



**CONSULTATION PAPER ISSUED BY THE  
INFO-COMMUNICATIONS DEVELOPMENT AUTHORITY OF SINGAPORE**

**PROPOSED ALLOCATION OF SPECTRUM FOR INTERNATIONAL MOBILE  
TELECOMMUNICATIONS (“IMT”) AND IMT-ADVANCED SERVICES AND  
OPTIONS TO ENHANCE MOBILE COMPETITION**

**22 April 2014**

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## PART I: INTRODUCTION AND OVERVIEW OF CONSULTATION

1 With the projected growth in mobile data consumption<sup>1</sup> increasing the demand for spectrum for 4G and future International Mobile Telecommunications-Advanced (“**IMT-Advanced**”) systems and services, IDA estimates that between 1 GHz and 2 GHz of spectrum will be required to deliver mobile broadband services by around 2025, depending on the demand scenarios. It is thus timely and essential to review the allocation of spectrum to ensure the optimal use of scarce spectrum resources, and to facilitate IDA’s vision of establishing Singapore as a ‘Smart Nation’<sup>2</sup>. Our vision of a ‘Smart Nation’ is underpinned by a high speed, trusted and resilient infocomm infrastructure, comprising fixed and wireless networks. In particular for wireless networks, we are planning to facilitate the deployment of a Heterogeneous Network (“**HetNet**”) which will allow seamless transition between mobile and wireless networks for end users. Hence, IDA’s overall plans and initiatives for spectrum allocation will take into account the technological trends and developments in the mobile and wireless space. As part of this review, IDA will also be exploring possible means of injecting further competition into the local mobile market. Overall, IDA’s efforts in ensuring optimal use of spectrum and enhancing competition aims to create a more vibrant wireless and mobile landscape in Singapore, in line with our vision of becoming a ‘Smart Nation’.

2 In line with international trends and spectrum harmonisation efforts regionally, IDA has identified several spectrum bands that may be allocated, or re-farmed, for 4G and IMT-Advanced services in the next few years.

3 The first of these bands, namely paired spectrum in the 2.5 GHz band and the 1800 MHz band were allocated in IDA’s 4G spectrum auction in 2013, with rights expiring in 2030. A total of 270 MHz of spectrum was allocated in this 2013 4G auction.

4 On the supply side, the other spectrum bands in which 4G and IMT-Advanced technologies can be deployed, and the status of the bands’ availabilities for long term allocation are summarised as follows:

**Table 1: Status of Spectrum Bands**

	<b>Spectrum band</b>	<b>Current assignments</b>	<b>Frequency</b>	<b>Amount of spectrum available<sup>3</sup></b>	<b>Expiry of existing assigned uses</b>
<b>Sub-1GHz bands</b>	700 MHz	Terrestrial broadcasting	698-790 MHz	90 MHz	After Analogue-Switch Off (“ <b>ASO</b> ”), including ASO for neighbouring jurisdictions at the

<sup>1</sup> Various studies forecast mobile data traffic to experience Compounded Annual Growth Rates (“**CAGR**”) of between 40% and 70% over the next few years.

<sup>2</sup> IDA’s vision of a ‘Smart Nation’ encompasses citizens and people at the core of the transition – to use infocomm to enhance and improve citizens’ lives and ensure that the use of infocomm is maximised to its fullest potential for the benefit of Singapore.

<sup>3</sup> Not all the spectrum in the band may be allocated for commercial mobile services as there may be other current or potential uses, e.g. for temporary assignments.

