonised licence-exempt spectrum for RLAN (Wi-Fi) services at 5 GHz through a revision of Decision 2005/513/EC as amended by Decision 2007/90/EC, depending on the outcome of technical sharing studies and of the impact in the market[7].

In addition, the 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 to achieving the target for all citizens to have access to broadband speeds of not less than 30 Mbps by 2020[8]. Pursuant to Article 8 of the RSPP, Member States and the Commission shall also ensure spectrum availability and protect the radio frequencies necessary for monitoring the Earth's atmosphere and surface, allowing the development and exploitation of space applications and improving transport systems.

The majority of RLAN devices in use today are still operated in the 2.4 GHz band (where, based on EC Decision 2006/771/EC, 83.5 MHz of spectrum is available to a large number of short range devices) because the vast majority of commercially available access points have until recently only been capable of operating there. While there is already 455 MHz of the 5 GHz band harmonised for WAS/RLAN, there is also evidence that an increasing number of client devices including smart phones and tablets now have dual-band capability and that large-scale public Wi-Fi networks are a significant driver of 5 GHz use today, particularly where outdoor coverage is being provided[9]. In this regard, providing an additional spectrum resource on a shared basis without refarming existing usage could provide additional socioeconomic benefits with limited opportunity costs if a sharing possibility can be identified under the applicable preconditions.

In addition, a new generation of RLAN systems (known as IEEE 802.11ac) will be able to achieve throughput rates sufficient to wirelessly extend high-speed fixed broadband infrastructures (of 30 or 100 Mbps or more) to a broad range of client devices without reductions in speeds if operating in 80 MHz and/or 160 MHz channels. This compares to

5 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, OJL 108 of 24.4.2002

6 Decision 243/2012/EU of 14 March 2012, OJ L 81 of 21.3.2012

7 Commission Communication on promoting the shared use of radio spectrum resources in the internal market (COM(2012)478).

8 Article 3(c).

9 See WIK/Aegis, 2013, current use of the 5 GHz band.

the 20 MHz or 40 MHz channels supported by 802.11n which are typically used today. In addition, the increased throughput rates can also support new applications that rely on uncontended channels for high-speed wireless data transfer between devices, such as for locally streaming HD video. In this regard users will have to rely on an uncontended (in geographic terms) 80 MHz channel to leverage new Wi-Fi generations to deliver what will most likely be on average between 63Mbps and 170Mbps[10]. In high-density residential environments a minimum of eight separate frequency channels are required to ensure that contention between neighbouring access points does not reduce the available bit rate for each user[11].

In the light of these WAS/RLAN technology trends, it is appropriate to assess and study a possible extension of the 5 GHz band for WAS/RLAN usage that would result in WAS/RLAN devices being able to operate on a shared basis within one large uninterrupted block of frequencies starting from 5150 MHz up to 5925 MHz[12]. A recent industry study[13] has estimated that the potential of such a WAS/RLAN extension in improvements in speed for residential users and the increased potential for mobile data-offload alone would results in benefits for Europe of €16.3 billion. Designating an uninterrupted block of spectrum in the 5 GHz range for WAS/RLANs would result in a 70% increase in available spectrum (up to 775 MHz in the range at 5 GHz) but may also result in a 125% increase of possible available 80 MHz channels (from 4 to 9). Realising a beneficial sharing opportunity for WAS/RLAN to operate on a shared basis in an uninterrupted band from 5150 MHz to 5925 MHz would therefore ensure that sufficient spectrum capacity for private and public Wi-Fi deployments will be available throughout the internal market.

However, such an opportunity can only be realised if appropriate coexistence between WAS/RLAN and those civil and/or military radio applications[14] for which the bands 5350-5470 MHz and 5470-5725 MHz are already assigned or designated is duly safeguarded. In particular with regard to radio applications that represent priorities of EU spectrum policy as specifically outlined in the RSPP, such as the European Earth monitoring programme (GMES)[15] in the band 5350-5470 MHz as well as Intelligent Transport Systems (ITS)[16] in the harmonised 5875-5905 MHz band, it will be necessary to ensure full protection of the envisaged usage.

