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RSPG BEREC Report on Competition: Transitional Issues in the Mobile Sector in Europe

February 2011

Section I: Introduction

1. In 2010 the joint working group of ERG/BEREC and RSPG was asked to develop two reports on competition issues and spectrum, both primarily focusing on the use of spectrum by the mobile sector.
2. This is the first of the two reports and primarily deals with competition related issues arising from the liberalisation of spectrum at 900 and 1800 MHz and the award of other relevant spectrum (such as 800 MHz and 2.6 GHz) for electronic communications services. The second report dealing with longer term competition issues, especially in relation to network and spectrum sharing issues, is expected to be published later in 2011.
3. The information provided in this report is based upon the answers provided by ERG/BEREC and RSPG members to a questionnaire circulated by the working group in March 2010 to gather information on the developments and transitional issues associated with 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz. 26 responses were received to this questionnaire. In this report we consider the answers provided and try to assess the technological evolution and spectrum requirements necessary for incumbent and new entrant MNOs to meet the growing demand for mobile data applications and the associated regulatory requirements to enable the delivery of these services and, at the same time, promote effective competition and avoid its distortion.
4. In considering the points raised in this report it is important to note that the mobile market is dynamic and evolving. Moreover, it is developing at different rates across Europe and differing market forces apply in each country. These depend on the historical development of the mobile market in each country and impact the approaches incumbent MNOs and new entrants take to “up grading” / deploying new networks.
5. As such this analysis is time sensitive and must be viewed as a “snap shot” of the current market and the potential direction it may take. Should circumstances change substantially in the future it may be necessary to revisit the issues discussed in this analysis. It should be noted that a first report on transitional issues, which called for the subject to be reassessed, was produced by the Working Group about 18 months ago which is available at http://rspg.groups.eu.int/documents/documents/meeting/rspg19/rspg09_277_erg_rspg_report_on_transitional_spectrum_issues_090603.pdf.

Background

6. Across Europe the mobile sector plays a vitally important role to citizens and consumers, to industry, the overall economy and society as a whole. Significant changes in recent years – reflecting rapid growth, technological improvements and, in part, regulation – have brought benefits to consumers and contributed to society.
7. Although subscriber growth across most of Europe is now slowing, the sector continues to see rapid development, not least from increasing demand for data and mobile broadband services (partly driven by the increasing variety and take-up of smartphones, machine-to-machine, 3G data cards and other USB dongles). The emergence of mobile broadband services is a key feature of this report.

8. The term 'mobile broadband' herein refers to high speed mobile data services which can only be provided, or are best provided, using 3G technologies and beyond, for example UMTS, HSPA(+), WiMAX and LTE. Mobile broadband includes the provision of services to any type of device, including mobile handsets and laptops with USB 'dongles' or embedded modems / datacards.

Section II: The mobile sector in Europe

Development of the mobile sector in Europe

9. The award of spectrum to mobile operators has been undertaken by Member States since the mid-1980s. Although the spectrum to be used has been harmonised at European level, the award mechanisms, the number of operators in each country and the conditions of the authorisation have largely been determined at national level. By acting independently, Governments and National Regulatory Authorities have been able to establish the competitive framework and regulatory conditions which are best suited to benefit their own citizens and consumers. For example, in a number of cases, they have sought to promote competition by introducing new entrants into national markets. However, in other cases, the number of competitors has decreased over time as a result of mergers and/or operators returning licences.
10. The effect of independent regulatory policies across the Member States is that the number of mobile operators, their spectrum holdings and the regulatory conditions under which they operate can differ significantly between Member States. This makes attempting to undertake analysis at the European level complex, especially with regard to drawing any conclusions, though similar challenges and trends in the regulatory environment may be observed.
11. In the majority of countries the mobile market is served by 3 – 4 MNOs though there are exceptions. In the majority of countries, the two biggest MNOs have more than 65% market share, with a few exceptions to this trend. MVNOs and service providers also operate in the majority of countries, with most operating through commercial agreements.

Mobile sector spectrum asymmetry

12. Across Europe there are different sorts of asymmetries that have developed in the mobile sector. In this report we consider asymmetric situations as being:
 - Where one or more MNOs do not have access to specific spectrum bands to which other MNOs have access;
 - Where MNOs do have access to the same spectrum bands, but not to the same amount of spectrum;
 - Where the expiry date of licences within a spectrum band are not uniform and expire at different times; and/or
 - Any combination of the above.
13. These asymmetries are partially explained by the different spectrum awards in terms of timing and procedures – as well as changes over time in

regulatory policies – that have taken place in each Member State (generally starting with 900 MHz, then 1800 MHz, then 2 GHz) over the past 20 or so years.

