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By post and by email (loh_oon_sien@ida.gov.sg)

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Dear Mr.Haire

Re: Consultation Paper: Deployment of Wireless Broadband Technologies in Singapore

Motorola commends IDA for responding to interests shown by potential new entrants wanting to deploy commercial wireless broadband networks in Singapore and we are pleased to provide comments on the consultation paper: *Deployment of Wireless Broadband Technologies in Singapore*.

We agree that making radio spectrum available for commercial deployment of wireless broadband technologies will encourage the proliferation of broadband services and competition in the broadband market in Singapore. We would like to add that competition in the broadband market will be further enhanced if IDA makes provisions to allow outdoor deployment of private wireless broadband networks by users in the government and private sectors in the licence-exempt bands in 2.4 GHz and 5 GHz.

9.1(a) View and comments on the potential of and benefits arising from the deployment of wireless broadband technologies, the likely services/applications to be deployed and the potential demand from businesses and consumers.

Wireless broadband technologies can deliver speeds equivalent to wired alternatives and can be rolled out quickly and effectively. As mentioned in the consultation paper, wireless broadband networks are viable as cost competitive alternatives for new entrants to the broadband market.

In addition, there are applications in which wireless broadband technologies lend themselves better than their wired cousins:

- Can be used to extend existing wired networks
 - o Existing fixed line or cable network operators can extend the reach of their networks easily.
 - o A university used wireless broadband to provide broadband connection to staff and faculty living off campus.
- Overcomes physical obstacles and rights-of-way concerns
 - o Can be used to provide broadband access to shipping in the Singapore harbour
- Provide broadband connections that are moved frequently or are temporary, at very short notice.
 - o Wireless broadband was used to provide internet access to 1000 people in a remote disaster recovery area within 24 hours in the wake of the Columbia space shuttle disaster.



9.1(b) Views and comments on the allocation of the 2.3 GHz and 2.5 GHz bands for wireless broadband technologies and the harmonization of spectrum at the border areas. What are the coexistence issues that need to be considered with regards to the deployment of systems (FDD & TDD) in the same geographical area in adjacent frequency blocks, and the deployment of systems across geographic boundaries in the same frequency blocks? What are the technical assessment and methodology to be used for the deployment and coordination of systems, including separation distances, power spectral flux density limits, out-of-band-emission limits, frequency guard bands etc, to ensure coexistence of system operations? What are the mitigation techniques that could be employed in case of co-channel interference between systems operating in adjacent geographical areas? Does the 5 MHz, 5.5 MHz or 6 MHz channeling plan for the 2.3 GHz band and the 2.5 GHz band meet industry requirements? What is the appropriate duplex separation (Transmit/Receive) for the FDD wireless broadband technologies in the 2.3 GHz and 2.5 GHz bands respectively? What is the minimum, as well as optimal amount of spectrum required by an operator for specific geographical deployment or nationwide deployment? Please provide supporting reasons for each comment and proposal made.

The 2500-2690 MHz spectrum is well suited for mobile operations, including mobile broadband services. It is well established that the propagation characteristics of spectrum below 3 GHz¹ are particularly suitable for wide area mobile services. The ITU recognized this fact when it identified additional frequency bands for IMT-2000, including the 2500-2690 MHz band, at the World Radiocommunication Conference in Istanbul, noting that IMT-2000 applications “require spectrum below 3 GHz.”

Motorola believes that the suitability of this spectrum for mobile uses is likely to lead to significant use of this band for a range of mobile services, provided that IDA makes an allocation to the mobile service in this band and adopts a licensing structure that allows mobile operations to be a viable option in this spectrum.

Configuration of the 2500-2690 MHz band to allow the successful deployment of mobile operations, including IMT-2000 services, would enable harmonization with future global uses of this spectrum.

