

# MAXIMIZING THE NEW SPECTRUM OPPORTUNITY

WRC-07 and onwards

Ericsson is shaping the future of Mobile and Broadband Internet communications through its continuous technology leadership. Providing innovative solutions in more than 140 countries, Ericsson is helping to create the most powerful communication companies in the world.





# 1 Introduction

Today's consumers are demanding. They want increasingly advanced services, they want them available at all times, and they want to use them everywhere they go, across countries and across continents. In short, they want it all. Operators worldwide are striving to meet this demand. They are not only improving capacity and coverage in existing markets but also connecting rural and underserved communities with mobile communications and broadband services. In these efforts, Ericsson is a trusted and reliable partner that has the experience, gleaned from over 130 years of telecom expertise, to take them forward, faster.

Consumers' current expectations of wireless service are built on their past experience, which is characterized by extraordinarily rapid expansion and improvement of wireless networks and technologies. Over the last 10 years, the mobile markets have experienced tremendous growth in the availability of service, the number of subscribers, the variety of high quality devices, and the sophistication of services. This growth was not merely by accident, rather it was planned and the plan was executed.

Three key considerations influence the success of the industry generally, as well as that of individual markets. These are: internationally harmonized spectrum allocations, global standards, and economies of scale. Through the International Telecommunication Union (ITU) regulators and the industry jointly laid the groundwork for the GSM/IMT-2000 market success by carefully identifying and allocating spectrum for market expansion. Subsequently,

the industry devised a plan for success, which when implemented, resulted in unparalleled network expansion, innovation, and equipment simplicity and affordability.

The time has come to repeat this process. Industry must plan now, via WRC-07, for future growth. The aim is to duplicate the success of the past, but doing so will be a real challenge. Looking ahead, mobile traffic is projected to increase 50 fold by 2020<sup>1</sup> and more spectrum is needed for mobile broadband services. **Thus, spectrum allocations that increase system capacity and that are suitable for new IMT-Advanced<sup>2</sup> systems with highly developed capabilities are critical.**

Historically, the ITU WRC is where significant spectrum decisions are made. For example, in 1992, the 2.1 GHz "core bands" that stimulated such tremendous industry growth were identified for IMT-2000 systems<sup>3</sup>. Consequently, WRC-07 must work hard to ensure that the three principles that stimulate market growth – internationally harmonized spectrum allocations, global standards, and economies of scale – are predominant in its decision making.

At the end of this document, Ericsson sets forth its specific recommendations as to each of the Agenda Item 1.4 candidate bands. Ericsson urges countries to make WRC-07 decisions that are consistent with these recommendations because this is the plan that will ensure that wireless services continue to enrich people's lives and promote economic development across the globe.



## 2 Availability of mobile spectrum spur market growth

Earlier ITU decisions aimed to spur growth in the mobile market and in economies worldwide by: identifying and allocating internationally harmonized spectrum to the extent possible; underscoring the importance and influence of global standards; and fostering economies of scale. They were very successful. The spectrum identified was largely implemented consistently at the national level and resulted in rapid growth of GSM/IMT-2000 markets. As a result of the ITU decisions, networks, devices, and services all improved significantly.

**Networks:** The GSM/IMT-2000 ecosystem currently connects more than 2.5 billion people to mobile communication networks and is growing by 1.7 million every day. The number of GSM/IMT-2000 mobile subscriptions will likely pass the 3 billion user milestone during the 2nd half of 2007. By year 2012, Ericsson expects there to be 5.5 billion mobile subscriptions globally, 1.2 billion of which will be mobile broadband enabled and of those (70%) will be the lion share based on WCDMA/HSPA.

**Devices:** The quality and functionality of mobile devices available for GSM/IMT – 2000 mobile networks is remarkable. Manufacturers produce myriad electronic devices with built-in connectivity including mobile phones, laptops, cameras, gaming devices, MP3 players, and health monitoring systems. These devices are increasingly more innovative, incorporate higher resolution displays, and feature improved processing power and software, all at continually affordable / lowered / dropping price points.