Asymmetric spectrum holdings

14. A particular issue that has arisen in a number of Member States is that assignments of spectrum to mobile operators across 900 MHz, 1800 MHz, 2.1 GHz are asymmetric. Asymmetric spectrum ownership can be an important issue as different spectrum bands have different propagation characteristics: higher frequencies offer opportunities to carry greater capacity while bands at lower frequencies provide potential for better coverage. Spectrum at 900 MHz is particularly attractive to mobile operators as it offers excellent coverage potential, including inside buildings. As 900 MHz was among the first spectrum bands to be made available for mobile telephony it was generally awarded to the first operators and, in many countries, has not been available to later entrants to the market.
15. Even in countries where all the MNOs have access to 900 MHz spectrum, in most cases one or more operator has access to a relatively small amount of this spectrum (for example less than 2x10 MHz). In 4 countries, at least one operator has no access to 900 MHz spectrum while another has access to less than 2x10 MHz of 900 MHz spectrum. Overall in the 900 MHz band there is 2x35 MHz of spectrum available.
16. A key role of Spectrum Managers is to promote effective competition and avoid distortions of competition. Unequal spectrum holdings are not an impediment per se in reaching these objectives as long as operators do not benefit from unmatchable advantages associated with given spectrum holdings. Reducing asymmetries among spectrum holdings might be used as a tool to promote effective competition and avoid distortions of competition but the issue must be considered carefully depending on the circumstances.
17. Belgium, France and Poland have either indicated they will or, under certain circumstances, may reclaim spectrum in the 900 MHz or 1800 MHz bands. In Belgium this will depend on who acquires spectrum in upcoming awards. In France a provision has been implemented in existing licences allowing the NRA to reclaim 900 MHz spectrum in order to balance the spectrum held by the MNOs. In Poland there are plans to reclaim the 1800 MHz spectrum currently occupied by military use.
18. In addition Denmark, Finland and Sweden have already undertaken a process of reclaiming spectrum. Denmark completed a process in 2009 of reclaiming both 900 and 1800 MHz spectrum in order to make more spectrum available. The freed spectrum was scheduled to be auctioned off in October 2010. Only one application was received in the award process and accordingly a new licence in each of the 900/1800 MHz bands was issued to the applicant - the MNO, which had no previous spectrum in those bands. The new licenses entered into force on 1 January 2011. Finland started a process of re-assigning spectrum in the 900 MHz band in 2005, with further revisions to licence conditions in 2007 in order to facilitate provision of UMTS in the band. As a result all MNOs in Finland now have equal amounts of spectrum and contiguous frequency blocks in the 900 MHz band. Sweden has reclaimed approximately half of the 1800 MHz which it is intended to award by auction. In Italy the 900 MHz band has been re-assigned on the

basis of 5 MHz blocks in order to correct historically fragmented assignments and to enable one block to be set aside for a new 3G entrant.

Asymmetries in licence expiry dates

19. In some Member States expiry dates of 2G and 3G licences are not uniform across operators, for example due to different dates of assignments of spectrum or different licence durations. In 17 countries at least one GSM licence will expire in the next five years (either a single spectrum allocation licence, i.e. just for 900 MHz or 1800 MHz or a combined 900/1800 MHz licence). In all other cases the 900 and 1800 MHz licences will expire between 2016 – 2027, with most of these expiring between 2021 – 2025.
20. The approaches to deal with different expiry dates vary across Member States. In some countries licences are renewable annually, in other countries licences are renewed when they expire, and in others licences can be extended as a consequence of predefined obligations and conditions.
21. Some Member States have indicated that they do not plan to renew or extend licences when they expire. In Norway, Ireland, Switzerland, Denmark and the Netherlands, Spectrum Managers have announced that they are not planning to renew the 900 MHz licences. In many cases plans are still under development but the Netherlands has confirmed it is planning to auction the 900 MHz spectrum in the future, while in Ireland and Switzerland it is proposed that all frequencies will be re-awarded through auctions planned for 2011. In Sweden, all block licences are for a fixed duration period which will not be extendable, with new licences to be awarded via a selection procedure to be determined (e.g. beauty contest/ auction).
22. In some countries spectrum managers have sought to resolve the issues by attempting to remedy the asymmetry in expiry dates. For example in Slovenia it is proposed to extend the duration of the 900 MHz licences that expire in 2013 to 2016 to harmonise the expiry dates of the 900 and 1800 MHz licences and then in 2015 (one year before expiry) to consult on the further award of the 900, 2100 and 2600 MHz (in combination with 800 MHz) bands. Similar approaches have been pursued in Germany (where the 2G licences have been extended to 2016 for a uniform expiry date) and in Belgium (where the 2G licences have just been renewed to align the 2G end date with that of the 3G licences). In Ireland, ComReg is proposing that, while the 900 MHz band will be auctioned in 2011 along with the 800 MHz band and possibly also the 1800 MHz band, the spectrum rights of use for all bands will not become effective until January 2013.

