

Vodafone's response to RSPG consultation on Draft Opinion:

**Strategic Challenges facing Europe in addressing the
Growing Spectrum Demand for Wireless Broadband**

May 2013

Growing Spectrum Demand for Wireless Broadband

1 Introduction

Vodafone welcomes the opportunity to respond to this RSPG consultation, and the importance placed by RSPG on meeting the growing spectrum demand for wireless broadband.

Vodafone agrees that the Commission should develop a strategic roadmap for broadband services for the timeframe up to 2020. This will increase the clarity and confidence necessary for businesses to make the substantial investments needed in wireless infrastructure. However, with changes in the use of spectrum it can take more than a decade before a decision on spectrum leads to a licence award. Therefore, a concrete roadmap for the period up to 2020 needs to be complemented by a look further into the future, to see if anticipated spectrum requirements in the following decade will require decisions before 2020.

To ensure that the benefits of wireless broadband can continue to be delivered, the European strategy needs to achieve the following objectives:

- Sufficient spectrum for both coverage (to ensure that high speed broadband services reach all areas) and capacity (to meet demand in urban areas).
- Global harmonisation (supporting roaming and leading to cheaper terminals).
- Suitability of bands to be implemented ubiquitously in terminals (in particular, new bands should where possible be adjacent to existing bands or within the frequency range of the RF components already used in terminals).
- Sufficient spectrum in each individual band to facilitate an efficient use of the spectrum.

These objectives should form part of the forthcoming proposals from the Commission on the Single Market in Information and Communications Technology.

2 Comments on RSPG Recommendations

2.1 Development of a strategic plan by the Commission

(paragraphs 1. and 2. of the recommendations)

Vodafone welcomes the recommendation of RSPG that the Commission should develop a strategic plan to make the necessary spectrum available to meet the future demand for wireless (terrestrial & satellite) broadband services in the time frame 2013-2020.

Vodafone supports the target in the RSPP of 1200MHz of spectrum by 2015, which is a challenging objective. However, licence awards over a number of years have shown that the value of spectrum for mobile services varies widely, depending on the degree of harmonisation, technical factors and availability of equipment (especially terminals). It is important, for both EU citizens and operators, that future releases of mobile spectrum are of high quality, and that this is not compromised by a focus only on the overall quantity of spectrum available.

The timeframe for making new spectrum available for a harmonised use can be very long, especially if it action by a WRC is needed. If decisions that are not made by WRC-15, it might not be possible to revisit them until the conference-after-next, in around 2023, and this might not result in licence awards until around 2030. Therefore, while a concrete roadmap needs to extend until around 2020, it is also necessary to look ahead to see what decisions need to be taken before 2020 in order to make sufficient spectrum available in the following decade.

Detailed analysis of the usage of candidate bands

There is a scarcity of publicly available information on the actual level of use in the EU of some frequency bands - particularly the 700MHz and 3.8-4.2GHz bands, and also the 2090-2110MHz, 2200-2215 MHz, 2.7-3.4GHz and 3.4-3.8GHz bands (see discussion on these bands later in this response). A detailed analysis of the usage of these bands (and perhaps some others) will be valuable in informing decisions on candidate bands for wireless broadband.

Many of these candidate bands would require action by WRC-15 in order for them to be brought into use effectively for wireless broadband, and the window of opportunity for this is quite short. It is therefore important that this analysis can be completed quickly – which means that the number of bands needs to be kept to the minimum.

Spectrum needs for SAB/SAP (PMSE)

In the long term, it would be beneficial for PMSE to move from the UHF band, both for PMSE users and other potential users of this spectrum. In the past, PMSE could use the UHF band without incurring any opportunity cost though excluding other potential uses. However, as the intensity of use of UHF spectrum increases (whether from mobile broadband, or from broadcasting such as SFNs), the opportunity cost from PMSE in this spectrum will also rise.

