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RADIO SPECTRUM POLICY GROUP

STRATEGIC SPECTRUM ROADMAP TOWARDS 5G FOR EUROPE

RSPG Opinion on 5G implementation challenges (RSPG 3rd opinion on 5G)

"in memory of Peter Anker"

RSPG Secretariat, Avenue de Beaulieu 33, B-1160, Bruxelles, office BU33 7/65
Telephone: direct line (+32-2)29.21.261, switchboard 299.11.11; Fax: (+32.2)296.83.95
E-mail: cnect-rspg@ec.europa.eu Web-site: http://www.rspg-spectrum.eu
Web-site CIRCABC: https://circabc.europa.eu/w/browse/f5b44016-a8c5-4ef6-a0bf-bc8d357debcb

Introduction

In November 2016 a strategic roadmap for 5G was first established when the RSPG adopted and published its first "Opinion on spectrum related aspects for next-generation wireless systems (5G) [1]", where it was outlined what spectrum will be needed for next-generation wireless systems.

An opinion was sought in order to build on RSPG's efforts and contribute actively to the development of Europe's spectrum policy strategy regarding 5G.

The work in 2016 focused on identifying the building blocks needed for a rapid launch of new wireless services in the next generation wireless systems:

- 3.4-3.8 GHz (3400-3800 MHz) will be the first primary band for 5G and bring the necessary capacity for new 5G services;
- 26 GHz (24.25-27.5 GHz) will be the pioneer band in Europe above 24 GHz to give ultra-high capacity for innovative new services, enabling new business models and sectors of the economy to benefit from 5G;
- 5G can be launched over the existing EU harmonised mobile bands, including in particular bands below 1 GHz which can enable 5G coverage to all areas (e.g. 700 MHz) ensuring that everyone benefits, while enabling the transition from the current to the next generation of networks.

For 2017 the RSPG worked on spectrum strategic questions and recommendations and issued a supplementary opinion focusing on areas set out in the first Opinion, relevant issues brought up in the public consultation[2] and other relevant areas from an RSPG perspective.

The RSPG, in its second Opinion (February 2018)[3], adopted further recommendations for policymakers on strategic issues related to 5G:

- Large blocks of 3.4-3.8 GHz made available by 2020;
- Flexibility in authorisation (for example concerning geography);
- Cross border service performance needs to be defined;
- Coverage requirements set according to national needs;
- Sufficiently large portion (e.g. 1 GHz) of the 26 GHz band made available (locally) in response to market demand by 2020; and
- General authorisation in 66-71 GHz.

For 2018 the RSPG, following the feedback received from the stakeholders during Workshops and building on the work of CEPT, presents an analysis with a view on how to defragment the 3.4-3.8 GHz band in EU. Furthermore, the RPSG 5G working group invited experts from verticals associations to exchange views about the possible verticals requirements regarding spectrum use in other areas than mobile broadband (internet of things, intelligent transportation and other verticals) and presents a proposal for a categorization of verticals engagement in 5G spectrum.

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[1] http://rspg-spectrum.eu/wp-content/uploads/2013/05/RPSG16-032-Opinion_5G.pdf

[2] https://circabc.europa.eu/d/a/workspace/SpacesStore/4ed94c29-182f-418a-b202-6861f69a4f3a/Responses_5G.pdf

[3] https://circabc.europa.eu/sd/a/fe1a3338-b751-43e3-9ed8-a5632f051d1f/RSPG18-005final-2nd_opinion_on_5G.pdf

The RSPG Third Opinion on 5G implementation issues

I. Concerning the Defragmentation of the 3.4-3.8 GHz frequency band:

1. The RSPG recommends that Member States (MS) design spectrum award mechanisms that provide the opportunity to obtain sufficiently large contiguous spectrum blocks to facilitate high throughput multi-Gb/s 5G services such as enhanced mobile broadband[4]. The RSPG notes that national awards processes may result in various spectrum blocks sizes due to market players strategies and that trading/leasing of rights of use ("spectrum trading") could also be considered as part of the national defragmentation tools/policy.

2. The RSPG notes that, taking into account different national legacy situations and competitive landscape, Member States may need different approaches at national level in order to achieve the above defragmentation objectives. In this regard, the RSPG recommends that Member States consider the guidance on defragmenting the band that has been developed by the CEPT (ECC Report 287) and that Member States share their defragmentation process with the RSPG through their Peer Review.

3. The RSPG recommends that, in order to facilitate 5G use in this primary band[5] and subject to national situation, Member States phase out, as soon as possible, legacy ECS use in the band, which is not compatible with the 5G harmonised technical conditions[6].