Section III: Evolution of the 900 and 1800 MHz spectrum and future spectrum awards

Spectrum liberalisation

23. Spectrum liberalisation, understood as the introduction of technology and service neutrality, gives spectrum users greater flexibility over how to use the spectrum they hold, in terms of the service or technology they deploy. As such it can help to bring spectrum into use for new technologies and applications quicker than regulatory measures requiring more direct intervention, such as refarming. It also gives spectrum users greater freedom

to respond dynamically to changes in consumer demand over time, rather than relying on regulatory intervention which can be slow, burdensome and costly. Such a regulatory concept is implemented at the European level under the WAPECS (Wireless Access Policy for Electronic Communications Services) approach described and defined in the relevant EC and ECC Decisions applicable to the relevant mobile bands. These are the 900/1800 MHz bands currently used for GSM and recently opened for UMTS, the 2 GHz band, the 2.6 GHz band, the 3.4/3.6 GHz band as well as the 800 MHz band. At this stage, there is a lack of visibility on the practical consequences of the implementation of the resulting least restrictive conditions (see CEPT response to EC 2 GHz mandate: CEPT report 39 part 1). BEREC-RSPG notes that CEPT is currently collecting feedback from administrations on that issue focusing on 3.4/3.6 GHz and 2.6 GHz bands. BEREC-RSPG also notes that CEPT already launched initiatives to address cross border co-ordination issues in the 800 MHz and 2.6 GHz band.

24. Spectrum liberalisation is often combined with trading of spectrum usage rights in order to give users greater flexibility both over how spectrum is used and by whom. The principles of spectrum liberalisation are also now encompassed in the new European Directives through clauses on technology and service neutrality and practical implementation of the WAPECS approach.
25. When considering the implications of liberalising the spectrum currently used for the provision of 2G mobile services, an important consideration is the extent to which there are other bands available which could offer similar benefits. This is particularly relevant for spectrum below 1 GHz due to its scarcity and its importance in the provision of mobile networks as described above. In relation to networks deployed using 900 MHz spectrum, the most likely alternative would appear to be the upper sub-band of cleared digital dividend spectrum (790 – 862 MHz). This is because 800 MHz, being near in frequency to 900 MHz, has similar physical characteristics.
26. Across Europe there is a general positive acknowledgement on the substitutability of the 800 and 900 MHz bands, with most of the respondents to the questionnaire considering that the benefits of 800 MHz and 900 MHz were comparable and substitutable. A few responses qualified their view in that the bands were only substitutable in terms of physical and propagation characteristics, and that the substitutability of use of the bands would be time critical (i.e. comparable in the long term but possibly not the short term). This is due to differences in the speed of technological development, continued legacy GSM operation in the 900 MHz band and the availability of equipment for the two bands, as well as in terms of the amount of bandwidth available.
27. The timing of availability and potential use of 800 MHz spectrum is therefore a key issue for Spectrum Managers when considering how to manage the liberalization of 2G spectrum. Under the revised GSM Directive and EC Decision 2009/766/EC, Member States are required to make the 900 MHz as well as 1800 MHz spectrum available for UMTS by 9 May 2010 (although the GSM Directive only applies to the 900 MHz band). In some countries UMTS 900 networks and handsets are already in use but, by contrast, a number of uncertainties remain for 800 MHz spectrum, including:
 - the nature and extent of European harmonisation of this spectrum;

- the timing of when Member States may make available the spectrum (i.e. 790-862 MHz) so it can be used for mobile services;
 - cross-border co-ordination issues; and
 - when suitable equipment will become available.
28. However, some uncertainties are being reduced, e.g. the adoption in 2010 of an EC Decision supporting a specific channelling arrangement for 790-862 MHz. Other policy initiatives are currently under way, including through the Radio Spectrum Policy Programme, to try to further reduce these uncertainties by defining common principles and a timeframe for ensuring the availability of the band.
29. Regarding the 900 and 1800 MHz bands, technical conditions to introduce LTE and WIMAX are being finalised¹ and an update of the EC Decision 2009/766/EC to list these two systems in the EC Decision could be foreseen within the next few months to provide visibility to the market and better regulatory conditions to address competition issues at national level.
30. The availability of next generation mobile systems and services in the 900 and 1800 MHz bands will mainly depend on market demand (e.g. equipment orders by mobile operators). At the present time UMTS 900 MHz equipment (base stations and terminal equipment) is becoming available within the European market. It is understood that equipment is being developed next for the 800 MHz band, though this will depend on the development of the regulatory framework and the availability of the spectrum. Next generation (including LTE and WIMAX) equipment for these bands is in the early stages of development. Availability of mobile terminals is a key issue and without the perspective of economies of scale, there is less interest from the industry to develop terminal equipment
31. The timelines are essential when comparing the 800 and 900 MHz bands. Even though there is likely to be a relatively short period of time between the availability of the two bands, it may nonetheless be a critical period for the take-up of wireless broadband services. As such the benefits from wider access to lower frequency spectrum, even in this interim period, may be significant.
32. In relation to incumbent 900 MHz operators, it should also be taken into account that the rollout of UMTS 900 as well as LTE 800 can be based on existing GSM 900 network deployments, lowering the total rollout cost. New entrants to either the 800 or 900 MHz band could be required to undertake more deployment efforts. On the other hand, incumbent 900 MHz operators deploying UMTS or LTE in the 900 MHz band will need to take into account the legacy GSM systems in place and avoid degrading the GSM service. This can introduce significant complexity.
33. So far, most Member States have liberalised the use of 900 & 1800 MHz to allow the use of UMTS, while some are in the process of liberalisation and others have already allowed LTE in the 1800 MHz band. In general the most common approach reported for implementing the revised GSM Directive² has been by amending national frequency plans and allocations (as indicated by

¹ See CEPT reports 40, 41 which have been subject to public consultation

² GSM Directive 2009/114/EC and accompanying EC Decision 2009/766/EC

Germany, Estonia, Lithuania, Luxembourg, Slovenia, Poland, Denmark, UK, Portugal and the Netherlands) or by amending national legislation (Bulgaria and Italy) to allow UMTS in the 900 & 1800 MHz bands. Often this approach is combined with the amending of MNO licences. In Norway new licences were awarded to the MNOs following a small refarming procedure to provide contiguous spectrum for each licensee and to reflect some technical adjustments relating to the protection of GSM-R. In general, where licence conditions were amended, no additional obligations or conditions were placed on the MNOs and their existing licence conditions remained unaffected.