The time has now come when Europe should identify alternative spectrum for radio microphones, where this use is compatible with the primary service and there is low opportunity cost from other potential uses. This should be done soon, so that they can be migrated into the new spectrum as new equipment is purchased, over a period comparable to the equipment lifetime.

Technology advances have enabled Radio microphones to operate at higher frequencies, and they are now widely available for 2GHz and above. Vodafone proposes that the 2025 – 2090MHz band should be considered as a harmonised band for radio microphones. This band is already used for another SAB/SAP application, wireless cameras, but technology advances mean that these can also be migrated to a higher frequency band.

2.2 Development of a long term strategic policy on future use of the UHF band

(paragraphs 3. and 4. of the recommendations)

In recent months, there have been significant initiatives in Europe in the development of digital terrestrial television (DTT) - in EUⁱ, Germanyⁱⁱ ⁱⁱⁱ, EBU^{iv} and DVB-Forum^v. These are building momentum for the early release of the 700MHz band for mobile broadband. As a result, national strategies for future use of the UHF Band^{vi} are already being overtaken by events.

One key step in making this spectrum available for wireless broadband is a primary mobile allocation in the Radio Regulations. If WRC-15 does not take action, there may not be another opportunity until the WRC in around 2023, and these decisions would be unlikely to lead to licence awards much before 2030.

Vodafone therefore believes that WRC-15 should make a co-primary mobile allocation for the whole of this band. However, it may be considered premature for WRC-15 to extend the identification for IMT below 694MHz; if so, WRC-15 request further studies on identification of part(s) of this band, to be considered by a future WRC under the report of the Director of the RB (this would avoid the need for an agenda item).

Refinement of the lower band edge and channelling arrangements

Spectrum below 1GHz is valuable for many applications. It is therefore important that the 700MHz band is utilised efficiently. The frequency arrangement for mobile broadband will inevitably not make full use of the spectrum, because of the need for a FDD centre gap and guard bands. This spectrum can be used by other applications such as PPDR, but it is essential that this is done in a way that does not create coexistence problems. It is therefore important that the 700MHz is considered holistic way. However, this is difficult, because the work in ITU¹ and CEPT² is fragmented between a number of different groups.

Vodafone has developed a frequency arrangement for the 700MHz band, which makes effective use of the spectrum for both wireless broadband and public safety; this is described in the annex to this response. This can fit entirely within the 694-790MHz band. However, the overall spectrum utilisation can be increased if the public safety spectrum can be allowed to extend below 694MHz – perhaps only in geographic areas where the upper TV channels are not used for broadcasting. To accommodate this, it would be helpful for the lower boundary of the mobile allocation to be reduced slightly by WRC-15³, perhaps to 686MHz. This ‘refinement’ would be for public safety, so there would not be any need to modify the lower boundary of the identification for IMT, and it might be appropriate to do this under agenda items 1.1 or 1.3, instead of 1.2.

2.3 The 1452-1492MHz band

(paragraph 5. of the recommendations)

This band falls within a frequency range that is a good candidate for identification for IMT by WRC-15 (and mobile allocation if needed). Vodafone believes that the value of this spectrum would be greatly increased if a wider bandwidth than 40MHz can be made available. We would therefore urge caution to Administrations about proceeding with licence awards before WRC-15, because these awards might turn out to be inconsistent with the decisions made then.

Vodafone believes that Europe should seek identification of at least 80 MHz by WRC-15 in the frequency range 1300 – 1518 MHz, excluding 1400 – 1427 MHz (plus co-primary mobile allocation if required). The option of using the whole of this wider band for supplementary downlink may have benefits:

- It would provide extra downlink capacity, to accommodate the downlink bias of many traffic forecasts.
- It would avoid the need for an extra PA in terminals (they are already likely to have an antenna and receiver, for GPS).
- It may ease coexistence with passive services in the 1400 – 1427 MHz band.