**Services:** Highly sophisticated and capacity intensive services such as Internet, telemedicine, mobile learning, e-Government, mobile TV, video conferencing, and remote access to the office are being launched at a staggering pace.

In light of this striking progress, it is clearly right to focus on the three principles set forth above.

## 3 Mobile communications stimulate socio-economic growth

In addition to personal/commercial benefits, mobile communications bring important socio-economic benefits to our global community. Mobile communications stimulate entrepreneurial and economic development both locally and globally, permit social inclusion and access to information through universal access to services, and enable important social initiatives like e-Government, mobile Learning, and e-Health. Improving the availability of these services for all people is an important goal for the WRC-07.

Mobile communications are especially important in developing countries. As *The Economist* magazine pointed out in an article entitled "Calling an End to Poverty" (July 2005), "Mobile telephony... is vital in developing the economies in less developed but high growth countries, where other forms of communication such as fixed networks, postal agencies or even roads and transport are often limited... A recent study by the London Business School found that, in a typical developing country, a rise of 10 mobile phones per 100 people boosts GDP growth by 0.6 percentage points".<sup>4</sup> Because mobile devices can counteract the difficulties associated with the poor infrastructure prevalent in rural areas they are a key contributor to reducing poverty.<sup>5</sup>

Similarly, access to broadband services brings substantial improvements to society and daily living all over the globe. Broadband services facilitate industrial growth, lead to

advances in research and development, and support a more sustainable society. For example, when 1/10<sup>th</sup> of BT employees became home-based teleworkers their productivity increased by 20% and their work-related travel was reduced by 17% (or over 100 million kms per year), which saved time and the environment.<sup>6</sup>

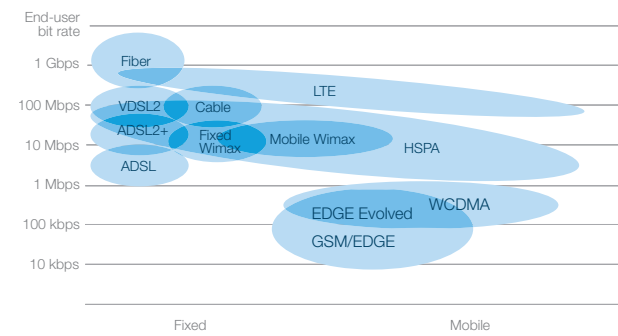
But, broadband services are not yet available to everyone, everywhere. At present, there are only 350 million fixed and mobile broadband subscriptions worldwide. The vast majority of the world's population does not have access to broadband. Even in highly industrialized regions like Europe and the USA, typically less than one-half of all households have broadband, and broadband connections are concentrated in urban areas; rural areas have been left behind. A recent study published by the Pew Internet & American Life Project noted that less than 25% of rural Americans have high-speed connections at home, compared with about 40% of suburban and urban dwellers.<sup>7</sup>

The major challenge facing industry today is how best to bring broadband services to a greater number of people, to bridge the digital divide between rural and urban areas, and to ensure such services are affordable to everyone. In Ericsson's view, the way to achieve this goal is to expand existing mobile broadband delivery systems and to foster the continued evolution of radio-based broadband technologies.



# 4 Harmonized spectrum is critical

Globally harmonized spectrum is central to the availability of advanced mobile and broadband services. New technologies, economies of scale, open and interoperable solutions, as well as competitive service and equipment markets all rely on harmonized spectrum, which brings costs down and makes mobile communications increasingly more affordable. For instance, currently available technology is expanding the availability of mobile and broadband services. The latest generation of 3G technologies provides user speeds equal to DSL and can be rolled out quickly and cost-efficiently. As a result, high-speed access to the Internet is no longer limited solely to the urban home and office.



Note: EDGE evolved will be available from 2008. HSPA includes both HSPA and HSPA-Evolved. LTE final specification of the standard is expected in 2007

Figure 1: Overview of high speed broadband access technologies

Although technical innovations like third generation (3G) WCDMA systems are keeping pace with consumer demand and delivering mobile broadband now, more globally harmonized radio spectrum is essential to meeting future mobile broadband demand.<sup>8</sup>

Regulators world wide are invited to continue to identify and allocate spectrum that, consistent with the three principles above, allows existing and advanced radio technologies to reach their full potential. In this way, regulators will provide the necessary foundation for those advanced technologies with distinct performance and efficiency advantages that will deliver truly ubiquitous mobile broadband, such as those within the 3GPP family of technologies.