34. In a few cases (Belgium, France, Sweden and Finland) no changes to licence conditions or regulatory requirements were necessary as it was considered the revised GSM Directive had already been implemented. In these cases a competition assessment was undertaken which, in all cases, resulted in some spectrum at 900 MHz being re-awarded (either to a new entrant in this band or to an existing operator with least spectrum). The Czech Republic also reported a similar position but the process is subject to ongoing consultation, while Denmark noted an award process or refarming would be necessary. Switzerland, as a non-EU Member State, amended its national frequency plan based on ECC/DEC (06)13. As a consequence all MNO licenses were changed accordingly to allow UMTS in the 900 & 1800 MHz bands.
35. In a few countries countries (Cyprus, Austria³, Slovak Republic, Hungary, Ireland, Spain and France⁴) the process to implement the amended GSM Directive/EC Decision is either under ongoing investigation and discussion or consultation.

Future spectrum awards:

790-862 MHz (the “800 MHz band”)

36. In October 2009, the European Commission recommended⁵ that Member States:
- take all necessary measures to ensure that broadcasting services cease using analogue transmission technology by 1 January 2012, and
 - support regulatory efforts towards harmonised conditions of use other than, and in addition to, broadcasting services.
37. BEREC-RSPG believes that uncertainty about the availability of 800MHz equipment will be a key issue in determining how 800 MHz use may apply competitive pressure on 900 MHz use. For this reason, taking into account that the technical conditions to use the 800 MHz band are already known, it is believed that the timing of the awards of the 800 MHz spectrum across Europe and the actual availability of this band for mobile use will be key factors driving the development of equipment that can use 800 MHz and determining the speed of deployment.

³ Implementation expected in early 2011

⁴ EC Decision only

⁵ http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/document_storange/legislation/dd_recommendation/en_rec.pdf

38. In its Opinion on the Radio Spectrum Policy Programme ⁶ (RSPP), the RSPG noted that the 800 MHz band should be subject to an EU-wide coordinated approach based on the guiding principles of service and technology neutrality and harmonised standards. This, it noted, would be ideal for extending coverage and improving in-building penetration. The RSPG therefore invited the European Parliament and the Council to consider that coordinated availability of the 800 MHz band for Electronic Communication Services (ECS) other than broadcasting should be achieved in all the EU Member States by 2015⁷. The Commission has proposed in the RSPP a date of 2013 by which the 800 MHz band must be made available for electronic communications services, with derogations possible until 2015.
39. A number of European countries have decided to clear the 800 MHz band and many others are in the process of considering what action to take. In particular in Austria, the Czech Republic, Denmark, Finland, France, Germany, Ireland, Norway, Portugal, Sweden, Switzerland, Spain and the UK it has been decided to release the whole of the 800 MHz band with several other countries consulting on whether to do so (e.g. the Netherlands).
40. BEREK-RSPG considers that the total market size represented by the countries that have already committed to clear the whole of the 800 MHz band is significant. Given this, and the propagation advantages of 800 MHz (i.e. the close similarity with 900 MHz propagation characteristics), it is considered that 800MHz is an important frequency band for mobile services in Europe, as illustrated by the prices paid for 800 MHz blocks in the recent German auction.
41. However, as a result of the different timeframes for deployment of wireless broadband at 800 MHz and 900 MHz, Spectrum Managers will likely need to consider the various regulatory mechanisms available (see paragraphs 64-74) to reduce any significant competitive advantage an incumbent MNO may accrue through the earlier liberalisation of 900 MHz. These competition issues are considered in more detail in the next section.

2500 – 2690 MHz (the “2.6 GHz band”)

42. In addition to the award of the 800 MHz band it is important to consider, in parallel, the ongoing developments in the 2.6 GHz band (2500-2690MHz) as this spectrum is expected to play an equally important role in the deployment of wireless broadband services across Europe, albeit with lesser coverage than anticipated at 800 MHz. It is expected that the potential uses will cover a range of mobile broadband and data intensive services reflecting the increasing convergence in communication services.
43. In 2008 the European Commission published Decision 2008/477/EC on the harmonization of the 2500-2690 MHz frequency band for terrestrial systems

⁶ See

http://rspg.groups.eu.int/documents/documents/opinions/rspg10_330_rspp_opinion.pdf

⁷ The set implementation date may have to be postponed in Member States facing frequency coordination issues with non EU countries until such issues are resolved in line with the policy recommended in this Opinion on the RSPP. A similar need for postponement of implementation could arise in Member States where exceptional national or local circumstances would prevent the availability of the band.

capable of providing electronic communications services in the Community". This Decision, which refers to the previous RSPG work on WAPECS ("Wireless Access Policy for Electronic Communications Services"), sets the technical conditions under which this spectrum should be made available across Europe. It offers administrations flexibility over the balance of paired (FDD) and unpaired (TDD) spectrum that can be awarded to operators, as well as providing operators with flexibility as to the technology and service that may be deployed. BEREC-RSPG notes that the authorisations recently granted in some EU countries introduced flexibility on the paired (FDD) and unpaired (TDD) spectrum but this has not been deployed by the rights holders thus far.

