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ERICSSON'S COMMENTS TO THE 4G PUBLIC CONSULTATION PAPER

SPECTRUM FRAMEWORK FOR FOURTH GENERATION (4G) MOBILE COMMUNICATION SYSTEMS IN SINGAPORE

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ERICSSON

1 Distribution List

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2 Ericsson's Comments to the 4G Public Consultation Paper: SPECTRUM FRAMEWORK FOR FOURTH GENERATION (4G) MOBILE COMMUNICATION SYSTEMS IN SINGAPORE

2.1 Executive Summary

Ericsson welcomes the opportunity to provide comments to iDA's initiative on the SPECTRUM FRAMEWORK FOR FOURTH GENERATION (4G) MOBILE COMMUNICATION SYSTEMS IN SINGAPORE consultation paper. Ericsson has taken the approach of providing comments with a view on the operational and technical opportunities as well as the socio-economic aspects based on our experiences.

The key points of Ericsson's views on spectrum management are including considerations of consumers, operations, businesses and the society as a whole to reap the full benefit from using the scarce resource of radio frequency spectrum. An overarching national strategy on spectrum usages with the consideration of international harmonization is of exceptional importance for all national regulators and governments as they look to harvest these benefits for its citizens.

Ericsson believes that the IMT family of standards which includes the GSM/EDGE, UMTS/HSPA/LTE technologies (the 3GPP family of technologies) as well as the cdma2000 (the 3GPP2 family of technologies), will be the most thriving technologies for mass market public mobile broadband usage.

The Long Term Evolution (LTE) technology is the new IMT family member that provides the common future evolution path for GSM/EDGE, UMTS/HSPA and cdma2000 technologies, and is expected to totally dominate the mobile broadband market. Two LTE networks are already in commercial operation and as of April 2010, 97 operators in 49 countries have committed to deploy LTE networks within the next two years. It is expected that mobile broadband operators will gradually introduce LTE, in parallel to their expansion of the UMTS/HSPA network, starting in high capacity (densely populated) areas.

Globally, mobile data traffic is expected to double every year. Therefore, the mobile industry's view is that the currently available frequency bands for IMT are not enough to satisfy the spectrum requirements in the years 2015 – 2020 timeframe.

The identification of spectrum bands for IMT already made in earlier World Radiocommunication Conferences (WRCs) of the International Telecommunication Union (ITU) should be allocated to IMT on a national level as a first step and used in the most efficient way through implementation of international spectrum arrangements. Ericsson considers the licensing of spectrum rights of the 2300 – 2400 MHz and 2500 – 2690 MHz bands extremely important for the future successful introductions of high capacity mobile data services.

2.2 Ericsson's Comments

2.2.1 Question 1

IDA invites views and comments on the projected spectrum requirements to meet end users' demand for mobile broadband beyond 2015. To what extent can the existing wireless and mobile networks support the anticipated increase in mobile traffic?

IDA also invites views and comments on the likely technologies for the deployment of 4G mobile communication system that will meet end users' mobile communication needs beyond 2015.

Ericsson's Comments:

Globally, mobile data traffic is expected to double every year, and is forecasted to increase 64 times between the years 2008 and 2013. Therefore, the mobile industry's view is that the currently available frequency bands for IMT are not enough to satisfy the spectrum requirements in the years 2015 – 2020 timeframe.

Prior to WRC-07, Report ITU-R M.2078 was developed which took into consideration the new user demand requirements and network deployment. It was predicted that the total spectrum bandwidth requirement for both existing mobile cellular systems (including pre-IMT-2000, IMT-2000 and its enhancements) and IMT-Advanced up to year 2020, was calculated for both low and high user demand scenarios to be 1280 MHz and 1720 MHz respectively. Considering the contrast of the current situations and forecasts, it is deemed very timely to once again review the requirements for the future development of terrestrial IMT networks.

Technologies that can cost effectively operate in both paired and unpaired bands with different spectrum block sizes have the best position to fulfil market demands. Spectrum should be reused in the most effective manner i.e. with a minimum requirement of a frequency reuse factor of 1:1, to satisfy for the necessary spectrum efficiency needs.

