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Discussion Paper

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Approaching shortages of mobile broadband spectrum threaten to limit broadband deployment and economic growth

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Discussion paper

Mobile broadband is changing the way that people live and work by enabling access anywhere at any time. The growth and proliferation of mobile broadband services is increasingly an important part of overall economic growth. Access to additional radio spectrum is the oxygen of mobile networks, and the failure to adequately plan for the expanding demand for mobile broadband data usage threatens to limit development, innovation and competition in this service. Informed observers expect significant spectrum constraints to become apparent within the next five years or so, due to an on-going large increase in the data traffic in mobile broadband networks. The process of allocating and assigning spectrum for mobile service is a time consuming process in most countries and efforts to harmonize spectrum at the international level takes considerable long term planning (e.g., 10 to 12 years). Because of this multi-year process often required to allocate and assign new spectrum resources to operators, ICC has prepared this discussion paper to inform governments and regulators about the economic benefits of taking action now to ensure that sufficient spectrum is available to support the increasing demands following current and expected data traffic trends.

Within this discussion paper, ICC recognizes that there are many important uses of spectrum, including for both broadcast and mobile broadband. Indeed, broadcasting and mobile broadband services will need to co-exist, because no matter how much spectrum is allocated for mobile broadband, there are limits to the services offered over it, such as popular video content like sporting or entertainment events, which may not be economically or practically carried on the Internet when a high volume of viewers are simultaneously accessing a particular program. Moreover, broadcasting plays a critical role in emergency situations, in that it reaches the largest number of people in the most efficient way. Therefore, ICC recognizes the importance of ensuring that mobile broadband will co-exist in conjunction with other essential technologies such as broadcast services. With this in mind ICC supports ensuring that the essential quality of broadcast service is preserved and that broadcasters are granted substantially the same service area. Decisions on compensation of broadcasters should be taken on a case-by-case basis by the relevant national regulatory authority, taking into account all stakeholders' views and the specific national situation. For example, in some of the proposed incentive auction legislation in the U.S., broadcast spectrum license holders who voluntarily relinquish UHF spectrum would receive a share of the auction proceeds to cover their expenses; whereas, in the United Kingdom the national regulator made available spectrum in the lower UHF band in recompense for the release of channels 61 and 62, in order that the 800MHz band could be freed up for mobile broadband. Nothing in this ICC paper should be construed as granting greater importance to the use of spectrum for a particular technology, whether broadcast, mobile broadband, or others. The focus in this ICC paper on mobile broadband is because this is a new and emerging use of spectrum.

ICC's Task Force on Internet and Telecommunications Infrastructure and Services (IT IS) has a strong interest in promoting the development of mobile broadband services and technologies, and supports efforts to allocate and assign adequate of spectrum in timely manner to support the growth of mobile data services and the subsequent benefits to the global community.

Mobile broadband contributes to economic growth and productivity. In the United States, for example, an Ovum study finds that annual productivity gains as a result of wirelessly enabling business applications will grow to about $130 billion by 2016.[1] A study conducted for the European Commission reports that opening up the 790-862 MHz sub-band to mobile broadband services by 2015 in all European Union member states under common conditions of use would generate an added

[1] *Ovum, The Increasingly Important Impact of Wireless Broadband Technology and Services on the US Economy (2008).*

value compared to individual national initiatives of between 17 and 44 EUR billion.[2] The World Bank reports that broadband penetration results in even greater economic growth in developing countries than in developed economies.[3] Since developing countries often have less legacy fixed network infrastructure, particularly in rural areas, they have an even more significant opportunity for mobile spectrum to deliver broadband services. Similar opportunities arise in other countries that lack extensive fixed network infrastructure to support broadband services. For example, according to a recent study, "[t]he prospects of a spectrum shortage in the Americas, especially Latin America, during the coming decade are too large to ignore. Absent new spectrum it will be difficult if not impossible to meet rapidly increasing demands for mobile broadband services that are affordable, widely accessible, of high quality, and can generate widespread economic and social value." [4]