44. BEREC-RSPG considers that this spectrum will help to support the development of innovative and advanced mobile data and broadband services, will foster competition in the provision of these services across Europe and has the potential to deliver substantial benefits for consumers and the European economy as a whole. In particular, this band is likely to be of interest to operators looking to adopt the next generation of wireless broadband technologies, not least as 2.6 GHz also offers opportunities for deployment on a global basis so as to support roaming and economies of scale in equipment manufacture. This is because 2.6 GHz is available internationally for new uses (in many countries on a greenfield basis) in the near term.
45. Given the potential of the 2.6GHz spectrum, in particular the scope for new competition and innovation, BEREC-RSPG considers it important that awards of this band take place as soon as possible across Europe. BEREC-RSPG notes that eight countries (Germany, Sweden, Norway, Denmark, Finland, the Netherlands, Austria and Estonia) have already awarded 2.6 GHz licences and understands that in four countries (Finland, Sweden, Denmark and Norway) LTE 2.6 GHz networks are already operational.
46. Of the remainder, most countries have designated the 2.6 GHz band for electronic communication services (in compliance with EC Decision 2008/477/EC) and plans are in place to make it available:
 - In 6 countries (Belgium, Cyprus, Bulgaria, Switzerland, Czech Republic and Portugal) it is expected that the band will be made available by auction in 2011⁸;
 - France is still considering whether the frequencies to be awarded in 2011 will be allocated via a tender process or an auction.
 - Spain and Italy have undertaken public consultations and Spain has proposed a date for the award of 2011.
 - Slovenia and Slovak Republic are planning to award the 2.6 GHz spectrum by a comparative selection process (beauty contest). In Slovak Republic it is hoped this will take place in 2011 while in Slovenia, where the spectrum is currently used on a temporary basis, a tender is expected in 2015.
 - In Ireland the band is currently occupied by MMDS (classified as an ECS). These licences are due to expire in 2012 and 2014, but no decision has yet been taken on the future of this band.

⁸ In the Czech Republic the auction procedure is expected to start in 2011, with the final stage in 2012

47. The extent of the utilization of the 2.6 GHz band will crucially depend on the development of wireless broadband in the forthcoming years. A strong rise in data traffic, possibly driven by the use of data hungry applications or by the spread of easy to use wireless mobile devices, could create a shortage of available spectrum to satisfy demand. Frequencies in the 2.6 GHz band have the advantage that they can support large amounts of data traffic and, combined with lower frequencies bands, such as 800 or 900 MHz which provide better coverage, could help operators to meet their traffic demand.
48. As with 800 MHz the development and widespread take up of these 2.6 GHz services is also partly dependent on the availability of user devices. At present 2.6 GHz dongles are available on the market and it is understood that handsets are currently being developed with the first likely to be placed on the market in early 2011. However, how this translates into manufacturers producing multi-band phones is unclear at the present time and will to a certain extent depend on market demand.

Section IV Future challenges: new technologies and competition issues

Current and future technologies

49. From the review conducted by BEREC-RSPG it appears that the majority of countries do not have a clear indication as to how long GSM will continue to operate, but the general consensus across all the responses is that GSM (at 900 MHz and 1800 MHz) will still continue to be used for the foreseeable future. In particular:
- Germany stated, within the consultation process for the spectrum auction at 800 MHz, 1.8 GHz, 2.1 GHz and 2.6 GHz, MNOs declared that they plan to use the 900 MHz band for GSM at least until 2016 (expiry date of the GSM licenses);
 - Finland advised that GSM technologies are expected to continue to operate until 2017, when the GSM concessions of the 2 largest network operators expire; and
 - the Czech Republic suggested recent indications show that GSM services may not end before 2022.
50. Some countries noted that the demand for mobile broadband is likely to be a strong driver in transitioning towards new technologies. However, uncertainty on the rate of migration across technologies may raise competition issues. For example, operators may argue that they need certain amounts of spectrum to run parallel GSM and UMTS / LTE networks or, more generally, Spectrum Managers may need to deal with shifts in the availability of devices to support wireless broadband.
51. It is possible that operators may seek to deploy LTE in different bands across Europe. For example in some countries, operators have indicated they are considering deploying LTE in 1800 MHz rather than 2.6 GHz or 800 MHz depending on the spectrum price of each band. For example the Polish operators CenterNet and Mobyland are in the process of launching the first LTE network in Poland in the 1800 MHz band with a 2 x 20 MHz channel. According to their statements, they seem to consider the 1800 MHz band as a

substitute for the 2.6 GHz and 2.1 GHz band⁹. In Sweden it has been indicated that if operators do not get spectrum at 800 MHz they may need to move GSM customers from 900 to 1800 MHz (to facilitate deployment of LTE at 900 MHz).