The 2500-2690 MHz band has the potential to achieve significant harmonization benefits in the longer term, particularly if the band plan in is consistent with one of the scenarios being considered by the ITU. The benefits that would flow from such harmonization include:

- **Manufacturing Economies of Scale:** Consistent licensing rules for the 2500-2690 MHz band would enable manufacturers to produce equipment that can be used in both local and international markets and thus achieve economies of scale, which in turn would lead to reduced equipment costs. Lower equipment costs would directly benefit consumers and make equipment affordable for a wider base of customers, encouraging more widespread deployment and the provision of services to a broader cross-section of the community.
- **Global Roaming:** Harmonization of the 2500-2690 MHz band plan and licensing rules with international markets would allow Singapore consumers to use their mobile phones when travelling abroad, which is likely to encourage increased consumer use of mobile wireless devices.
- **Facilitation of Multi-Mode Equipment:** Harmonized global spectrum would facilitate the design and development of multi-mode equipment that would operate in the 2500-2690 MHz spectrum as well as other bands.

¹ Final Acts of the World Radiocommunication Conference (Istanbul 2000), Resolution 223 §o



To maximize these potential benefits, IDA should adopt a band plan that is consistent with one of the scenarios identified by WP 8F in its revised draft of ITU Recommendation M. 1036-1, which addresses possible frequency arrangements for the 2500-2690 MHz band to accommodate IMT-2000 mobile services². The draft recommendation lists several possible band plan scenarios, most of which include a combination of FDD and TDD frequency blocks. Moreover, three of the scenarios incorporate an FDD spectrum pairing separated by a “core” frequency block that would consist of TDD and/or additional FDD spectrum³. Most notably, all of the scenarios consider the deployment of only lower power operations in the 2500-2690 MHz band. Although the draft ITU recommendation does not specify bandwidths for these scenarios or take into account incumbent wireless services—as IDA must—it provides a good indication of likely future international frequency arrangements in the 2500-2690 MHz band, and thus offers valuable guidance regarding harmonization as IDA considers various plans to configure this band. IDA should therefore use this draft recommendation as a tool to assess the harmonization potential of proposed band plans for the 2500-2690 MHz spectrum.

RECOMMENDED FEATURES OF A NEW BAND PLAN FOR THE 2500-2690 MHZ BAND

Any configuration of the 2500-2690 MHz band must balance a number of competing factors. The new band plan should provide adequate regulatory certainty to enable the commercial success of licensees in the band, while providing licensees with sufficient flexibility to deploy new and innovative technologies. Moreover, the new licensing rules must allow licensees to successfully utilize the mobile allocation.

With these considerations in mind, Motorola recommends that any proposed band plan should incorporate the following key features:

Appropriate Power Limits

The new licensing rules should focus on promoting low power operations in the 2500-2690 MHz band. IDA should adopt limits on signal strengths that will allow deployment of low power cellularized operations.

Contiguous Spectrum Blocks

To maximize flexibility and efficient use of the 2500-2690 MHz band, the band plan should include large contiguous spectrum blocks. Contiguous spectrum would also enable more efficient operation of spread spectrum technology. Furthermore, large contiguous blocks would allow IDA to make spectrum assignments that provide the highest level of technological neutrality and would facilitate the deployment of broadband services.

Accommodation of FDD Operations

The 2500-2690 MHz band should facilitate the development of mobile services by accommodating FDD operations. Motorola believes that FDD technology will be the primary enabling technology for IMT-2000 because it is well suited to high mobility, wide area applications. The Telecommunications Industry Association (“TIA”) has noted, in contrast, that TDD technology is useful generally in low power, lower mobility applications. The band plan for the 2500-2690 MHz spectrum therefore should accommodate FDD technology. If IDA were to designate paired spectrum for FDD operations, the spectrum pairing should provide an adequate duplex gap to minimize the size

² See ITU WP 8F Document 8/1023-E, Draft Revision of Recommendation ITU-R M. 1036-1: Frequency Arrangements for Implementation of the Terrestrial Component of International Mobile Telecommunications-2000 (IMT-2000) in the Band 806-960 MHz, 1710-2025 MHz, 2110-2200 MHz and 2500-2690 MHz, (Feb. 28, 2003).