2.4 The 2GHz MSS bands

(paragraph 6. of the recommendations)

The 1980 – 2010 MHz and 2070 – 2200 MHz bands are immediately adjacent to the existing paired band; it could be rapidly implemented in terminals with negligible extra cost, and would therefore generate considerable value for both consumers and mobile operators.

These bands were awarded in EU to two companies under Commission Decision 626/2008/EC and 2011/667/EU, but there is no evidence of plans to offer commercial services using this

¹ In ITU, different aspects are addressed by WRC-15 agenda items 1.1, 1.2 and 1.3, and by JTG 4-5-6-7, WP5A and WP5D.

² In CEPT, different aspects are addressed by CPG PTD, ECC PT1, FM49 and their parent groups.

³ As discussed in the previous section, we believe that WRC-15 should make a primary mobile allocation to the full 470-694MHz band, in which this ‘refinement’ would not be needed.

spectrum. The Decision required the licence holders to meet milestones for the launch of satellites and offering of commercial services, which have all now passed. The EU Committee COCOM has established a Working Group on MSS issues which, inter alia, will examine “any alleged specific breach of the common MSS authorisation conditions in accordance with Article 9(2) of Decision 626/2008/EC” and “facilitating and coordinating ... the application of Member States' rules on enforcement to any authorised operator of mobile satellite systems ... including rules for suspension or withdrawal of authorisations”.

Vodafone urges Member States, with the support of the Commission, to act on the findings of the Working Group, and then to reallocate this band for terrestrial mobile services.

2.5 3800 – 4200 MHz band

(paragraphs 2. & 8. of the recommendations)

The predicted growth of mobile broadband traffic is likely to need IMT channel bandwidths of up to 100MHz at some point. The existing bands identified for IMT and the bands that are likely to be identified by WRC-15 are not large enough to support this capability. The 3800 – 4200 MHz band, together with the 4400 – 4900 MHz band, have sufficient bandwidth for this purpose.

The Commission should therefore both analyse the usage of these bands and the potential of sharing between FSS and terrestrial wireless broadband services.

2.6 Bands not addressed in the Draft Opinion

The bands described below have been proposed in ITU as candidate bands for WRC-15 agenda item 1.1, and should receive further consideration by RSPG and the Commission for wireless broadband in the EU:

2090 – 2110 MHz and 2200 – 2215MHz

These bands would be paired with 1900 - 1920MHz and 2010 – 2025MHz. Together with the 2GHz MSS band, this would more than double the size of the 2GHz paired band, from 2 X 60MHz to 2 X 125MHz. The Draft Opinion discusses (page 8) the reasons why the 1900 - 1920MHz and 2010 – 2025MHz have not been used for TDD. However, this wider 2GHz FDD band could be rapidly implemented in terminals with negligible extra cost, and would therefore generate considerable value for both consumers and mobile operators.

We recognise that CEPT has decided not to consider these pairings further, but the decisions were made without any real consideration of the benefits and challenges of making these bands available. We would therefore encourage RSPG to include these bands in the list in paragraph 2. i) of the recommendations, for a detailed analysis of current usage. We appreciate that the nature of the current uses of these bands may mean that the full results cannot be made public, but stakeholders should be given assurance that a proper study has been carried out.

2700 – 2900 MHz

This band would be valuable for mobile broadband. It is adjacent to the 2.6 GHz band, which means that it would be easy to implement in terminals and base stations would not require extra antennas. The band forms part of the wider band of 2700 – 3400MHz, which is used for various type of radar. It is widely believed that this band is not used very intensively, and new radar technologies^{vii} ^{viii} and RF filters^{ix} will reduce the spectrum needed. It should therefore be possible to accommodate all spectrum requirements for these radars above 2.9 GHz.

4400 – 4900 MHz

This band should be considered, together with the 3800 – 4200 MHz band, should be considered for future support of IMT channel bandwidths of up to 100MHz. See section 2.5.