52. In some countries operators have argued that the current 900 MHz spectrum is needed to support GSM, with mobile broadband likely to be deployed in other bands (unless more spectrum is made available at 900 MHz where this is possible). In particular, some respondents noted that it will be easier to roll-out wireless broadband networks in bands (such as 800 MHz and 2.6 GHz) which are currently unused by mobile networks.
53. New technologies also pose questions in relation to the development of voice traffic. Currently it is considered that 2G networks deliver voice services to a relatively good quality and 3G technologies do not materially improve voice quality. Instead they are able to increase network capacity due to the increased spectral efficiency.
54. Another factor is the competitive pressure that General Packet Radio Service (GPRS) or Enhanced Data rates for GSM Evolution (EDGE) can potentially exert on other wireless mobile technologies. This is because GPRS and EDGE deliver a basic data service that can support lower data rate applications such as e-mail, limited web browsing and smaller file downloads. The extent to which these technologies can challenge others will depend on the use that consumers will make of wireless broadband, the amount of data traffic and legacy terminals.
55. A further issue regards substitutability among competing technologies. For further information on this issue see the previous report of this group which is available at http://rspg.groups.eu.int/documents/documents/meeting/rspg22/rspg10_335.pdf

Availability of equipment using 800 MHz

56. The above represents some of the factors that Spectrum Managers will need to take into account. However, a key issue is the timing of equipment availability. In relation to this, BEREC-RSPG notes that in addition to the growing use of LTE at 2.6GHz there has been a growing momentum for using LTE at 800 MHz both across Europe and globally with several countries carrying out tests of LTE at 800 MHz . In support of this the 3GPP completed work on including 800 MHz in the LTE standards in March 2010 with terminal test specifications for LTE800 expected to be completed in 2010/11.
57. Nonetheless, despite the increasing momentum for LTE at 800 MHz, BEREC-RSPG considers that a key issue relates to the uncertainty associated with the availability of user equipment, especially handsets. It seems clear that

⁹ According to the President of CenterNet and a board member of Mobyland, “the project’s uniqueness consists of new technological solutions. LTE the state-of-the-art technology operating on the basis of the harmonized 1800 MHz broadband, provides not only a higher speed of data download but also enables a better use of the telecommunications infrastructure than the solutions currently used by the other operators (HSPA+ in the 2100MHz band or LTE in the 2600MHz band)” <http://www.mobyland.com/n7.html>

LTE dongles will be developed before handsets given the relative simplicity of dongles compared to handsets.

58. As current handset design technology is limited by the number of frequency ranges that can be used by a handset (currently typically four) this means that handset manufacturers will only want to include 800 MHz in handsets if there is sufficient demand for this frequency relative to other frequencies. The demand for LTE800 to be included in handsets will therefore depend in part on the commitment of Europe to create a sizeable market for use by mobile operators relatively quickly to the benefit of European citizens and business.

Importance and relevance of cross border co-ordination to mobile transition

59. As UMTS has been designed to provide capacity more cost effectively than GSM and allow migration of the existing 2G infrastructure to a 3G capability, some operators could be motivated to migrate their 2G networks to UMTS as soon as possible, whilst others may prefer to wait and deploy other new technologies (e.g. LTE) later on if there is no immediate need to migrate technologies. This has the potential to create a situation whereby different technologies may be deployed in the same spectrum bands within a close geographical area.
60. A similar situation could potentially also develop whereby similar services are provided in neighbouring countries, but using different spectrum bands (e.g. mobile broadband in either 800, 900, 1800, 2100, 2600 and possibly also 3400 - 3800 MHz). To ensure these services can operate effectively they also need to be co-ordinated across national borders (including, where applicable, with non-EU countries) to ensure both spectral and economic efficiency.
61. It is therefore important that when considering the transition of mobile technologies that suitable methods and criteria for cross-border frequency coordination exist to ensure that neighbouring systems, both in terms of physical geography and spectrum adjacency, do not interfere with each other.
62. Appropriate coordination of spectrum use can enable equipment to be designed for the entire European market and this could drive down costs by taking advantage of the potential economies of scale. It would also ensure consistent performance of devices and networks across the EU, which would facilitate roaming and potentially minimise interference. Used efficiently, it will also improve the EU's competitiveness by increasing innovation in equipment and wireless services, as well as by facilitating access to mobile broadband. The key benefits of this are the opening up of larger harmonised markets and greater economic gain from a wider variety of services (through reduced costs due to fewer individual engineering solutions required) and the associated benefits this may bring for consumers (e.g. cheaper handsets) through increased economies of scale. In response to market demand and to administrations, CEPT is currently developing relevant practical solutions for cross border coordination in the 800 MHz, 2.6 GHz and in the 900/1800 MHz bands.
63. It is estimated that appropriate European coordination could increase the potential economic impact of mobile broadband spectrum use by an additional €20 to €50 billion between now and 2015. In the long run an additional benefit of € 30 billion could be realised beyond 2015 through further

EU coordination¹⁰. As recommended by the RSPG Opinion on the RSPP, competent national authorities should be encouraged to share experiences and best practices, in particular where cases of technical issues, such as harmful interference, have arisen during coordination activities. Specific cooperation among national authorities should be based on a 'collective support mechanism' as described and recommended by the Opinion.