³ See *id.* at 9. Scenario 1 would designate the entire core for TDD operations; Scenario 2 would designate the entire core as an external FDD downlink band; and Scenario 3 would divide the core between FDD and TDD operations. See *id.* These scenarios would be subject to appropriate guard bands to minimize potential interference issues.



and cost of the duplex filters needed in portable handsets. In addition, IDA should adopt the conventional duplex arrangement in order to minimize equipment design issues, facilitate the development of multi-mode equipment, and lower equipment costs for consumers.

Adequate Guard Bands Between FDD and TDD Operations

Significant guard bands would be necessary to segregate FDD and TDD operations to prevent harmful interference to FDD operations. Contributions to WP 8F indicate that these guard bands would need to be of the order of 10 MHz, even if other measures are taken to minimize interference from TDD base station transmissions. Motorola recommends that a guard band of at least 10 MHz would be required between an FDD uplink (mobile transmit) band and TDD spectrum. Significant guard bands would also be necessary between TDD operators unless the TDD systems are very closely coordinated. Such guard bands would need to be no smaller than the guard band required between FDD and TDD systems.

Harmonization with Anticipated Global Use of the 2500-2690 MHz Band

Any new band plan should maximize the potential benefits to Singapore consumers from harmonization of the licensing rules for the 2500-2690 MHz band with global uses of this spectrum. This can be best achieved by adopting a band plan that is modelled on one of the scenarios under consideration by WP 8F. If IDA were to adopt a band plan with designated paired spectrum for FDD operations, Motorola notes that three of the ITU scenarios (Scenarios 1-3) include paired FDD spectrum with an adequate duplex gap.

Channelling Plan

In Europe⁴ FDD carrier spacing between public operators is set at a minimum of 5.0 MHz. FDD carrier spacing within an operator's spectrum is variable, based on a 200 kHz raster and may be less than 5 MHz. This is suitable for FDD deployment to minimise interference between operators with no additional guard band required between adjacent carriers. This 5.0 MHz carrier spacing is also applicable between WCDMA and cdma2000 MC3X systems⁵.

If other technologies are deployed then a larger channel plan is required to provide for the necessary guard bands between adjacent systems.

9.1(c) Views and comments on the key features and service obligation to be applied for auctioning the spectrum for the deployment of wireless broadband technologies. If the key features are not appropriate, please provide supporting reasons why they are not.

-- No comment

9.1(d) Views and comments on whether spectrum should be auctioned in generic lots or in blocks with specified frequencies; the appropriateness of the lot sizes; and the maximum amount of spectrum to be set.

-- No comment

9.1(e) Views and comments on the deployment of wireless broadband technologies in the 3G spectrum bands. Are there any technical considerations that IDA should consider? Please provide detailed supporting reasons for each comment and proposal made.

Motorola strongly believes that 3G licencees be given the freedom of choice in deploying technologies that will support their business models provided the deployment is compatible with the technical framework of the frequency band . This will provide licencees with the flexibility to adopt emerging new technologies in responding to market demands.

⁴ ERC decision ERC/DEC/(99)25

⁵ Korea contribution to Radiocommunications Study Groups: document 8F/11-E



9.1 (f) Views and comments on the eligibility of existing 3G and broadband infrastructure providers for the 2.3 GHz and 2.5 GHz spectrum, and the limit on the spectrum amount for which they could bid.

-- No comment

9.1(g) Views and comments on whether there are issues that may pose problems to achieving transparent and seamless interconnection and open access. IDA further seeks comments on the type and level of QoS standards that will be appropriate and whether the existing set of QoS standards for broadband service providers are applicable for service delivery using wireless broadband networks. Please provide supporting reasons for each comment and proposal made.

-- No comment

9.2(h) Views and comments on the Market Trial Licence framework and the specific features set out in Annex 2. Is the market trial licence framework conducive in helping market participants test the commercial viability of innovative service? Are there additional issues that IDA should consider? Please provide detailed supporting reasons for each comment and proposal made.

-- No comment

Sincerely,

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