Ericsson has the opinion that LTE is the technology best suited to fulfil these requirements since it has a massive industry support and a clear 4G roadmap. LTE has now been selected as the mobile broadband evolution path for 97 operators in 49 countries, including most of today's leading Mobile Operators world wide.

With regard to the national regulatory policies and licensing, it is therefore important to look ahead due to the inevitable future increase in capacity demand in 3G mobile networks which will eventually benefit from a smooth evolution to LTE. This evolution should not be jeopardized by the limited availability of harmonized arrangements in the bands identified to IMT.

Early LTE implementations in December 2009 in the 2500 – 2570 MHz / 2620 – 2690 MHz bands and later in the 700/800 MHz bands, provide the possibility to allocate wide channels (20 MHz) which paves the way for high speed connections for demanding applications.

2.2.2 Question 2

IDA invites views and comments on the possible radio-frequency spectrum bands, besides the 700/800 MHz, 2.3 GHz and 2.5 GHz bands, that would be suitable for 4G mobile communication systems and the likely timeframe for deployment. To what extent are the 900 MHz, 1800 MHz and 2.1 GHz alternative bands for 4G deployment? Are there other frequency bands that are currently not allocated but could be potential candidates for 4G system deployment?

Ericsson's Comments:

The suitable national implementations of radio frequency spectrum bands for 4G should, to the extent possible, be following the ITU and APT/AWF recommendations and regulations for IMT.

The bands for GSM/EDGE, cdma2000, UMTS/HSPA and LTE that could be considered for terrestrial IMT and IMT-Advanced usage are in our view as follow:

- 450 – 470 MHz (used for cdma2000; expected LTE in the future)
- 698 – 960 MHz
    - 698 – 806 MHz (subject to ongoing work in APT/AWF, for LTE)
    - 824 – 849 MHz / 869 - 894 MHz (subject to national implementation)
    - 880 – 915 MHz / 925 - 960 MHz (subject to national implementation)
- 1710 – 2170 MHz
    - 1710 – 1785 MHz / 1805 - 1880 MHz (for GSM, HSPA and LTE)
    - 1900 – 1920 MHz (unpaired, may also be considered for new pairing with 2090 – 2110 MHz)
    - 1920 – 1980 MHz / 2110 – 2170 MHz (main band for HSPA and LTE)
    - 2010 – 2025 MHz (unpaired, for LTE)
- 2300 – 2400 MHz (unpaired, for LTE)
- 2500 – 2690 MHz
    - 2500 – 2570 MHz / 2620 – 2690 MHz (the main band for high data rate LTE services)
    - 2570 – 2620 MHz (unpaired, the main band for high data rate LTE services)
- 2700 – 2900 MHz (considered for possible future use for LTE)

- 3400 – 3600 MHz (specifications of the spectrum arrangement ongoing in 3GPP)
- 3600 – 3800 MHz (designated in CEPT and some other countries, specifications ongoing in 3GGP)
- 3800 – 4200 MHz (considered for the longer-term use for LTE)

The 3GPP standardisation body has defined a number of bands that can be used for LTE/4G with the 700 MHz / 800 MHz, with 2.3 GHz and 2.5 GHz bands being the most obvious. Ericsson sees a significant market demand for LTE in these bands and the corresponding device eco-system is expected to grow quickly.

In the next phase, Ericsson foresees markets where the 900 MHz, 1800 MHz, 2.1 GHz and later the 3.4 – 3.6 GHz and 3.6 – 3.8 GHz bands, will be used for LTE/4G.

2.2.3 Question 3

IDA invites views and comments on the demand for the 2.5 GHz band after 2015 in Singapore, and the technologies that are currently being developed for use in the 2.5 GHz band. Are these likely to complement or substitute existing networks? Please also comment on the availability of the network equipment.

Ericsson's Comments:

Ericsson expects the bands, 2500 – 2570 MHz paired with 2620 – 2690 MHz together with the unpaired band 2570 – 2620 MHz, to be excellent for the current and the evolution of the 3GPP technologies. These bands are necessary for the provision of high capacity and high data rates services.