It will therefore be necessary to carry out the appropriate technical studies and identify suitable sharing conditions to fully safeguard the envisaged operation of GMES and of safety-related ITS applications as well as to study the compatibility of WAS/RLAN with all other radio applications currently operated in these bands as well as in bands adjacent to these bands.

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10 In comparison to the headline speeds, the average usable throughput is considered to be substantially lower in real deployments depending, inter alia, on the user's distance from the access point or the use of one or two streams, whereby most current battery-powered portable devices can only support a single spatial stream. Compare the current status of Wi-Fi technology and its capabilities in Study on "traffic off-loading" (SMART2012/0015).

11 Ibid, see estimation of Wi-Fi spectrum demand in typical off-load scenarios.

12 See: http://www.digitaleurope.org/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=525&PortalId=0&TabId=353

13 Williamson et al. (2013) Future proofing Wi-Fi – the case for more spectrum. A report for Cisco, http://www.plumconsulting.co.uk/pdfs/Plum_Jan2013_Future_proofing_Wi-Fi.pdf

14 These include in some Member States various types of radars operating in the bands 5350-5470 MHz and 5725-5850 MHz for aeronautical and defence purposes.

15 Based on Regulation (EU) No 911/2010 of the European Parliament and of the Council of 22 September 2010 on the European Earth monitoring programme (GMES) and its initial operations (2011 to 2013) (OJ L 276, 20.10.2010, p. 1) and Article 8(1) RSPP.

16 Decision 2008/671/EC.

In addition, the deliverables of this mandate should contribute to consolidating Member States' positions in the on-going activities at CEPT and ITU on defining the technical and regulatory conditions regarding the proposed allocation to the mobile service of additional bands for radio local area networks (RLANs). Taking into account the current activity in the United States to make available an additional 195 megahertz of spectrum in the 5350-5470 MHz and 5850-5925 MHz bands for RLAN, there is a possibility for global harmonisation that would further strengthen the economies of scale for manufacturers.

In this context the likely use of an additional allocation in the requested bands to the mobile service by unlicensed WAS/RLAN devices and their potential proliferation across borders requires the detailed development of technical parameters in order to prevent EU priority applications such as GMES suffering interference from RLAN systems in large parts of the world.

The scope and schedule of the mandate therefore also reflects the need for the European Union and its Member States to develop a timely and common position on possible harmonised technical conditions in time for WRC-15. In addition and in order to ensure a possible global harmonisation when developing harmonisation measures on the basis of the response to this mandate, it will be necessary to review and/or reconfirm the results of the Mandate based on the relevant outcome of WRC-15.

4. TASK ORDER AND SCHEDULE

The purpose of this Mandate is to (1) study and identify harmonised compatibility and sharing scenarios for WAS/RLANs to operate on a shared basis in an uninterrupted band from 5150 MHz to 5925 MHz under the condition that (i) appropriate protection of EU priority applications, in particular the planned introduction of GMES in the band 5350-5450 MHz and the use of safety-related ITS applications in the frequency band 5875-5905 MHz, is ensured[17] and (ii) that coexistence of WAS/RLAN with other current civil and/or military radio systems to which the bands 5350-5470 MHz and 5725-5925 MHz and adjacent bands have already been assigned or designated (see Annex) is safeguarded; to (2) develop appropriate compatibility and sharing conditions to ensure a long-term spectrum access resource for WAS/RLANs to operate on the basis of a general authorisation as an essential wireless broadband infrastructure in the internal market; and (3) to review and/or reconfirm the compatibility and sharing conditions developed under task 2 for the Final report after WRC-15 taking utmost account of the possibility of international harmonisation.