A significant amount of additional spectrum will be required to promote continued innovation and satisfy the demand for next-generation mobile broadband services. Not only has the number of subscribers to mobile services increased, but also those subscribers' demand for voice minutes and data capacity has grown exponentially. For example, 98 percent of iPhone users use the data features of their phones. iPhone users are four times as likely to use the Internet as a typical subscriber, five times as likely to download an "app," six times as likely to watch mobile video, and seven times as likely to use location based services.[5] Spectrum demand is being driven by the increasing availability of 3G services, innovation in mobile devices, content and applications, growth in numbers and types of mobile devices, increases in per capita use of devices, and spectrum requirements of 4G technologies. The innovations introduced into 4G networks have given rise to a host of new services that will create additional capacity needs. Netbooks, personal GPS location technologies and e-readers all employ mobile connectivity to enable core requirements or enhance the user experience. Many economic sectors are making increasing usage of "machine-to-machine" applications, allowing the development of smart grids, and a broad range of industrial, transportation, medical, and other applications. While some of these mobile devices primarily support low bandwidth applications, many of the most popular devices support rich media applications and content that consume much more bandwidth. Devices such as laptops, netbooks, smartphones and tablets consume considerably greater capacity than traditional mobiles.

When these factors are combined—increased subscriber numbers, more devices, increased voice usage, increased data device and smartphone adoption among subscribers, and greater use of data applications by those subscribers—the impact is staggering. Mobile broadband network operators and content providers already report huge increases in data traffic resulting from existing smart phone usage. One annual study of global mobile demand reports that traffic will increase at a Compound Annual Growth Rate of 92% between 2010-2015; that global mobile traffic in 2015 will be three times the amount of all the traffic on the Internet in 2005; and that Asia-Pacific, Western Europe, and North America will generate the most mobile data traffic by 2015, but the Middle East & Africa will together experience the steepest data traffic growth curve.[6] Google reports that mobile usage of YouTube increased threefold in 2010 to more than 200 million views per day. Researchers predict even more staggering increases in this traffic as 4G networks and devices are increasingly deployed over the next few years. A recent staff paper released by the US Federal Communications Commission states that "mobile data demand is expected to grow between 25 and 50 times current levels within 5 years."[7]

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[2] *Commission of the European Communities, Transforming the Digital Dividend into Social Benefits and Economic Growth, Oct. 29, 2009, Sect. 4.2.*

3 World Bank, Information for Communications and Development 2009, Extending Reach and Increasing Impact, at 5-6.

4Martin Roetter, Spectrum for Mobile Broadband in the Americas: Policy Issues for Growth and Competition, Jan. 2010, at 32, http://www.gsmamobilebroadband.com/upload/resources/files/GSMA%20Americas%20MBB%20Spectrum%20Paper%20-Jan2011.pdf .

5 NielsenWire, iPhone Users Watch More Video… and are Older than You Think (June 10, 2009), available at http://blog.nielsen.com/nielsenwire/online_mobile/iphone-users-watch-more-video-and-areolder-than-you-think/.

6 See Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2010-2015, at http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.html .

[7] *FCC Staff Technical Paper, Mobile Broadband: The Benefits of Additional Spectrum, Oct. 2010, at 5 & 9. The paper also predicts that in the United States, "the broadband spectrum deficit is likely to approach 300 MHz by 2014." Id. at 2.*

The mobile technologies will undoubtedly continue to improve, but technology alone will not suffice to meet the exploding demand for mobile broadband capacity. Mobile network operators are constantly innovating to increase capacity, or developing solutions such as pico cells, advanced antenna solutions, and traffic off-load to WiFi networks, but there are near-term limits to their ability to accommodate rising demand exclusively through additional network investment to increase cell capacity and deploy more efficient equipment. As the compounding demands for mobile data services quickly eclipse any gains from these technological improvements, only the addition of new spectrum resources can meet the exploding demand for mobile broadband services.[8] In many countries, an important opportunity to begin to address this issue is provided by the potential availability of "digital dividend" spectrum for mobile broadband as the result of the switchover from analog to digital TV (DTV). It should be noted that no amount of spectrum or system efficiency can substitute for broadcast's one-to-many technology using broadband access, and therefore the introduction of DTV and its mobile derivative should be managed carefully as important public policy objectives. For example, one option is broadcast solutions within mobile broadband architectures, such as the proposed LTE specification for "Evolved Multicast Broadcast Multimedia Services (E-MBMS). Because broadcast provides video content to a large number of people in an efficient and cost-effective way a policy approach should ensure adequate spectrum for broadcast. With this in mind ICC supports ensuring that the essential quality of broadcast service is preserved and that broadcasters are granted substantially the same service area. Decisions on compensation of broadcasters should be taken on a case-by-case basis by the relevant national regulatory authority, taking into account all stakeholders views and the specific national situation. For example, in some of the proposed incentive auction legislation in the U.S., broadcast spectrum license holders who voluntarily relinquish UHF spectrum would receive a share of the auction proceeds to cover their expenses; whereas, in the United Kingdom the national regulator made available spectrum in the lower UHF band in recompense for the release of channels 61 and 62, in order that the 800MHz band could be freed up for mobile broadband.