II. In order to ensure connectivity for vertical industries:

4. The RSPG notes that 5G will play a significant role in providing a communications service that meets the specific requirements for verticals alongside others technologies.

5. The RSPG notes that connectivity for vertical industries could be provided by mobile operator's solutions, third-party providers and directly by verticals themselves in EU harmonised ECS bands or in dedicated spectrum for verticals.

6. The RSPG recommends that Member States consider other spectrum solutions including dedicated or shared spectrum for the business/sectoral needs ("verticals needs") that may not be met by mobile operators. Such solutions could take advantage of economies of scale and ecosystem availability in spectrum bands with EU harmonised technical conditions.

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[4] Commission Implementing Decision (EU) 2019/235 of 24 January 2019 on amending Decision 2008/411/EC as regards an update of relevant technical conditions applicable to the 3400-3800 MHz frequency band states that:
"there shall be spectrum available providing the opportunity to access sufficiently large portions of contiguous spectrum, preferably 80-100 MHz, for wireless broadband electronic communications services". This objective is of particular importance for a defragmentation.

[5] See first RSPG Opinion on 5G (RSPG 16-032)

[6] Commission Implementing Decision (EU) 2019/235 of 24 January 2019 on amending Decision 2008/411/EC as regards an update of relevant technical conditions applicable to the 3400-3800 MHz frequency band

7. The RSPG notes that, in addition to the above, in order to respond to some targeted EU public policy objectives requiring, for example pan European services for specific verticals, there may be need for technology neutral dedicated EU harmonised spectrum. RSPG recommends assessing these needs on a case by case basis and is ready to give its view when/where appropriate.

8. The RSPG recognizes that, in order to support implementation of EECC ((EU)2018/1972)[7], the European Commission might consider additional recommendations on spectrum use for verticals and in this case, it should seek advice from the RSPG.

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[7] See EECC ((EU)2018/1972) article 45

INFORMATIVE ANNEX 1

Enabling connectivity for vertical industries

EU Member States have started to implement some recommendations from the first and second RSPG Opinions on 5G at national level. In addition, in the third opinion the RSPG provides spectrum strategic views on verticals and proposes some high level recommendations to be made available on a short time-frame. In this context, the RSPG already highlighted that 5G will play a significant role in providing a communications service that meets the specific requirements of existing and new users.

Verticals' needs could be addressed differently in terms of spectrum management. Most of them wish to benefit from economies of scale and ecosystem availability in spectrum bands with EU harmonised technical conditions.

Connectivity needs of verticals may currently be classified in the 3 main categories described below:

- **Mobile operators solutions for verticals**

  For some vertical users, using a public mobile network will be sufficient for meeting connectivity requirements. This would reduce the need for exclusive assignment of spectrum for specific vertical applications.

  Nevertheless, some verticals may have specific needs which may not be addressed by mobile operators. In consequence, other spectrum solutions should still be considered from a strategic point of view in order to respond to verticals needs.

- **Spectrum that may be dedicated to different vertical groups**

  This includes two types of verticals. The first type is largely networked infrastructure-dependent. Such verticals are able to generate aggregated demands/needs to spectrum managers (mainly regarding wide area coverage). The other covers more fragmented and niche users mainly requiring local coverage and typically using a private network, as local areas for "on-site" industry.

  These types of users may have requirements for dedicated spectrum due to reasons of cost, security, or their want to have full control over the network.

  In both cases, EU harmonised technical conditions suitable for mobile networks and providing economies of scale are also suitable for these types of usages.

- **EU specific band for verticals**

  This vertical category could benefit from dedicated EU harmonised technical conditions in the context of technology neutrality, suitable, for example, for pan European service provision.

Further analysis is provided in the following sections:

Mobile Operator provision of solutions for verticals

The demand for vertical users connectivity may to a large extent be covered by mobile providers (either by existing or new entrants, including MVNOs). In particular, 5G network slices provide opportunities for virtual private networks, potentially offering different levels of service to different customer/business segments based on key performance indicators (KPIs) such as bit rate, latency, availability, and reliability.

In consequence, compared to 4G, 5G and particularly the ability to quickly and easily deploy different network slices, may reduce the need for exclusive assignment of spectrum for some applications, particularly those that require wide area coverage (e.g. nationally for many IoT applications, critical PPDR infrastructure, FRMCS, etc.).

