Initiative on pioneer 5G bands

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The RSPG, at its Workshop in London on 30th March 2016, welcomed inputs to its work on 5G spectrum. On May 30, the 5G Infrastructure Association (5G IA) Working Group Spectrum presented to the RSPG its view on the spectrum problem to be solved to enable a lead of the EU in 5G in an explanatory note.

Recently, by issuing the DRAFT RSPG Opinion on spectrum related aspects for next-generation wireless systems (5G) of 8th June 2016, RSPG proposes a number of bands for early deployment of 5G.

5G IA WG Spectrum welcomes the RSPG's recognition of the need for wider bandwidths for 5G, of the critical importance of global harmonisation, and of the focus, for bands above 6 GHz, on the list provided by WRC-15. 5G IA WG Spectrum also welcomes RSPG's recognition of the need for early indications of the 3.4 - 3.8 GHz band and of bands below 1 GHz to be available before 2020 as well as of the relevance of bands above 24 GHz. As set out in our earlier paper on pioneer bands for eMBB in Europe, 5G IA WG Spectrum believes that the minimum RF channel bandwidth for eMBB in the 3.4 – 3.8 GHz band should be 100 MHz, rising to 500 MHz in bands between 5 to 33 GHz and rising to 1 GHz or more for bands in the mm-wave region above 33 GHz.

The 5G IA WG Spectrum would like to follow up with its views on potential pioneer spectrum bands for 5G in Europe as a base for a dialogue within the planned RSPG 5G working group meeting in Dublin on 13th July 2016. With the present contribution, we aim to provide additional information to RSPG's important effort to pave the way, through early identification of potential pioneer bands, towards early and successful 5G deployments in Europe, in particular with respect to eMBB use case of 5G. The 5G IA WG Spectrum and myself as the rapporteur for this initiative will be more than happy to engage more deeply with the RSPG Working Group on 5G spectrum to assist in any way we can.

Pioneer bands as seen by the 5G IA WG Spectrum are a limited number of bands targeted now for testbed development, leading into prototypes, trials and early commercial deployments in Europe by 2020 to put the EU in 5G lead position.

The 5G IA WG Spectrum would like to suggest to RSPG to consider as 5G pioneer bands in Europe, subject to successful results of technical and regulatory studies with regards to the protection of incumbent services, the following ones:

3.4 - 3.8 GHz

eMBB for single digit Gbit/s urban mobile coverage

In Europe, this band is allocated to the mobile service and identified for IMT. It could provide opportunities to accommodate wide RF channel bandwidths of 100 MHz or more. This wide RF channel bandwidth is essential to deliver a peak data rate transmission in the order of low single digit Gbit/s per RF channel. This spectrum range and these RF channel bandwidths are considered to be suitable to contiguously cover densely populated areas.

It is in parts licensed to fixed wireless access providers and the current technical regulation and licencing need to be reviewed and possibly adapted to accommodate such wide RF carrier bandwidths.

Note 1: WRC-15 decided to maintain the FSS primary allocation in the frequency range 3.6 to 4.2 GHz. At WRC-15, the CEPT position was not to have a primary mobile allocation in the frequency range 3.8 to 4.2 GHz.

Note 2: The adjacent band 3.8 - 4.2 GHz is under investigation in other regions for early deployments of 5G and thus is subject to research and development within Europe.

24.25 - 27.5 GHz ("25 GHz")
31.8 - 33.4 GHz ("32 GHz")

eMBB for up to double digit Gbit/s

Both these bands are included for studies in ITU under A.I. 1.13 of WRC-19 and in CEPT WRC-19 preparation, which could result in new mobile primary allocations and/or identification for the future development of IMT requiring larger contiguous blocks of spectrum than those in the currently identified frequency bands. The band 25 GHz could offer up to 3.25 GHz contiguous RF bandwidth, while the band 32 GHz could offer up to 1.6 GHz. These bands may initially be used for 5G radio access networks in dense high traffic areas. Both bands are subject to intense research activities within 5G PPP.

For assessing their suitability as 5G pioneer bands, initial considerations were based on the following:

- Potential for early implementation and for common economies of scale with 5G spectrum initiatives outside Europe;
- Incumbent usage.

<u>Concerning the potential for early implementation and for common economies of scale with 5G spectrum initiatives outside Europe:</u>

24.25 - 27.5 GHz ("25 GHz")

The below-mentioned developments of 28 GHz in the USA and Korea (see dedicated section "Impact of 5G spectrum developments outside Europe") could offer the 25 GHz band the potential for common economies of scale for devices and chip sets. There are mobile technology industry experts examining whether devices with a large tuning range extending into the 25 GHz band in addition to the bands to be used in the USA and Korea are technically viable. If technically viable, such devices could become available (subject to commercial interest) in the 25 GHz band as a pioneer band in Europe with limited re-development efforts.

The frequency range over which it may be possible to extend the tuning range and the benefits for equipment and device implementation and the technical viability are under intense investigation. There are technical challenges as well as considerations that need to be given to the commercial and time to market aspects which could also impact the viability of this approach and any advantage it brings to identifying the 25 GHz band as a pioneer band. The impact deriving from the need to protect existing services both within and above the 25 GHz band on the ability to efficiently implement a large tuning range continues to be under study.