The 3GPP technology family includes Enhanced Data Rates for Global Evolution ("EDGE"), High Speed Packet

Access ("HSPA"), HSPA-Evolved ("HSPA-E"), and Long Term Evolution ("LTE") all of which promise very high data rates, reduced latency, high spectral efficiency, and spectrum flexibility.

The following are key spectrum considerations that both regulators and industry preparing for the WRC-07 need take into account:

### 4.1 Demands on mobile services drive the need for spectrum

The GSM/IMT-2000 family of mobile standards has already connected more than 2.5 billion subscribers. This growth is expected to continue. By 2010, more mobile traffic will be generated by data and information-based services than by voice. The broadband related traffic volume in mobile networks is predicted to grow at least 50-fold by 2020.

Totally, nearly 1.8 billion broadband subscribers are expected to have access by year 2012, and approximately two-thirds will be mobile broadband subscribers. The vast majority (70%) of mobile broadband subscribers will likely be served by WCDMA/HSPA networks, and about 20% will be served by CDMA 2000 EV-DO.

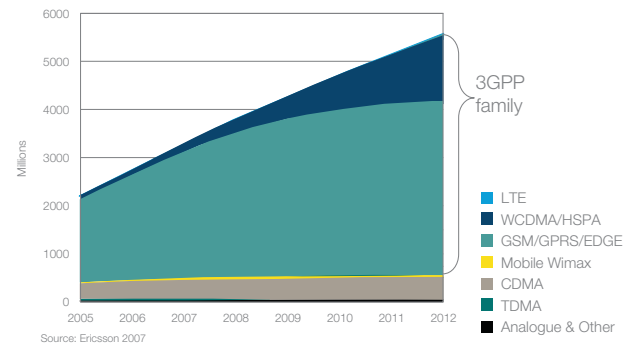


Figure 2: Forecasted growths in mobile subscriptions 2012

Coming to market in 2009, LTE will be firmly incorporated into existing and evolving networks by 2012. Highly developed technologies, like LTE, will capture substantial market share. These high capacity networks will support both the expanding consumer base and the increasing traffic volume resulting from improved mobile access to the Internet and multimedia, as well as to enhanced voice and data services.

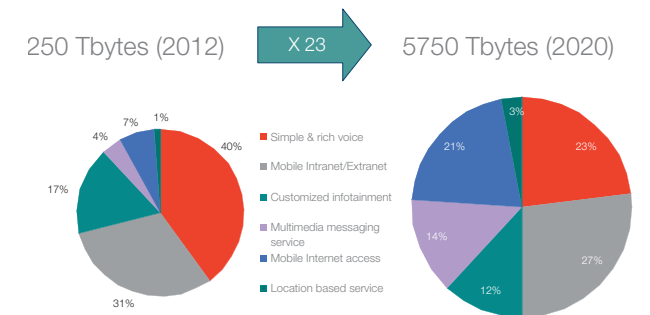
Advanced wireless technologies, like LTE, will also enable new and more sophisticated mobile applications. These applications will dramatically increase the demand for bandwidth. They include:

- Mobile Medicine: health monitoring, mobile medical examination, medical record access;
- Mobile Learning: remote learning, network community school;
- Mobile Science: virtual laboratory;
- Mobile Government: tax declarations, voting, obtaining information;
- Mobile Enterprise: VPN, Intranet access;
- Mobile Internet Access: e-mail, file transfer, streaming video/audio, Internet browsing;
- Mobile Commerce: banking, finance, promotions, m-payment ;
- Rich Voice Services: VoIP, video telephony, video-conference, collaborative work
- Location-based services: car navigation, maps, product and service finder;
- Machine-to-Machine: sensor nodes in products, electronic devices, and home appliances;
- Multimedia Messaging: e-mail, instant messaging, video messaging, telemetry; and
- Entertainment: multiplayer games, TV broadcasting.<sup>9</sup>

In addition to a multitude of new mobile applications, users increasingly expect the same services from mobile networks at quality levels comparable to that which cable and DSL networks provide. Mobile technology can deliver. IMT-Advanced is planned to offer peak data rates of up to 100 Mbps for high mobility access and up to 1Gbps for low mobility (nomadic/local wireless access).