The CEPT is hereby mandated to undertake the following tasks:

Task 1 – Identification of compatibility and sharing scenarios

Taking into account the relevant developments since the completion of the original studies carried out prior to WRC-03 for the bands 5150-5350 MHz and 5470-5725 MHz, to study and identify harmonised compatibility and sharing scenarios for WAS/RLANs in the bands 5350-5470 MHz and 5725-5925 MHz based on the latest generation of WAS/RLAN equipment (EN 301 893 v. 1.6.1. or 1.7.1.) and to define relevant protection parameters and conditions in close cooperation with all concerned stakeholders for:

17 In regard to the protection of the EU priority usages by GMES and ITS the Commission (DG JRC) will invite stakeholders to establish commonly accepted deployments assumptions for RLAN, ITS and GMES/SAR and where technically feasible to conduct laboratory tests with sample equipment to establish accepted interference protection limits.

1.1. Ensuring the planned operation of GMES/Copernicus (such as availability of proper satellite data based on SAR imaging systems) within the band 5350-5470 MHz[18].

1.2. Ensuring safety-related operation of ground-based ITS systems in the band 5875-5905 MHz in line with the provisions of Decision 2008/671/EC.

1.3. Facilitating coexistence between RLAN systems and other existing usage in various Member States in and adjacent to the bands 5350-5470 MHz and 5725-5925 MHz as listed in the annex, including FSS in the band 5725-5925 MHz and radiolocation applications in the bands 5350-5470 MHz and 5725-5850 MHz.

1.4. Assessing the impact, if any, of the future use of WAS/RLAN systems in the WAS/RLAN extension bands on SRDs operating in the bands 4500-7000 MHz, 5725-5875 MHz and 5795-5805 MHz according to the parameters harmonised in Decision 2006/771/EC[19].

For each compatibility and sharing scenario, the risk of interference, the deployment assumptions of all applications and the operational footprint of the actual use of the protected services/applications should be identified[20].

In addition, it should also be assessed whether and how coexistence can be ensured between the future WAS/RLAN usage, as an essential element of the wireless broadband EU priority, and other uses of the 5 GHz band that are currently considered on a shared basis, taking into account studies on-going in CEPT[21].

Task 2 – Development of compatibility and sharing conditions

Taking into account the expected development of WAS/RLAN technology and of the relevant standards until 2020, in particular the use of larger channel bandwidths, as well as the outcome of Task 1, appropriate mitigation techniques and/or operational compatibility and sharing conditions should be developed in close cooperation with all concerned stakeholders.

Based on the working assumption that WAS/RLANs would operate on a co-primary basis under an appropriate mobile allocation in the whole 5150 MHz to 5925 MHz band, and in the light of experience, the compatibility and sharing conditions should in particular identify the technical parameters that would be needed to ensure in the internal market consistent harmonised conditions and requirements for WAS/RLANs operating on a shared basis across the entire 5 GHz band.

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18 The centre frequency of the SAR on Sentinel-1 is 5405 MHz with an operating bandwidth of 90 MHz and centre frequency of the Altimeter on Sentinel-3 is 5410 MHz with an operating bandwidth of 320 MHz.

19 Including bands agreed for inclusion in the forthcoming 5th update, such as those for road tolling.

20 In particular where the use of the bands by primary radio services is not harmonised in the EU. Consistent with the approach to collect on a case-by-case basis comprehensive data for frequency ranges as proposed in CEPT Report 46, and with a view to lightening the administrative burden of individual Member States, the information on the operational footprint of the actual use of the relevant protected services/applications collected for the purposes of this mandate should be made available together with the Final Report in a machine readable format.

21 Such as on Broadband Direct-Air-to-Ground Communications (DA2GC) in the band 5855-5875 MHz or Wireless Avionics Intra-Communications (WAIC) in the band 5350-5460 MHz as well as Wireless Industrial Applications in the band 5 725-5 875 MHz. This is without prejudice to the final decisions that may be taken on any such usage in this or any other band.

To enable WAS/RLANs to operate on the basis of a general authorisation only those requirements should be implementable on the basis of harmonised standards and foster economies of scale in order to meet EU spectrum policy objectives, in particular taking into account sharing technologies and mitigation approaches implemented for existing WAS/RLAN equipment. These requirements should also take into account the regulatory and enforcement context of general authorisation. The compatibility and sharing conditions should also define the coexistence criteria that need to be taken into account by any other potential future use of the 5 GHz band in order to avoid interference with WAS/RLAN usage of the 5 GHz band.