2.7 Taking account of varying national requirements

(paragraph 9. of the recommendations)

It is likely that the long-term requirements of Member States for wireless broadband will be quite similar, though there could well be differences in the rate of adoption. It could therefore be proportionate for EU Harmonisation measures to have some flexibility on date of implementation, but there would be less justification for variation on the amount of spectrum to be made available.

2.8 General observations

The Draft Opinion recommends a large number of actions and topics for analysis by the Commission. Each of these is individually justified, but taken together may lead to a delay in the high level objective of the Opinion – meeting the growing demand for wireless broadband. It would be useful for RSPG to review the complete list of these actions and topics, to keep the number to the minimum necessary and give some indication of priority.

ⁱ Thinking European, and winning the wireless race; speech by Neelie Kroes to the Radio Spectrum Policy Group (RSPG), 20 Feb 2013;

http://europa.eu/rapid/press-release_SPEECH-13-140_en.htm

ⁱⁱ Mobile Informationsgesellschaft der Zukunft: Diskussionspapier - "Mobile Media 2020"; BMWi, 12 November 2012;

<http://www.bvft.de/wordpress/wp-content/uploads/2012/12/Medienstrategie-2020-BMWi.pdf>

ⁱⁱⁱ A study of future spectrum requirements for terrestrial TV and mobile services and other radio applications in the 470-790 MHz frequency band, including an evaluation of the options for sharing frequency use from a number of socioeconomic and frequency technology perspectives, particularly in the 694-790 MHz frequency sub-band; Technische Universität Braunschweig for BMWi, 21 January 2013;

<http://www.bmw.de/English/Redaktion/Pdf/study-of-future-spectrum-requirements,property=pdf,bereich=bmw,sprache=en,rwb=true.pdf>

^{iv} The future role of Broadcasting in a world of changing electronic communication; Roland Beutler; EBU Technical Review, 2013, Q1;

http://tech.ebu.ch/docs/techreview/trev_2013-Q1_Broadcasting_Beutler.pdf

^v DVB Forum: Report of Study Mission Group on Prospects of Terrestrial Broadcast Television, Oct 2012. Study mission on cooperative spectrum use, on-going.

^{vi} For example: Securing long term benefits from scarce low frequency spectrum: UHF strategy statement; Ofcom, 12 November 2012.

^{vii} Study into Spectrally Efficient Radar Systems in the L and S Bands - Short Report; BAE Systems for Ofcom, July 2006,

<http://stakeholders.ofcom.org.uk/market-data-research/other/technology-research/research/spectrum-efficiency/sers/>

^{viii} Assessment of coexistence between radar systems in the frequency band 2700-3100MHz, Annex 29 to the Working Party 5B Chairman's Report; ITU, Annex 29 to Document 5B/167-E, 14 December 2012, <http://www.itu.int/md/R12-WP5B-C-0167/en>

^{ix} This has been found through installation of filters to improve coexistence between radars above 2700MHz and mobile networks below 2690MHz.

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A POSSIBLE FREQUENCY ARRANGEMENT FOR THE 694-790MHZ BAND

1 Introduction

This contribution describes a possible frequency arrangement for the 694-790MHz band in ITU-R Region 1. It is based on the lower sub-band of 2 X 30MHz of the APT 700MHz bandplan⁴, and makes efficient use of the 96MHz of available spectrum by including sub-bands suitable for specialist applications of IMT, such as machine-to-machine communications (M2M) and public safety (PPDR):

- 2 x 30MHz for mobile broadband IMT networks.
- At least 2 x 5MHz suitable for specialist applications such as public safety (expandable to 2 x 15MHz in times of emergency).
- 2 x 3MHz suitable for low data rate mobile communications (e.g. one 3MHz LTE carrier).
- 5MHz suitable for low density direct-mode applications (e.g. for PPDR).

It is envisaged that the majority of terminals supporting the 700MHz band for Region 1 would include both sub-bands of the APT 700MHz band, because of the benefits of a global market and economies of scale; this would facilitate global roaming. The narrower sub-bands would be supported by terminals intended for the specialist applications, and would not generally be implemented in mass-market mobile broadband terminals.