To deploy 4G networks, such as LTE, in an efficient manner, for example, requires at least 20 MHz of contiguous, paired spectrum—10 MHz each for uplink and downlink per operator. Operators require new spectrum bands to launch new wide-bandwidth technologies. Further, to avoid disrupting service to existing mobile subscribers currently using 2G and 3G services, spectrum devoted to LTE or other 4G technologies must be cleared and reallocated from other legacy use. For 4G networks to achieve their full potential, operators will need sufficient clear, contiguous spectrum to support multiple 2x20 MHz or even wider channels, in order to meet the anticipated capacity demand.

In identifying additional spectrum for commercial mobile uses, the ICC observes that there are several key issues that may be of central importance to governments and regulators.

First, lower-band spectrum (sub 1 GHz) is generally considered more desirable for providing wide coverage because of its superior propagation characteristics and the need for fewer base stations. Higher-band spectrum (above 1 GHz) is generally considered more desirable for providing higher capacity and high peak data rates because of the availability of wider bands. The ITU and other expert observers have emphasized the need to ensure that new spectrum identified for licensed, mobile services are below 4 GHz, but there may be a need to look at slightly higher frequency bands (up to 5 GHz or 6 GHz) to gain access to sufficiently large contiguous bandwidths to match peak demand in hot spot areas. Spectrum between approximately 450 MHz and 3.8 GHz possesses propagation characteristics that are ideal for mobile services; markedly, the frequency bands for mobile broadband usages are currently being expanded up to 3.8 GHz both in terms of standardization and regulation in some parts of the world. In North America, with its heavy reliance on spectrum around 4 GHz for satellite distribution of TV content, not always compatible with mobile broadband systems, the mobile broadband services should be allocated below 3.8GHz.

Second, additional spectrum is best allocated in large contiguous blocks suitable for data-intensive services. LTE and other 4G standards require large contiguous spectrum bands to achieve high peak data rates and, to a degree, efficiency. LTE, while capable of scaling for use in smaller bandwidth

[8] *The use of unlicensed spectrum is unlikely to be effective for large-scale mobile networks, since only an exclusive licensee has the economic incentives to make the huge financial investment necessary to construct a large-scale mobile network.*

channels, does not achieve optimal spectrum efficiency gains until at least 20 MHz of bandwidth is accessible—which requires paired 20 MHz channels, or 40 MHz overall.[9] Indeed, future versions of the standard, LTE-Advanced, are designed to use paired 40 MHz channels, or 80 MHz overall per operator, and even larger bandwidths are foreseen to comply with the IMT-advanced performance targets of 1Gbps. New spectrum also should be allocated near existing commercial bands to allow the more efficient addition of new spectrum to existing networks.

Third, there are tremendous benefits of leveraging global economies of scale if additional spectrum is internationally harmonized. Device and network equipment manufacturers can then take advantage of those economies of scale, rather than having to devote scarce resources to making separate technologies for different national market circumstances. Globally harmonized spectrum therefore reduces equipment costs, resulting in saving for consumers and encouraging the expedited deployment of new technologies and services. This approach also results in easier international roaming and simplified international interference management.[10]

Fourth, to promote competition for mobile broadband services, a technology neutral approach, and also the efficient use of spectrum, governments and regulators can best promote service availability and innovation with a licensing regime that not only includes mobile network operators that manage scarce spectrum and numbering resources, but also that includes mobile resale licenses for parties that could negotiate voluntary commercial agreements with mobile network operators. Mobile resellers can foster a range of innovative new services that efficiently utilize mobile network operator resources, such as in the machine-to-machine space, and the licensing barriers should be minimal. At the same time, the ICC recognizes that mobile network operators must be able to manage the spectrum that they are responsible for, and have often paid substantial amounts to manage, so there is merit to the view that commercial agreements between mobile network operators and resellers should not be compulsory.