In order to achieve these very high data rates and meet rising demand, operators must either increase the density of base stations or utilize advanced wireless technologies. Practical limitations make increasing the density of wireless infrastructure infeasible. First, the CAPEX and OPEX associated with additional infrastructure deployments are prohibitively high. Second, tower and antenna deployments present significant site difficulties. Third, existing networks are already densely deployed; in central business districts, base stations are commonly situated 500 m apart. Thus, there are significant obstacles to increasing network density.

Developing new radio technologies appears to be the only solution. However, there are some challenges associated with this option too. To satisfy these requirements, new technologies will typically use wider bandwidths per channel (up to 100 MHz per channel/operator) in comparison to what are commonly used today (5 MHz per channel, which can be arranged in wider blocks typically 10 – 15 MHz per operator). Even though these new technologies will also make more efficient use of spectrum, and according to the ITU Report M.2078, the total spectrum bandwidth needed, including existing mobile cellular systems, will be between 1280 MHz (low estimate) and 1720 MHz (high estimate) by year 2020. If there are several parallel network deployments per country, spectrum requirements will be even higher. Thus, at the least, an additional 700 – 1200 MHz of spectrum will be required in the future.



Source: UMTS Forum Report #37 (2005) "Magic Mobile Future 2010-2020" and Report ITU-R M.2072 -World mobile telecommunication market forecast, (chapter 6.2.6, results from UMTS Forum)

Figure 3: Expected growth in usage (example from a representative European country)

Spectrum need to be harmonized in large contiguous blocks on a global basis. To encourage progress, industry must in parallel address the technical aspects of changing and growing spectrum needs. Although identifying and allocating harmonized spectrum resources according to a new set of technical specifications can be exceptionally difficult. However, Ericsson believes this is the necessary course since it will ultimately lead to the needed higher network functionality and lower CAPEX and OPEX for operators. In addition, identifying harmonized contiguous spectrum in lower as well as in higher bands will dramatically improve coverage and capacity, which is needed for many of the needs and advanced applications highlighted above.

Unfortunately, not just any spectrum is suitable for meeting the growing needs of mobile users and evolved mobile technologies. Additional spectrum below 5 GHz is critical to enabling cost-effective, true wide-area mobility.

Moreover, it must be harmonized globally to enable roaming and to achieve network equipment, device, and service economies of scale. Further, allocations of lower frequency spectrum, such as the 470 – 862 MHz band, are needed both to enable cost effective rollouts in rural areas and to meet tomorrow's greater demand for capacity. Allocations in higher spectrum bands, like the 3400 – 4200 MHz and 4400 – 4990 MHz bands, are also needed to provide more capacity in densely populated areas and to give sufficient indoor coverage.

#### 4.2 Right time for global spectrum harmonization

Thoughtful, appropriate spectrum planning is essential to the successful deployment of IMT-Advanced technologies. The early identification and allocation of spectrum bands is extremely valuable because it allows new radio interface standards to develop and facilitates detailed band planning, which are time consuming processes. For example, even though IMT-2000 spectrum was allocated at WARC-92, it took 7 years before national licenses were awarded and a few more years until mass deployment. Similarly, the IMT-2000 Extension band (2500 – 2690 MHz) identified at the WRC-2000 is only now, in 2007, being scheduled for licensing.

Both industry and regulators clearly understand the importance of planning. The soon-to-be-considered WRC-07 Agenda was actually established at the 2003 WRC where regulators attempted to anticipate the rapid market growth of mobile communications. And, indeed,



Figure 4: The evolution of IMT-2000/WCDMA Technology

the growth anticipated in 2003 became a reality. It is now time to plan for future growth. Although some advocate waiting to make key spectrum allocations until the next WRC in year 2011 (WRC-11), Ericsson believes this is an unwise strategy. Decisions made now will have massive socio-economic impacts over the next two decades. Therefore, action at WRC-07 is essential so that regulators have sufficient time: 1) to make spectrum available; 2) to accommodate necessary regional and national consultations that follow WRC decisions; and, if required, 3) to give sufficient time to move, retire or renew existing spectrum users, or to design, build, and deploy new equipment and new systems.