This paired arrangement allows for licenses with 2 x 20 MHz allocations which gives maximal throughput for the current version of LTE. The evolution of LTE in Release 10 will also include support for multi-carrier operations allowing simultaneous use of more than one carrier to increase the capacity. Multi-carrier support was demonstrated by Ericsson at the MWC 2010 in Barcelona. A throughput of up to 1Gbps was achieved and demonstrated with four 2 x 20 MHz carriers.

In selected markets, Ericsson is currently demonstrating LTE products using the unpaired centre portion 2570 – 2620 MHz of the band 2.5 GHz for the TDD mode of operation.

Ericsson has the opinion that iDA should implement the international harmonized spectrum arrangements, 2500 – 2570 MHz (uplink) paired with 2620 – 2690 MHz (downlink) together with the unpaired band 2570 – 2620 MHz, for the current and future use of IMT and IMT-Advanced. This is in consideration of the successes of the 3GPP family of standards, noting that networks are already in commercial operations.

2.2.4 Question 4

IDA invites views and comments on the paired and unpaired spectrum arrangements in the 2.5 GHz band after 2015.

Ericsson's Comments:

Ericsson would like to stress the importance to follow the preferred international harmonized option recommended by the ITU by Option C1 band plan of the ITU-R Recommendation M.1036-3 and CEPT/EC Decision ECC/DEC/(05)05. This option recommends allocating 2 x 70 MHz for FDD and 50 MHz for TDD use at the centre of the band maintaining a fixed 120 MHz separation between the uplink and downlink duplex blocks. As this band is common for all ITU regions, there are enormous benefits owing to economies of scale for those countries that would be able to implement the above-mentioned harmonized decisions on its national structures.

Following the ITU-R Recommendation, M.1036-3 Option C1 will be key to enjoy the benefits of standardization, avoiding interference problems and making the most efficient use of the spectrum that will be critical to provide more capacity for mobile broadband services, particularly in areas of high data traffic demand. This option has been proposed by several countries that have been the first movers in this regards. Good case studies can be observed in the tender processes put forward by Norway (Nov -07), Sweden (May -08), Hong Kong (Jan-09), and Finland (Nov-09), Denmark (Mar-10), Germany (April-10) and Holland (April-10). This arrangement is expected to be used in many other countries, as well as some countries in Latin America.

This trend means that ITU-R Recommendation M.1036-3 Option C1 represents the mainstream alternative that will stimulate market growth, in a technology-neutral way and pro-competitive environment.

2.2.5 Question 5

IDA invites views and comments on whether the size of 5 MHz guard block at the frequency boundaries between paired and unpaired spectrum is sufficient to safeguard the adjacent band. IDA also invites views on our proposal not to specify guard block requirement between licensees using the TDD or FDD band.

Ericsson's Comments:

From an economical and technical point of view, the 5 MHz channel blocks 2570 – 2575 MHz and 2615 – 2620 MHz are regarded as the minimum feasible guard bands or restricted channels to reduce the interference between operations to an acceptable level.

2.2.6 Question 6

IDA invites views and comments on whether allocating 5 MHz spectrum lot size is appropriate for the current technologies in the 2.5 GHz band. IDA also invites views on our proposal to allocate spectrum in individual blocks of 5 MHz and let operators who need a larger carrier size to combine multiple blocks together. Alternatively, should IDA allocate in larger blocks based on multiples of 5 MHz?

Ericsson's Comments:

Ericsson believes that it is important to allow operators to be able to use large contiguous spectrum blocks, preferably up to 20 MHz. LTE will work at its optimum performance in the band 2500 – 2690 MHz with 20 MHz channels. Bandwidth of at least 10 MHz is required for LTE to provide for the expected consumer experience.

In view of this, it is suggested that iDA consider allocating the bandwidth in blocks of 10 MHz.

2.2.7 Question 7

IDA invites views and comments on our proposal for an interleaved band plan with combinations of 15 MHz and 20 MHz paired spectrum blocks as well as 25 MHz of unpaired spectrum blocks available for assignment in contiguous block of 15 MHz, 20 MHz and 25 MHz respectively by IDA and whether this would be appropriate.

IDA also invites views and comments on the practical measures that operators would implement to allow coexistence of BSS and mobile services in the same band in the border areas so that more spectrum blocks can be made available.