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The following are examples of the steps some countries have taken to allocate additional spectrum for mobile broadband.

European Union: The European Commission has published draft legislation requiring EU national spectrum regulators to make the 800MHz band, freed up by the analogue to digital TV switchover, available by 1 January 2013 in accordance with harmonised technical conditions. Neelie Kroes, European Commission Vice President for the Digital Agenda, has observed that "[s]ervices which rely on radio spectrum represent 2% to 2.5% of annual EU gross domestic product (GDP), i.e. more than €250 billion according to a study undertaken by the Commission. This includes the European wireless electronic communications industry which supports 3.5 million jobs, generates around €130 billion annually in tax revenues and contributes €140 billion to European GDP."[11]] Germany and Sweden have now reallocated 800 MHz band spectrum by auction, and five more EU member countries, France, Ireland, Italy, Portugal, and Spain, will award this spectrum in 2011. The draft legislation also

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[9] *Mobile operators in Australia have complained that frequency allocations are inadequate to support LTE services where "no carrier has licences allowing them to create blocks larger than 15MHz in any one region and most are limited to 10MHz in metropolitan markets." GSMA Mobile Business Briefing, Australia facing LTE Spectrum Shortage, Feb. 22, 2011, http://www.mobilebusinessbriefing.com/article/australia-facing-lte-spectrum-shortage-voda-revamps-network. Some European operators have also expressed concern regarding the availability of sufficient spectrum to support LTE. Total Telecom, European Telcos Say LTE Will Not Solve Capacity Crunch, Oct. 28, 2010, http://www.totaltele.com/view.aspx?ID=459850&G=1&C=4&Page=0.*

[10] *A recent study finds that the harmonized allocation by Asia Pacific countries of the 700 MHz band for mobile services, which would ensure that these countries use the same frequency for LTE deployment with the same specifications, could increase their cumulative GDP by approximately $700 billion by 2020, as well as increasing tax revenues by approximately $130 billion and creating more than two million new jobs. Boston Consulting Group, Socio-Economic Impact of Allocating 700 MHz Band to Mobile in Asia Pacific, Oct. 2010, http://gsmworld.com/documents/bcg_report_2010.pdf .*

[11] *Europa Press Release, May 26, 2011, http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/11/345&format=HTML&aged=0&language=EN&guiLanguage=en.*

calls for spectrum already harmonised at the EU level to be made available for wireless broadband by 2012: including bands at 900 MHz / 1800 MHz and 2.6GHz.

France: During 2011, has auctioned 2 x 60 MHz for mobile broadband in 2.6GHz.

Germany: Has auctioned 360 MHz of spectrum to German mobile broadband providers in 2010, of 2x 30 MHz digital dividend spectrum in 800 MHz range, 800 MHz licences came with the obligation to cover rural regions before spectrum can be used in more densely populated areas to help bridge the digital divide. No adverse impact on broadcast has been reported from commercial LTE800 operation so far.

India: The Department of Telecommunications in India has established a working group with industry participation to consider the reallocation of the 700 MHz band.

Italy: In 2011, has auctioned 800 MHz band and 2.6 GHz bands together, with remaining blocks in 1800 MHz and 2.1 GHz, for mobile broadband.

Mexico: In January 2011, Cofetel, the national regulator, announced that it will reallocate 300 MHz of spectrum to mobile services within the next two years. By 2012, Cofetel will also auction for mobile broadband use the 700 MHz band presently used by broadcasters.

The Netherlands: Will hold a super auction in 2012, auctioning the 800MHz, 900 MHz / 1800 MHz bands, as well as parts of the 2.1 GHz and 2.6 GHz bands.