Regulatory tools available to spectrum managers to address competition issues

64. In addressing competition issues there are a variety of instruments that Spectrum Managers can employ either singularly or in combination to deal with the particular circumstances arising in national markets. These can be used either initially upon award of the licence(s) or post award following market analysis. Each measure has advantages and disadvantages and Spectrum Managers need to weigh these up in choosing the best approach. The following provides a non-exhaustive list of some of the options available to Spectrum Managers to address competition issues that may arise across the 900 MHz and 1800 MHz bands and/or in relation to future awards (primarily 800 MHz and 2.6 GHz).

i) Spectrum pricing:

65. Spectrum pricing (or Administered Incentive Pricing, AIP) is a mechanism which seeks to promote efficient use of spectrum by charging a fee based on opportunity cost. In this way spectrum users are incentivised to make optimal use of spectrum as the fee they pay will be based on the value of the next best alternative use (i.e. the opportunity cost of the use that is forgone). The starting premise of AIP is that spectrum needs to be used optimally for the benefit of consumers. However, while incentive pricing can help to promote efficient use of spectrum it seems unlikely, on its own, to reduce asymmetries in spectrum holdings. Furthermore, the calculation of AIP is not an easy task, considering the complexity of the methodology in determining the fees.

ii) "Spectrum trading and leasing": transfer of spectrum usage rights

66. Spectrum trading is the commercial transfer of spectrum usage rights and associated obligations to use spectrum between two parties: it allows licensees to transfer some or all of the rights and associated obligations that they enjoy as a result of their licenses to third parties. This enables spectrum to migrate between users, thus enabling spectrum to move into the hands of the user that values it most and will make best use of it. Spectrum trading can help to support commercial arrangements between parties which can be adapted as necessary to reflect market conditions.

67. Spectrum trading, especially when combined with liberalisation, may help to lower barriers to entry by providing access to spectrum through market mechanisms. At the same time, spectrum trading provides potential scope for spectrum users to acquire more spectrum which could potentially lead to competition concerns. Such assessment of competition issues may be included in the overall process of the transfer of spectrum usage rights. Based on the EU regulatory framework and Competition Law, national

¹⁰ <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/1112>

measures are also in place to deal with and/or prevent anti-competitive spectrum hoarding.

iii) Spectrum caps:

68. Spectrum caps can be used to limit the amount of spectrum a particular operator can hold, either in total or in certain bands, thereby ensuring that spectrum is more equally shared amongst competing operators. Spectrum caps are most commonly used to limit an operator's ability to acquire new spectrum, for example by requiring that they divest existing spectrum that they hold before acquiring more spectrum in a new award.
69. Spectrum caps are relatively simple to apply and could, if set correctly, be a mechanism to address market distortions. The disadvantage of spectrum caps is that it can be difficult to calculate the correct level of the cap and that in certain circumstances it may cause excessive fragmentation of spectrum among players. Nonetheless, spectrum caps remain a useful tool, particularly when used alongside some of the other mechanisms described here.

iv) Refarming

70. Essentially refarming is an administrative technique for changing a spectrum use or users. In some cases refarming can be implemented relatively quickly and simply (for example where spectrum is liberalised in the hands of an existing user), but in others it can be a complex, lengthy and costly process (for example where it needs to be cleared and awarded). However, even in the first case the situation can be significantly more complex, for example if the act of liberalisation risks giving the existing user a competitive advantage.
71. Refarming can help to promote competition through the process of making more spectrum available. This can help to promote competition between existing players and/or provide scope to introduce a new entrant into the market. Furthermore, refarming is part of the current scenario of liberalisation of services and technologies in which, to the extent possible, it is left to the market to decide which services and technologies are more efficient for each band.

v) Regulated access

72. Regulated access, in line with the requirements of the EU Regulatory Framework, is a mechanism under which incumbents are required, through regulation, to provide access to all or part of their networks. This can help to promote competition by allowing other operators to provide a competing service in downstream markets.
73. A key difficulty with this approach is in setting the terms of access at the correct level. If set too favourably then the operator being provided access will have a competitive advantage and the network operator may have a disincentive to roll out their network. On the other hand, if the network operator is allowed to discriminate in favour of its own business (for example, in terms of price or quality) then the operator being provided access will not be able to compete in the downstream market and consumers will not benefit from increased competition. Moreover, even where regulated access is effective, there is likely to remain only limited competition at the network level

which may hold back innovation and investment in the network.

74. Under certain circumstances operators may choose to allow access to their networks on commercial terms, most obviously to utilise spare capacity on their networks, thereby increasing spectrum efficiency. As with regulated access, this can also be expected to promote competition in downstream markets, potentially leading to downward pressure on prices. However, the fact that such increased competition in the downstream market may impact on an operator's profits may mean that operators prefer not to offer such forms of commercial access at competitive prices.