	Spectrum band	Current assignments	Frequency	Amount of spectrum available <sup>3</sup>	Expiry of existing assigned uses
					border areas. ASEAN has indicated its target of 2020 for ASO.
	800 MHz	Trunked radio	806-821 MHz, 851-866 MHz	To be determined	On annual assignment basis
		Short Range Devices (“SRD”)	866-869 MHz		Licence-exempt band
		2G (Extended GSM or “EGSM”) – also known as Public Cellular Mobile Telecom Services (“PCMTS”)	880-890 MHz (Uplink)		31 March 2017
	900 MHz	2G, 3G, (4G allowed) – also known as PCMTS	890-900 MHz, 935-945 MHz; 900-915 MHz, 945-960 MHz	Up to 50 MHz	31 March 2017
		2G (EGSM) – also known as PCMTS	925-935 MHz (Downlink)		
>>1GHz bands	1.4 GHz	Digital audio broadcasting	1452-1492 MHz	40 MHz	To be determined
	1.9 GHz	3G	1920-1980MHz	120 MHz	31 December 2021
	2.1 GHz	3G	2110-2170 MHz		31 December 2021
	2.3 GHz unpaired spectrum for Time Division Duplex (“TDD”) technologies	Un-assigned (previously assigned for Wireless Broadband Access (“WBA”))	2300-2350 MHz	50 MHz (Based on ‘half-band sharing’ arrangement with neighbouring jurisdictions where Singapore has priority use of half of 2.3 GHz band)	No existing uses but currently available for trial use
	2.5 GHz unpaired spectrum for TDD technologies	Partially assigned for WBA/4G	2570-2620 MHz	50 MHz	30 June 2015
	3.5 GHz	Satellite downlink	3400-3600 MHz	200 MHz	To be determined

5 IDA is also closely monitoring developments at the International Telecommunications Union (“ITU”) and the proposals at the World Radio-communication Conference (“WRC”) 2015 to identify new spectrum bands to be made available for commercial mobile services. In the meantime, this consultation paper intends to seek views from industry players and members of the public on the suitability, timeframes and technical issues related to the allocation of the above-mentioned spectrum bands, as well as associated policy proposals to enhance competition in the mobile market.

6 On the policy options for competition enhancement, IDA is exploring possible approaches for facilitating the entry of Mobile Virtual Network Operators (“MVNOs”) into Singapore. In IDA’s 4G spectrum auction in 2013, IDA had set aside spectrum for

a new mobile network operator to enter the market. Although no new operator came in, IDA remains open to facilitating the entry of new players into the mobile market, if there is industry interest. Besides entering as a full-fledged mobile network player, IDA has observed successful cases of MVNOs operating in other countries, where such MVNOs have introduced innovative pricing and services to consumers and stimulated competition in the mobile market. Hence, IDA would like to seek views on industry players' interest in entering this market as a full-fledged mobile network operator, or as an MVNO, and the various factors influencing the entry and business case of an MVNO.

7 In addition to IDA's efforts to allocating more licensed spectrum to serve the growing demand for wireless and mobile data connectivity, IDA is concurrently working on enabling complementary methods to deliver mobile data connectivity. In line with our vision of enabling a HetNet, IDA would like to explore means to encourage seamless traffic roaming between different networks to facilitate seamless connectivity and data offloading. Some of IDA's ongoing initiatives, such as the enabling of a framework for the use of TV White Spaces<sup>4</sup> and bringing about Wi-Fi connectivity<sup>5</sup> such as Wireless@SG, will help support our efforts in building a HetNet. IDA welcomes views on other policy issues that IDA should consider, as well as means or measures to encourage the deployment of HetNet.

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<sup>4</sup> Utilising the Very High Frequency ("VHF") and Ultra High Frequency ("UHF") bands

<sup>5</sup> Utilising the 2.4 GHz and 5 GHz bands

## PART II: SPECTRUM BANDS TO BE ALLOCATED

8 This section discusses the issues related to the allocation of each of the spectrum bands that could potentially be made available for commercial mobile uses in the near-to-mid term.

9 For the avoidance of doubt, IDA reserves the right to make any spectrum band available to commercial operators, and may reserve selected frequencies within a spectrum band for other commercial uses such as for trials, temporary or administrative assignments, as well as for non-commercial uses such as the Government's communication requirements.