Norway: Expects to reallocate the 800 MHz band by auction in 2011.

Serbia: The Ministry of Telecommunications has proposed that countries in South East Europe should develop a unified approach to the allocation of "digital dividend" spectrum.[12]

Spain: In 2011, Spain has made available for mobile communications providers 250 MHz from the "digital dividend" in the 700-800 MHz band, and from the new band of 2.6 GHz, and also will reallocate its bands of 900 MHz and 1800 MHz.

Sweden: PTS, the national regulator, awarded the 2.6 GHz band in 2008, leading to the launch on the world's first LTE network in 2009. In March 2011 the 800 MHz band was awarded. The PTS has identified more than 500 MHz of spectrum to be awarded under a service and technology neutral regime up until 2013.

Switzerland: Will hold a super auction in Q1 2012, allocating the 800 MHz, 900 MHz / 1800MHz, 2.1 GHz and 2.6 GHz bands.

United Kingdom: Ofcom, the national regulator, is in the process of reallocating an additional 355 MHz of mobile broadband spectrum. The 800 MHz and 2.6 GHz bands are due to be auctioned in late 2012. Additionally, on March 31, 2011, the UK government announced plans to release a further 500 MHz over the next ten years, including 160 MHz from the 2310-2390 MHz and 3400-3600 MHz bands.

United States: In March 2010, the Federal Communications Commission released its National Broadband Plan concluding that 500 MHz of additional spectrum should be made available for mobile broadband use within ten years, with 300 MHz of this amount available within five years. In June 2010, President Obama issued an Executive Memorandum directing the Government to make this additional spectrum available. In addition, the US has already reallocated most of its 700 MHz band "digital dividend" spectrum to mobile broadband services.

[12] *Ministerial Conference on Digital Dividend, Jun. 16, 2010, http://www.b92.net/eng/news/politics-article.php?yyyy=2010&mm=06&dd=16&nav_id=67850 .*

The International Chamber of Commerce (ICC)

ICC is the world business organization, a representative body that speaks with authority on behalf of enterprises from all sectors in every part of the world.

The fundamental mission of ICC is to promote trade and investment across frontiers and help business corporations meet the challenges and opportunities of globalization. Its conviction that trade is a powerful force for peace and prosperity dates from the organization's origins early in the last century. The small group of far-sighted business leaders who founded ICC called themselves "the merchants of peace".

ICC has three main activities: rules-setting, dispute resolution and policy. Because its member companies and associations are themselves engaged in international business, ICC has unrivalled authority in making rules that govern the conduct of business across borders. Although these rules are voluntary, they are observed in countless thousands of transactions every day and have become part of the fabric of international trade.

ICC also provides essential services, foremost among them the ICC International Court of Arbitration, the world's leading arbitral institution. Another service is the World Chambers Federation, ICC's worldwide network of chambers of commerce, fostering interaction and exchange of chamber best practice.

Business leaders and experts drawn from the ICC membership establish the business stance on broad issues of trade and investment policy as well as on vital technical and sectoral subjects. These include financial services, information technologies, telecommunications, marketing ethics, the environment, transportation, competition law and intellectual property, among others.

ICC enjoys a close working relationship with the United Nations and other intergovernmental organizations, including the World Trade Organization, the G20 and the G8.

ICC was founded in 1919. Today it groups hundreds of thousands of member companies and associations from over 120 countries. National committees work with their members to address the concerns of business in their countries and convey to their governments the business views formulated by ICC.

ICC Commission on E-Business, IT and Telecoms (EBITT)

Business leaders and experts drawn from the ICC membership establish the key business positions, policies and practices on e-business, information technologies and telecommunications through the EBITT Commission.

With members who are users and providers of information technology and electronic services from both developed and developing countries, ICC provides the ideal platform to develop global voluntary rules and best practices for these areas. Dedicated to the expansion of cross-border trade, ICC champions liberalization of telecoms and development of infrastructures that support global online trade.

ICC has also led and coordinated the input of business around the world to the World Summit on the Information Society, Geneva 2003, Tunis 2005, and continues this effort in the activities established in the Tunis Agenda through its initiative, Business Action to Support the Information Society (BASIS http://www.iccwbo.org/basis).

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