Ericsson's Comments:

Ericsson would recommend Option A for allocation due to the fact that more spectrum could be made available per operator and also taking into consideration the significant traffic increase in mobile broadband networks based on our global experience.

Therefore Ericsson would strongly urge iDA to start harmonization activities with the regional countries for the 2500 – 2690 MHz band to be used for 4G. This is important since commercial deployments are expected to take place much earlier than 2015.

On iDA's proposal for an interleaved band plan, the preferred international band plan is that licenses of paired block of sizes 5 MHz, 10 MHz, 15 MHz or 20 MHz be offered to the market. Ericsson does not see any immediate need for the use of the 25 MHz channel bandwidth schemes.

2.2.8 Question 8

IDA invites views and comments on the likely technologies for the 2.3 GHz band and the availability of network equipments for use in the band. IDA also invites views on our proposal to retain the existing channelling plan for the 2.3 GHz band and to allocate the spectrum in blocks of 5 MHz when the band is re-allocated after 2015. Please also comment on whether the current amount of 50 MHz spectrum available in the 2.3 GHz band is sufficient to meet industry demands after 2015.

Ericsson's Comments:

Ericsson expects the LTE eco system to become very strong as LTE terminal devices will eventually support multiple technologies, namely GSM/EDGE, HSPA and LTE. For the 2.3 GHz spectrum, LTE TDD products are being trialed and it is expected that there will be commercial products available in the near future.

For global and regional harmonization, cross-border coordination, synchronization of networks and interference mitigation, Ericsson understands that a raster of 5 MHz blocks serves the TDD access scheme in this band.

In view of bandwidth requirements of at least 10 MHz for LTE to provide for the expected consumer experience, iDA could consider allocating in blocks of 10 MHz. Ericsson expects 20 MHz channels to be the natural building block.

Ericsson believes that this band is needed to support future capacity demands which could be delivered with the LTE technology.

2.2.9 Question 9

IDA invites views and comments on what is an appropriate timeframe for IDA to allocate the 2.3 GHz and 2.5 GHz bands. Should the allocation of the 2.3 GHz band proceed separately from that of the 2.5 GHz band, given the greater uncertainty over the timeframe in which the 2.5 GHz band would be available? If so, when would be an appropriate timeframe for IDA to allocate the 2.3 GHz band?

Ericsson's Comments:

LTE products for the FDD part of the 2.5 GHz band are already in commercial operation and we are expecting commercial LTE TDD products for both bands to enter the market very soon.

In the near future, Ericsson expects, in an international perspective, the eco system to provide a wide range of LTE devices supporting all standard band plan options in the 2.3 GHz and 2.5 GHz bands in FDD as well TDD mode in combination with fallback options for 3G and GSM.

Ericsson has the opinion that both bands should be allocated at the same time since LTE products for 2.5 GHz are already in commercial operation. In addition, this also provides operators the choice of TDD or FDD for deployment.

2.2.10 Question 10

IDA invites views and comments on what would be a fair and efficient allocation mechanism for the 2.5 GHz band. In the case where there are existing deployments in the band, should IDA grant first rights of refusal for the current right-holders?

Ericsson's Comments:

Ericsson has the opinion that IDA should grant first rights of refusal for the current right-holders in the case where there are existing deployments in the band.

2.2.11 Question 11

IDA invites views and comments on the proposal to impose both service provisioning and coverage obligations on the operators awarded the 2.3 GHz and 2.5 GHz spectrum after 2015. In particular, what would be an appropriate service provisioning obligation and the timeframe for deployment bearing in mind that the spectrum assignment is likely to take effect only from 1 July 2015? Similarly, what would be an appropriate measure for service coverage obligation and the timeframe for deployment?

Ericsson's Comments:

Ericsson has the view that the following should be considered for rolling out a 4G mobile communication system:

- 2G and 3G backward compatibility
  Since LTE terminal devices will eventually support multiple technologies, namely GSM/EDGE, HSPA and LTE, it is important that there is corresponding support on the system.

- Gradual rollout starting with hot-spots
  As LTE is meant to support ultra high-speed mobile broadband services, build-up should start with the hot-spots where there are such demanding applications, and gradually progressing to nation-wide coverage.

Ericsson has no strong opinion regarding the timeframe for deployment which will depend on each operator's readiness.