31.8 - 33.4 GHz ("32 GHz")

The below-mentioned developments in the USA and Korea have been considered whether to offer the 32 GHz band the potential for common economies of scale for devices and chip sets.

Concerning the 27.5 - 28.25 GHz band considered by the USA, the relative size of the tuning range to cover 27.5 - 33.4 GHz is similar to that of the tuning range of 24.25 - 29.5 GHz. However, the need to protect the passive service below the lower edge of the 32 GHz band, in the middle of the tuning range, requires specific attention. This might result in such a tuning range to be not technically viable and might require specific standalone 32 GHz re-design.

Concerning the 26.5 - 29.5 GHz band in Korea the relative size of the tuning range of 26.5 - 33.4 GHz is larger than that of the tuning range of 27.5 - 33.4 GHz. Implementing the wider tuning range of 26.5 - 33.4 GHz, taking further into account the passive service protection requirements, might pose additional challenges.

<u>Concerning the incumbent usage:</u>

The 5G IA welcomes the initiative taken by CEPT (ECC PT1) through a questionnaire to gather, by next 1st September, the views of CEPT administrations and industry on the frequency bands under study for WRC-19 agenda item 1.13, with respect to: the incumbent services/applications currently allocated/ assigned, the number of stations, how widely the existing services are deployed in space and time (e.g., the geographical deployment in urban relative to rural areas), the expiry date for the existing licences, the future plans for the bands, the issues/challenges, and the band prioritisation.

24.25-27.5 GHz ("25 GHz")

Based on information currently available, the 25 GHz frequency range is used in Europe for major space exploration programs of the European Space Agency and for the new generation of meteorological satellites of Eumetsat. It is used also by the Fixed Service: according to the

ECC Report 173[1], issued in March 2012 and based on a questionnaire conducted through CEPT administrations in autumn of 2010, there are less than 100 links in the 24.25 - 24.5 GHz band, a total of about 37,000 of fixed P-P links and 2,259 P-MP Base Stations in more than 30 countries in the 24.5 - 26.5 GHz band, and 30 links used for military/NATO needs also in the 26.5 - 27.5 GHz.

31.8 - 33.4 GHz ("32 GHz")

According to the ECC Report 173, mentioned above, around 8,000 P-P links are active in 31 countries and no P-MP.

In conclusion, at this stage, the 5G IA WG Spectrum cannot state a clear preference among these two bands, but aims to give more information and recommendations soon based on the results of ongoing studies.

700 MHz

mMTC/URLLC universal coverage

This band (694 – 790 MHz) was allocated at WRC-12 to the mobile, except aeronautical mobile, service on a primary basis in Region 1 and is targeted to be re-purposed from terrestrial TV broadcast to IMT use by 2020 in Europe. While it cannot deliver the wide bandwidths required for eMBB, it can very well support large area and outdoor-to-indoor coverage required for the 5G use case families mMTC and URLLC thus enabling new vertical use (like IoT communications for Smart Grids, car-to-X communication for highly automated driving etc).

Impact of 5G spectrum developments outside Europe

The US is actively preparing to finalise a ruling in the summer 2016 enabling commercial 5G deployment in the 28 GHz band (27.5 - 28.35 GHz), 37 GHz band (37 - 38.6 GHz), 39 GHz band (38.6 - 40 GHz) and the 64 - 71 GHz band.

In Korea, for the purposes of the Olympic trial, 3 operators will be granted 1 GHz of spectrum each in the frequency range 26.5 - 29.5 GHz.

With respect to the frequency range 27.5 - 29.5 GHz in Europe, 5G IA WG Spectrum notes that there are fixed links, both P-P and P-MP for Fixed Wireless Access including mobile backhauling, in this band and that the satellite industry is using or planning to use this band.

As regards the ability to commercially roll out the first 5G networks in Europe with RF channel widths well exceeding 100 MHz (as is expected to be the case in the US with respect to the band 27.50 - 28.35 GHz), Europe's global leadership in 5G will critically depend on the timely selection, identification, harmonisation and clearance, ideally by 2020, of a first pioneer band above 6 GHz in Europe from among the two identified in this document.

A final observation is that, as European R&D centres are at the forefront of 5G product and technological innovations on a global basis, including for deployment outside Europe, the identification of recommended pioneer bands for Europe should not preclude Test and Development

[1] Subject to potential revision (see: Questionnaire from WG SE 19 regarding the revision of ECC Report 173 on current use and future trends for the fixed services in Europe, deadline 14 October 2016)

authorisations for in house lab-trials and demos of equipment operating in the frequency range 26.5 - 29.5 GHz

The 5G IA WG Spectrum would like to offer as background information the following documents:

1.) What is the spectrum problem?
(already sent to the RSPG WG on 5G spectrum for its meeting on 2nd June in Stockholm)
2.) 5G PPP vision on 5G
https://5g-ppp.eu/wp-content/uploads/2015/02/5G-Vision-Exec-Summary-v1.pdf
3.) 5G PPP brochure on 5G empowering vertical industries with its socio-economic benefits
https://5g-ppp.eu/wp-content/uploads/2016/02/BROCHURE_5PPP_BAT2_PL.pdf