2 Considerations in the development of the frequency arrangement

In developing the frequency arrangement described in this paper, the following objectives and issues were considered important:

- The lower sub-band of the APT bandplan should be the basis for the 700MHz bandplan for Region 1.
- Any modifications to the APT bandplan must give benefits for both Europe and Asia Pacific (i.e. the economies of scale must outweigh any drawbacks in both regions).
- The reasons for alignment between the APT and European 700MHz bandplans are roaming and economies of scale; therefore, the total number of bands that need to be supported by terminals for use in both regions must be feasible in the 2018 timeframe.
- It must also be feasible to implement the individual bands in terminals (the maximum feasible duplexer bandwidth at 700MHz is around 30MHz without performance compromises).
- The bandplan needs to show a higher utilisation of spectrum than 60MHz out of 96MHz. (uses will be found for any vacant spectrum, and it is better for this to be done in a planned way).
- It is desirable for momentum to start to build before WRC-15, to achieve the timescale for implementation in Europe and confidence for earlier implementation in Africa.

⁴ The bandplan developed by the Asia Pacific Telecommunity - 'APT bandplan' - comprises two sub-bands, and the lower sub-band provides an opportunity for harmonisation of frequency arrangements for Region 1 with substantial parts of Regions 2 and 3.

Vodafone has reviewed other options proposed for the bandplan for 694-790MHz, but we have not found any that provide more than 2 X 30MHz of spectrum for broadband IMT and also meet these objectives.

3 Key features of the frequency arrangement

3 x 30 MHz for broadband IMT

This spectrum is aligned with the lower 2 x 30MHz sub-band of the APT bandplan, which will facilitate implementation of global terminals. It is not possible to use the upper APT sub-band, because this overlaps with the existing European 800MHz band.

The coexistence with broadcasting would benefit from the frequency separation that would be provided by the sub-band below (that could be used for PPDR) and its guard band.

At least 2 x 5MHz for public safety (expandable to 2 x 15MHz in case of emergencies)

This is immediately below the IMT broadband spectrum. In the diagram, the harmonised allocation for public safety is shown as 2 x 5MHz; however, it is likely that the harmonised public safety band could be extended to 2 x 10MHz if TV channel 48 is not used for broadcasting; this would also benefit the co-existence between broadband IMT and broadcasting.

The higher affordable cost of public safety terminals and the narrower operating band, together with a lower density of users and the likelihood that they will be further away from TV reception aerials, would significantly reduce the potential for interference to DTT reception (compared to commercial mobile services).

The width of this band can be extended to 2 x 15 MHz for use in emergencies such as natural disasters and major public disorder. The terminal transmissions would then be close to the highest used DTT channel, which may cause some interference in the locality of the terminal *in areas where the top TV channel is used*, but this could be considered acceptable for the emergency situations in which this spectrum would be needed.

2 x 3MHz, suitable for M2M communications (utilities)

This fills the 3MHz gap between the APT lower sub-band and the Region 1 800MHz band and uses a part of the centre gap. For both uplink and downlink, the duplex direction is the same as the adjacent mobile spectrum, so there is a low potential for interference. It would support a single 3MHz LTE carrier. This frequency range would probably not be implemented in consumer handheld IMT terminals.

5MHz for direct mode, suitable for PPDR

Public safety organisations may require terminals to support ‘direct mode’ (direct terminal-to-terminal communication) in case the network is not available. This is inherently TDD, and can conveniently be located within the remaining ‘centre gap’ of the bandplan. This is expected to be compatible with the mobile network because it is not immediately adjacent, provided that the level of utilisation will be very low under normal circumstances (it will only be used out of PPDR network coverage, which is likely to be in locations where there is no 4G network coverage either, and therefore no potential for interference). The optimal position of the direct mode sub-band within the 7MHz of available spectrum depends on the expected utilisation and results of coexistence studies.

A bandplan for Region 1 700MHz band