Moreover, if a harmonized spectrum solution for IMT-Advanced is established at WRC-07, and then industry can avoid unnecessary regional divergence, which drives up the price and reduces the seamless availability of services on a global basis.

#### 4.3 Safeguarding against interference

In addition to addressing the foregoing spectrum needs, WRC-07 is also invited to strive to protect the 2500 – 2690 MHz band from satellite interference. The 2500-2690 MHz band, commonly referred to as the IMT-2000 Extension band, was identified for IMT-2000 on a worldwide basis by WRC-2000. The band is also allocated to various satellite services, including Broadcasting Satellite Service (BSS), Fixed Satellite Service, and BSS (sound) service in some countries. As an IMT-2000 Extension band for public communications, this band should be protected from interference.<sup>10</sup> At WRC-07, new regulatory provisions, including satellite emission limits, must be established to ensure protection from the impact of interference.

## 5 Recommended actions

As noted above, the WRC-07 is the right time to plan for the future success of the wireless industry. Allocation and identification of spectrum are expected to attract a high level of interest. The WRC-07 must be guided by the successes of the earlier World Radiocommunications Conferences (WRC), which incorporated three key considerations into its decision making: identifying internationally harmonized spectrum, supporting global standards, and facilitating economies of scale.

Of these three factors, the global spectrum allocations are the most critical decisions the WRC-07 will make. In fact, identifying additional spectrum for new IMT Advanced systems with highly developed capabilities is essential to meeting the projected demand for wireless broadband services. Further, the identification of globally harmonized spectrum supports standardized radio technologies, which in turn, support economies of scale. Operators are able to reduce the OPEX, CAPEX, and utilize spectrally efficient technologies to bring more affordable and advanced wireless and broadband services to everyone, everywhere.

If WRC-07 identifies new spectrum for IMT-Advanced according to the considerations above, the WRC-07 will pave the way for a truly global mobile digital society and will enable next generation mobile networks and services to be introduced to all people. In light of this objective, Ericsson recommends that WRC-07 take the following actions on the Agenda Item 1.4 candidate bands to address spectrum needed by 2015-2020.

**The candidate frequency bands 3400 – 4200 MHz and 4400 – 4990 MHz:** Priority item: The 3400 – 3800 MHz band alone does not fulfill estimated spectrum requirements. First of all, WRC-07 should consider upgrading the 3400 – 4200 MHz to the Mobile Service on a primary basis and identifying the whole or parts of range 3400 – 4200 MHz. In addition, WRC-07 should identify the 4400 – 4990 MHz band for IMT. (Note: From an international and global perspective, this would allow for flexible implementation of IMT in those countries where parts of bands 3400 – 4200 MHz and 4400 – 4990 MHz are used for other services.

#### The candidate frequency band 2700 – 2900 MHz:

First of all, allocate this band to the Mobile Service and

then identify the 2700 – 2900 MHz band for IMT. The radio wave propagation properties of this band are more favorable compared to bands in 4 GHz range. In addition, this band is situated 'near' bands already identified for IMT-2000. So, antenna reuse may be possible. Moreover, the 2700-2900 MHz band and the 2500 – 2690 MHz band have similar propagation conditions and, in some countries, only a limited number of radar systems are deployed in it so there would be minimal displacement of existing users.

#### The candidate frequency band 470 – 862 MHz:

Ericsson supports a globally harmonized solution for providing both coverage and capacity in large geographical areas of low population density. A globally harmonized sub-band is needed in order to realize the special combination of both coverage and capacity. For this reason, Ericsson recommends that WRC-07 allocate to the Mobile Service on a primary basis in Region 1 and in all Regions identify, at a minimum, 2 x 40 MHz within the 470 – 862 MHz band as a sub-band for IMT. In addition, WRC-07 should assure that this sub-band is within a limited tuning range of no more than 200 MHz.