### Sub-1 GHz bands

10 There are three spectrum bands to be considered: 700 MHz, 800 MHz and 900 MHz bands. Given their good propagation characteristics, these bands are likely to be in demand for delivering mobile broadband services. Internationally, several countries have allocated these bands for mobile broadband deployment. Countries such as the USA, Australia, Canada and New Zealand have already auctioned the 700 MHz band for mobile broadband. As Europe's digital dividend<sup>6</sup> lies in the 800 MHz band, European countries such as the UK, Germany, Sweden, Italy and France have already conducted auctions for the use of this band. Use of the 800 MHz band in the Asia Pacific region is rather diverse, with Japan and South Korea allocating it for mobile broadband use, while others such as Malaysia and Indonesia continue to use it for Code Division Multiple Access ("CDMA") i.e. 2G services. The 900 MHz band is currently used for 3G or 4G services in many countries; UK's regulator OFCOM for example, has allowed operators to re-farm their current spectrum holdings in the 900 MHz band for 4G services, while Taiwan auctioned the 900 MHz band for 4G services.

11 In Singapore, industry players have previously requested that IDA allocate the 700 MHz and 900 MHz bands for mobile services<sup>7</sup>.

12 In terms of technological pathways, the 700 MHz and 800 MHz bands are likely to be deployed for 4G services, while the 900 MHz band may be used either for 3G or 4G services. However, the considerations and constraints for the long term allocation of each of these bands differ.

### *700 MHz band*

13 While the 700 MHz band, which is being used for analogue broadcasting, has been designated for re-farming to be in line with the Asia-Pacific Telecommunity ("APT") 700 MHz band plan for mobile broadband (see Figure 1 below), the timeline for the availability of this band is expected to be later than the availability of the 900

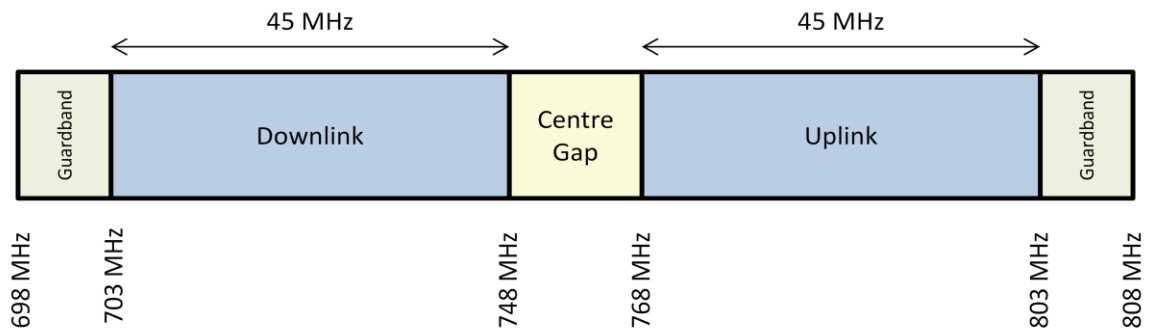
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<sup>6</sup> The term 'digital dividend' is generally understood in the industry as broadcast spectrum that is made available for mobile communication services after Analogue-Switch Off ("ASO").

<sup>7</sup> In IDA's public consultation on the "Proposed Framework for the Reallocation of Spectrum for 4G Telecommunication Systems and Services" issued in 2012, respondents had requested that spectrum in the 900 MHz band be made available for early re-allocation, and also sought more clarity on the availability on the 700 MHz band.

MHz band. ASEAN as a whole is targeting to achieve ASO by 2020. While it is possible that the 700 MHz band for Singapore may be made available before then, this is subject to the ASO schedules of Singapore and its immediate neighbours at the border areas.

**Figure 1: APT 700 Band Plan**



14 While IDA notes that there may be complementarities between the 700 MHz band and other spectrum bands, such as the 900 MHz band, the residual uncertainty in the timeframe for the availability of the 700 MHz band in turn affects whether long term rights for the 700 MHz band should be allocated together with other sub-1 GHz spectrum bands, or with spectrum bands above 1 GHz. IDA also notes that considerations of substitutability and complementarities may be less for existing Mobile Network Operators (“**MNOs**”) that have already obtained certainty for much of their long term spectrum holdings for 4G and IMT-Advanced services through the 2013 4G auction.