Experience in Member States

75. Most Member States indicated that they would expect to utilise a combination of the above mechanisms to address issues that arise. Some Member States noted that tools such as spectrum pricing and trading of spectrum usage rights might help to mitigate competition issues to a certain extent, but that this would depend on the particular circumstances being addressed. Others considered that the mechanisms identified above, even in combination, may not be sufficient to completely solve all the competition and regulatory issues that may arise.

Section V: Conclusions

76. Member States are experiencing an increasing usage and demand for mobile data services and broadband applications / services. This is partly driven by the increasing variety of smartphones and social dynamics, 3G dongles and relevant data retail tariffs as well as the continuing development of more efficient spectrum technologies (i.e. UMTS / LTE, WiMAX etc).
77. Moreover, all European countries are aware of the issues and implications associated with mobile transition and the resulting competition issues it raises. However, whilst there was a good response to the questionnaire distributed, it must be stressed that the issues it sought answers on are complex, not least as the individual circumstances in each Member State are very different.
78. BEREC-RSPG considers that it is important to have an understanding of the varying European processes when applying solutions at the national level. Although there is no common European solution to address the issues identified in this report, it is nonetheless possible on the basis of the above analysis and the responses to the questionnaire to draw out some common themes and broad conclusions.

Common themes

- In the majority of European countries the mobile market is served by 3 – 4 MNOs (with a few exceptions).
- In some countries there is a significant degree of asymmetry in spectrum holdings across the MNOs in both 900 MHz and 1800 MHz; furthermore, in many European countries there are asymmetries in 900 MHz and 1800 MHz licence expiry dates – in a few countries Spectrum Managers are looking to harmonise expiry dates across the MNOs.

- The majority of European countries have now implemented the revised GSM Directive and EC Decision 2009/766/EC, or are in the process of doing so, through various regulatory and licensing mechanisms – as such, the majority of European countries now allow use of non GSM technologies in the 900 MHz and 1800 MHz bands.
- It is uncertain how long GSM services in 900 MHz and 1800 MHz will continue for – this issue has not been investigated in detail by the group.
- Whilst a small minority of countries have (or are planning to) reclaim (refarm) the 900 MHz spectrum, a number of countries expressed a view that the reclaiming of 900 MHz was not necessarily required when implementing the revised GSM Directive – this view was mirrored for 1800 MHz.
- There is a widespread commitment across Europe to open up the 800 MHz band to ECS other than broadcasting.

Broad conclusions

- BEREC-RSPG notes that a greater number of MNOs can help to increase competition but the benefits of such increased competition may need to be balanced against any potential downsides, such as inadequate spectrum block sizes for broadband technologies.
- BEREC-RSPG understands that MNOs with less than 2 x 5 MHz of 900 MHz spectrum will not be able to run a dual UMTS / GSM service in that band due to insufficient spectrum.
- BEREC-RSPG believes that, while asymmetries make the analysis of mobile spectrum at European level complex, they may not necessarily be a cause for concern. Indeed circumstances will differ across Member States and national Spectrum Managers and NRAs will need to tailor policies to meet their specific needs, to promote effective competition and avoid distortions of competition in their domestic markets.
- BEREC-RSPG further notes that Spectrum Managers and NRAs have different instruments that they can use to deal with competition concerns.
- BEREC-RSPG considers that it is not necessarily discriminatory for different operators to have different rights to use spectrum, as is currently the situation in many European countries. Furthermore such asymmetric spectrum holdings should not prevent further assignments of new spectrum, provided the assignment does not result in competitive distortion.
- BEREC-RSPG notes that at the technical level, most European countries see the 800 MHz band as substitutable for 900 MHz; however, complexity of 3G/4G network rollout will differ due to the presence of legacy systems in the 900 MHz band and the availability of new equipment in these bands – it was noted 3G equipment is already available for 900 MHz.
- BEREC-RSPG considers that (where possible, depending on regulatory, technical, licensing, co-ordination issues etc) the 800 MHz and 2.6 GHz bands should be made available as soon as possible within the next few years.
- BEREC-RSPG notes that in general the most common approach to award the 800 MHz band (where applicable) and 2.6 GHz spectrum is via an auction process; furthermore consideration is being given in a number of Member States as to whether this should be done in parallel for the two bands.
- BEREC-RSPG understands that the majority of NRAs are still considering whether it is necessary to apply spectrum caps to the award of 800 MHz.

- BEREC-RSPG notes that there is a range of views across NRAs on the effectiveness of market mechanisms in addressing competition issues - overall the general view expressed was positive, but qualified.
- RSPG-BEREC considers that a harmonised band plan (i.e. harmonised frequency arrangement for 800 MHz) shall be considered as an essential requirement to achieve the best spectrum efficiency and avoid interference between different mobile networks¹¹ and key elements to ensure further development of the mobile broadband market. This does not preclude the possibility for harmonised frequency arrangements to include flexibility, e.g. for applications (mobile/fixed) or duplex arrangements (FDD/TDD) and different channel bandwidths where possible and relevant.

¹¹ See CEPT Report 39 – part 1