- Beyond the primary 3.4-3.8 GHz and the 26 GHz pioneer bands, already subject to the previous 5G Opinions and a Commission mandate, the RSPG highlights that harmonized European technical conditions in the 700 MHz and also in the 800 MHz and 1.5 GHz bands are already compatible with 5G. These bands (3.4-3.8 GHz, 26 GHz, 700 MHz) are already the core for the initial roll out of 5G services in response to verticals needs.
- In addition, a 5G update of the European harmonised technical conditions should be considered in a short time frame for the 900/1800 MHz, 2.1 GHz and 2.6 GHz bands in line with market demands and taking advantage of the expiration dates of current authorisations in these bands in a number of EU Member States.

Nevertheless, depending on the national context, there are some verticals whose needs may not be adequately addressed by mobile operators due to various factors, for example:

- Business-specific applications needs and demands are in permanent development. Mobile operators may face difficulty in responding to the pace of such development. Perhaps only some ad hoc services might be developed.
- Some areas to be covered could be challenging (e.g. indoor, challenge areas)
- Some verticals' service requirements could be too specific or economically not feasible to meet (the "5G slices" will need be predefined in order to respond to some KPI requirements defined by verticals)
- Lack of business interest in 5G coverage,
- Some vertical users may want to deploy, and retain full control of their network for data security, cost, or other reasons.

In consequence, other spectrum solutions should be considered from a strategic point of view in order to respond to verticals needs.

Dedicated spectrum for verticals

As discussed above, some verticals will wish to deploy their own network, using dedicated spectrum. This may be due to a wide variety of reasons, including cost, control, data security, and flexibility to upgrade/change technologies.

Some of these verticals are able to generate aggregated demands/needs to spectrum managers (mainly wide area coverage). Others are more fragmented such as niche users wanting to address local coverage needs. In consequence, this generates two different categories of needs, potentially with some common criteria.

It is important to note that verticals needs are addressed on a national level, and therefore responses may differ according to national context and differing national demands.

The two sub-categories above may also benefit from using spectrum with EU harmonised technical conditions suitable for mobile networks (in particular, but not exclusive to the 2.6 GHz, 3.4-3.8 GHz, 26 GHz bands). The access to dedicated spectrum may be based on specific authorisation regime for verticals or through trading or leasing of operators spectrum. The verticals' needs for dedicated spectrum vary from country to country and depend on what services/slicing mobile operators may offer.

Dedicated spectrum for wide area "networked infrastructure[8]-dependent" verticals

These verticals may be able to express aggregated spectrum needs/demands either by sectoral representative organizations either at European level or national level (see Agurre in France, KMBG in NL).

These verticals could be described accordingly:

- network infrastructure dependent (i.e. Utilities) over a large area (which could not be subject only to local authorisation)
- users of a telecom network infrastructure for its own needs
- vertical as a service provider using telecom network infrastructure for its customers

Examples of such verticals could be transport services, utilities such as energy companies, PPDR providers using smart (IoT based) and/or ultra-reliable services.

These verticals may have various needs, which could be served by various sets of radio communications solutions. 5G may be one among many technologies to address their needs. Solutions may also include technologies using general authorisations (e.g., LPWAN IoT). This could also include hybrid solutions, for example, a vertical using their own private network, as well as using a mobile operator's network.

[8] Network infrastructure refers to various types of infrastructures for the vertical activities: utilities, railways, trains

Moreover, making portions of EU-harmonised spectrum available for those verticals could give them the opportunity to offer specific applications. (See 2.6 GHz TDD in France, 3.5 GHz TDD in NL) This particular type of (local or wider) usage could then benefit from economies of scale and equipment availability resulting from harmonised technical conditions suitable for WBB.

Regarding spectrum authorization, individual licenses (including at a local level) will likely meet the needs of these types of users. In case there is no spectrum scarcity, a first come first served approach seems appropriate.

The spectrum licensee in case of individual authorisation is either the vertical itself or a service provider to the vertical.

Nevertheless, harmonised technical conditions for 5G would also apply to such license.

Dedicated spectrum in local areas for "on-site" Industry

Demand from these verticals is generally fragmented. The requirement for dedicated spectrum at a local level has mainly been expressed by the manufacturing industry. Some needs may also be addressed by RLAN, IoT, whereas other users may have a requirement for the specific characteristics delivered by 5G. This category generally refers to verticals with local areas coverage requirements.