Task 3 – Review of compatibility and sharing conditions after WRC-15

Taking utmost account of the possibility of international harmonisation[22], to assess the need to review and/or reconfirm the compatibility and sharing conditions developed under task 2 for the Final report based on the result of WRC-15, in the event that this would have a material effect on the parameters chosen for completion of tasks 1 and 2.

In the work carried out under the Mandate, the overall policy objectives of the RSPP, such as effective and efficient spectrum use and the support for specific Union policies shall be given utmost consideration. In implementing this mandate, the CEPT shall, where relevant, take utmost account of EU law applicable and support the principles of service and technological neutrality, non-discrimination and proportionality insofar as technically possible.

CEPT is also requested to collaborate actively with all concerned stakeholders and the European Telecommunications Standardisation Institute (ETSI) which develops harmonised standards for conformity under Directive 1999/5/EC.

CEPT should provide deliverables according to the following schedule:

Delivery date	**Deliverable**	**Subject**
March 2014	Interim Report from CEPT to the Commission	Description of work undertaken and interim results under tasks (1) and (2) of this Mandate
November 2014[23]	Final Draft Report A from CEPT to the Commission	Description of work undertaken and final results under tasks (1) and (2) of this Mandate
March 2015	Final Report A from CEPT to the Commission taking into account the outcome of the public consultation	Description of work undertaken and final results under this Mandate taking into account the results of the public consultation
March 2016[23]	Final Draft Report B from CEPT to the	Review and/or reconfirmation of the final results under this Mandate

22 Such as resolutions at the ITU WRC-15.
23 Subject to subsequent public consultation.

	Commission	taking into account the results of WRC-15. Description and assessment of relevant results of WRC-15 regarding final results of the Mandate on tasks (1) and (2) and final results of task (3)
July 2016	Final Report B from CEPT to the Commission	Review and/or reconfirmation of the final results under this Mandate based on the results of WRC-15. Final results of task (3), taking into account the results of the public consultation.

In addition, 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 EU, pursuant to Article 4 of the Radio Spectrum Decision.

Annex:

The RSPG has recently identified the following preliminary candidate bands and relevant considerations for an RLAN extension in the medium timeframe (beyond 2015)[24]

Frequency band [MHz]	Size [MHz]	Current Use	Pros of WBB in band	Cons of WBB in band	Action to make band available for WBB
5350 - 5470	120	Active Sensors, Defence Systems, Position fixing, Radiodetermination applications, Shipborne & VTS radar, Weather radar	Potential band for Wi-Fi applications. Allocating the band for Wi-Fi could be useful to mobile networks in providing data offload and indoor wireless connectivity.	New routers would be required to utilise this additional spectrum for Wi-Fi. Existing harmonised Wi-Fi standards needs to be developed further.	Sharing studies underway in JTG 4-5-6-7. Studies should be undertaken to see if band could be utilised for Wi-Fi.
5725-5875	150	Amateur, BFWA, Defence systems, ISM, SRDs, Radio determination applications, RTTT, Weather radars, Fixed links, FSS, UWB	Band identified by CEPT for Broadband Fixed Wireless Access (ECC/REC/(06)04). See also ECC Report 68.	May not be available in all Member States due to e.g. defence systems or RTTT.	Studies should be undertaken to see if this band could be more widely available for wireless broadband including Wi-Fi, taking into account the to the need to protect services in the upper adjacent band.
5875-5925	50	RTTT (ITS), Fixed links, FSS, UWB	Potential for Wi-Fi.	Sharing with FSS Earth stations may impose geographical constraints on usage. Decision 2008/671/EC on the harmonised use of radio spectrum in the 5875 - 5905 MHz frequency band for safety related applications of Intelligent Transport Systems.	Sharing studies underway in JTG 4-5-6-7. Studies should be undertaken to see if band could be utilised for Wi-Fi.

24 See Annex 1 and 2, as well as section 9.7 of the RSPG Opinion on Strategic Challenges facing Europe in addressing the Growing Spectrum Demand for Wireless Broadband (RSPG13-521).