15 In terms of coupling the spectrum bands for allocation, IDA could allocate the 700 MHz band as a standalone band at such time where the timeframe for availability of the band is certain, or couple the allocation of the 700 MHz band with the 900 MHz band, 800 MHz band or 1.9/2.1 GHz band as discussed later in this document.

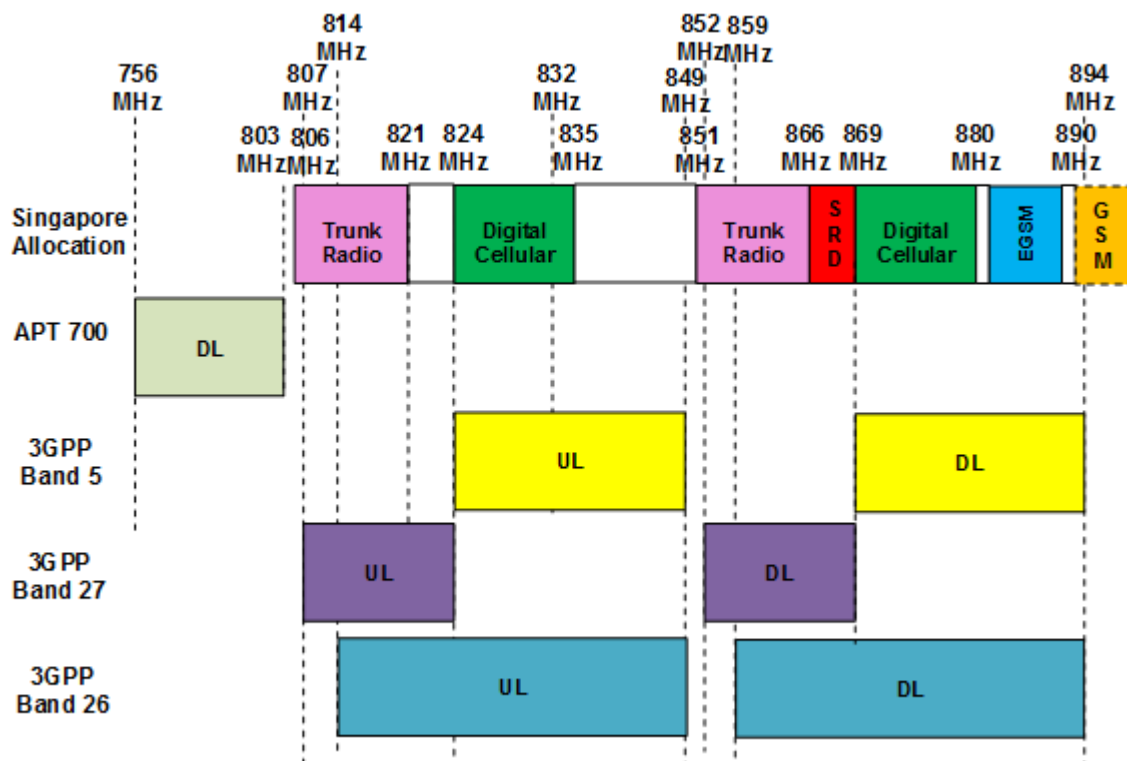
**Question 1: IDA seeks views on whether the 700 MHz band should be allocated as a standalone, or coupled with other bands such as the 900 MHz, 800 MHz or the 1.9/2.1 GHz bands.**

*800 MHz band*

16 The 800 MHz band is currently allocated and utilised for several types of services. These include digital trunk radio services (e.g., walkie talkies), SRD (e.g. Radio-frequency identification (“**RFID**”)) and, for the EGSM band, cellular mobile services.

17 IDA is currently considering several options to re-farm the 800 MHz band as shown in the figure below. Among the options, IDA is currently inclined towards re-farming the band in the longer term towards a modified 3rd Generation Partnership Project (“**3GPP**”) band 26 as this will allow IDA to maximise the utility of the spectrum by: (i) availing 2 x 25 MHz for allocation to mobile services; (ii) minimising impact on existing end users; and (iii) reaping potential economies of scale associated with this option.