These verticals could be described accordingly:

- Manufacturing/ machine oriented (robots, etc.)
- Specific local needs (even multi-site)
- Automation
- Massive indoor needs

The specific requirements of this category could be fulfilled on an ad hoc basis, in particular due to the following:

- In a band with specific characteristics such as the 26 GHz band, there are opportunities for shared spectrum use between mobile operators offering wide-area services and local vertical indoor applications.
- Automation requirements should be considered carefully. Spectrum bands suitable for 5G are not all equivalent for responding to indoor requirements with many obstacles.
- Particular indoor usages could also be considered. For example, robots may be wirelessly interconnected by NR (instead of cables) for low latency and reliability within a factory.

This vertical ecosystem would benefit from EU harmonised technical conditions suitable for mobile networks and providing economies of scale. According to the current RSPG analysis, there is no need for dedicated EU-harmonised frequency bands

for such local usage. National decisions are the best approach to identify the solution to answer to national needs.

EU harmonised band for specific verticals

For pan European vertical applications such as autonomous cars, automatic trains/metros, there may be merit in considering EU harmonised bands.

These verticals are able to develop their own requirements and standards. Evolution towards connected cars and 5G implies interactions/synergies between various sectors (Automobile/ mobile industries). Autonomous cars appear also as a new market with new stakeholders in the automotive sector (i.e. Tesla, Google).

RSPG recommendations have already triggered initiatives from the European Commission on road ITS and urban rail ITS in 5.9 GHz[9] and on FRMCS pursuant to EC mandate.

The authorisation regime depends on sharing and usages conditions. Both licensed and license-exempt regimes are possible. This should be defined on an ad-hoc basis according to the assumptions made during the development of technical conditions.

RSPG references

RSPG Opinion on IoT Document RSPG17-006 Final
RSPG Opinion on ITS Document RSPG17-008 Final
RSPG 1st Opinion on 5G Document RSPG16-032 FINAL
RSPG 2nd Opinion on 5G Document RSPG 18-005
RSPG BEREC report on ‘mobile connectivity in “challenge areas”’ Document RSPG18-001

[9] It is noted that, for ITS road, there is an ongoing debate about the technology (G5 vsLTE/5G)

ANNEX 2

Public Consultation Results

A public consultation on the draft version of this Opinion was held from 15 October 2018 until 26 November 2018. In total 25 responses were received. All non-confidential responses are published on the RSPG website - http://rspg-spectrum.eu/wp-content/uploads/2019/02/PC_responses_3_RSPG_Opinion.zip.
The RSPG appreciated all comments received. The RSPG considered them carefully and improved the draft opinion as appropriate. The following respondents provided comments:

1&1 Telecom
5G Alliance for Connected Industries and Automation (5G-ACIA)
5G Infrastructure Association (5G IA)
AIRBUS
BASF
Bosch
Cable Television Association in Poland
CELLNEX
DIGITALEUROPE
Deutsche Telekom
EBU
EchoStar Mobile
EMEA Satellite Operators Association (ESOA)
ETNO
European Utility Telecom Council (EUTC)
FastWeb
Gerard Pogorel
Global mobile Suppliers Association (GSA)
GSMA
Huawei
International Amateur Radio Union (IARU)
Joint Radio Company (JRC)
Nokia
TDF
TIM

The RSPG welcomes the number of responses received from a diverse range of stake holders representing the majority of the services with an interest in the development and use of 5G networks.

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The wide support for this opinion from stakeholders was clear.

As expected, many of the individual comments reflected specific commercial and industrial interest and as a consequence opposing views on the same topic are presented by different parties. The role of spectrum managers is to balance these opposing views to achieve efficient and effective spectrum management.

The RSPG notes that most of the responses are dealing with the subjects of defragmentation of the 3.4-3.8 GHz band and the verticals needs. Main elements are noted below.

- Phasing out ECS legacy use in the 3.4-3.8 GHz band as recommended by the RSPG was widely supported. Some respondents suggested that a similar approach is adopted for the 26 GHz band.
- The mobile industry supported the need for defragmentation in a timely manner and suggest that mobile operators are given access to the whole 400 MHz of spectrum in the 3.4-3.8 GHz band for 5G. A few stakeholders, such as Satellite operators and Radio-amateurs highlighted specific issues, such as the potential effect of defragmentation on other services.
- Some respondents emphasized the approach to defragmentation outlined by CEPT (ECC Report 287, August 2018) and interest in solutions such as trading, leasing, sharing and possibly national roaming to be implemented at a national level to deal both with the defragmentation objectives as well as responding to the verticals needs. In addition,
- The importance of the verticals as part of the 5G ecosystem was widely recognised, however there were diverging views about the optimum way to facilitate spectrum access. Part of the vertical industry requested dedicated spectrum for verticals. As noted above, other respondents supported a range of tailored national solutions for verticals needs.

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