#### The candidate frequency band 2300 – 2400 MHz:

Identify the 2300 – 2400 MHz band for IMT. This band is near to those already identified for IMT-2000, which may facilitate reuse of the antenna used in the 2500 – 2690 MHz band and would present similar propagation conditions.

#### The candidate frequency band 410 – 430 MHz and 450 – 470 MHz:

Identify the 410 – 430 MHz and the 450 – 470 MHz bands for IMT. These bands are already allocated to the Mobile Service on a primary basis in all three ITU-R Regions. These lower frequency bands have better propagation characteristics, which allow operators to build larger cells with significant coverage benefits and cost efficiencies. However, there may be adverse impacts to antenna size and terminal and base station efficiency associated with this use. Some administrations are considering using this band for IMT.

**Amount of spectrum for IMT:** Ericsson supports identifying spectrum in line with ITU-R M.2078's higher market estimates, i.e. 1720 MHz by 2020. Identifying spectrum for IMT in accordance with the higher market

estimates benefits all countries, including those countries that currently do not envision IMT implementation in all spectrum. This allows important flexibility on a country by country basis. Regulators can implement spectrum bands that are best suited to their markets. For instance, when determining the amount of spectrum that is needed for IMT Advanced, a country can choose either to implement less than the lower estimate scenario, subject to local

market demands, or implement the full band based on the high estimate scenario.

**Sharing with satellite:** In countries with heavy precipitation, part of the spectrum identified for IMT-Advanced should be shared with satellite networks, e.g. a confined part of the candidate band 3800 – 4200 MHz could remain for the satellite usage in those countries.

## 6 Conclusion: Agenda Item 1.4 is key

Present mobile communications market data reflect a healthy, striving sector. Future projections suggest continued strong growth both in the number of mobile subscribers and in the volume of mobile traffic. The WRC-07 has the opportunity to lay the spectrum allocation framework for the deployment of the very high data-rate IMT-Advanced services by 2015 – 2020 that is critical to continued market success.

The WRC-07 must act now to encourage the introduction of advanced technologies that enhance the mobile user's experience. IMT-Advanced technologies are especially important to this continued growth, particularly in emerging markets, where IMT coverage solutions will improve geo-

graphical coverage, support new business models, and make affordable IMT devices more readily available.

For these reasons, Ericsson urges the WRC-07 to identify globally harmonized spectrum for IMT-Advanced below 5 GHz. Specifically, Ericsson recommends that the ITU WRC-07 allocate to the Mobile Service on a primary basis, and identify for IMT the candidate bands discussed above: the 470 – 862 MHz band, the 2300 – 2400 MHz band, the 2700 – 2900 MHz band, the 3400 – 4200 MHz band, and the 4400 – 4990 MHz band, in whole or in part. In this way, the WRC-07 can assure that industry can deploy IMT-Advanced technologies and bring rich mobile communications and reliable broadband to all people, everywhere.

- 1) Defined as "total traffic volume per mobile subscriber per day" – Ericsson estimates based on analyst reports and MIB 2006.
- 2) IMT Advanced Systems refers to future developments of IMT-2000 systems and systems beyond IMT-2000.
- 3) IMT-2000 systems include but are not limited to WCDMA, CDMA200, EDGE, and TD-CDMA.
- 4) *The Economist*, July 2005, "Calling an end to poverty" [http://www.thenextpractice.com/news/the\\_economist\\_calling\\_an\\_end\\_to\\_poverty.php](http://www.thenextpractice.com/news/the_economist_calling_an_end_to_poverty.php)
- 5) Using mobile devices, fishermen and farmers can check prices in different markets before selling their produce, people can search for jobs in other communities, and fund remittance is simplified.
- 6) ITU-D & British Telecom.
- 7) *Newsweek (Double Issue)* July 2-8, 2007.
- 8) Extrapolations from international studies reveal that the demand for mobile broadband services and applications will continue to grow exponentially.
- 9) *Mobile Industry Backing terrestrial spectrum for IMT group*, Jan 2007.