**Figure 2: Options for the Re-farm of 800 MHz band**



18 However, the eventual band plan to be adopted has to be chosen in coordination with Singapore’s immediate neighbours, and taking into consideration the impact to the existing services using the said band. Among other factors, Malaysia and Indonesia currently allocate the EGSM spectrum in the 800 MHz band (i.e. 880-890 MHz) for the provision of EGSM and CDMA services respectively. Any spectrum re-allocation on IDA’s part alone will likely result in service degradation from cross-border interference with these services.

19 In addition, there is a need to ensure that the requirements of existing users in the 800 MHz band are met and that existing users are given a reasonable migration timeframe upon IDA’s decision to re-farm the band. Hence, IDA’s review has to take into consideration the needs of the existing users of trunked radio, SRDs and EGSM in the 800 MHz band:

- (a) Trunked radio: 2 x 15 MHz of frequency is currently allocated for trunked radio. Current uses include port, logistic and transport operations. Re-farming of these frequency bands for mobile broadband services could have significant impact on the operations of the existing users.
- (b) SRD: SRDs (including RFID) currently operate on a licence-exempt basis and are able to operate in several frequency bands besides the 800 MHz band. Examples of such uses include wireless remote controls, wireless local networks, and devices enabling cruise control in vehicles. The SRD users in the 800 MHz band can potentially be migrated to a different frequency band such as the 920 – 925 MHz band. However, users may incur some costs as a result of the migration, such as hardware costs for

device replacement. On the other hand, allowing SRDs to co-exist with mobile broadband networks could lead to interference risks as an OFCOM-commissioned study has indicated<sup>8</sup>. There is a possibility that SRDs can interfere with mobile services.

- (c) EGSM: As the spectrum rights to the EGSM band will expire on 31 March 2017, the MNO operating in this band will have to adjust its network to cater to the re-farmed band plan, depending on the new spectrum holdings it manages to acquire. However, it is unlikely that end users will be affected by the migration as the majority of mobile devices are able to function in multiple bands (i.e. dual/tri-band).

**Question 2: IDA seeks views on:**

- (a) whether the 800 MHz band should be re-farmed for mobile services;**
- (b) the band plan that should be preferred by Singapore and the underlying reasons;**
- (c) details of transitional issues to migrate existing services and systems in the 800 MHz band to the revised band plan;**
- (d) possible impact to end users of digital trunked radio and SRD/RFID, if, as a result of the eventual 800 MHz band plan: (i) the end users do not have to be migrated but will have to coexist with mobile broadband services; or (ii) the end users have to be migrated; and**
- (e) possible co-existence issues between mobile broadband, and digital trunked radio and SRD/RFID.**

*900 MHz band*

20 The 900 MHz band is currently allocated by way of the PCMTS spectrum rights and used for the provision of 2G and 3G services. The provision of 4G services using this band is also allowed as IDA stated in its 'Interim Decision issued by IDA on the Spectrum Framework for 4G Mobile Communication Systems in Singapore' ("**4G Interim Decision**"), issued on 24 January 2011. The PCMTS spectrum rights include rights for the use of a portion of the EGSM band that sits in the 800 MHz band. The PCMTS spectrum rights will expire on 31 March 2017.

21 Apart from the EGSM band, which depending on IDA's decision on the re-farming of the 800 MHz band, may be made available for long term allocation as part of the 800 MHz band, IDA is prepared to re-allocate the 900 MHz band for commercial mobile services, i.e. for 2 x 25 MHz of spectrum.

22 In terms of the allocation timeframe and approach, IDA is exploring several options for the re-allocation of the 900 MHz spectrum band:

- (a) First, IDA could allocate long term rights in the band as a standalone band (i.e., 900 MHz band only) for the provision of commercial mobile services using 4G or IMT-Advanced technologies, until mid 2030 to coincide with the expiration of the spectrum rights allocated in the 2013 4G auction. This

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<sup>8</sup> ERA Technology, 2011. *Investigation on the receiver characteristics of SRD equipment in the 863 – 870 MHz band.*



could be done through a market-based allocation mechanism for efficiency and transparency;

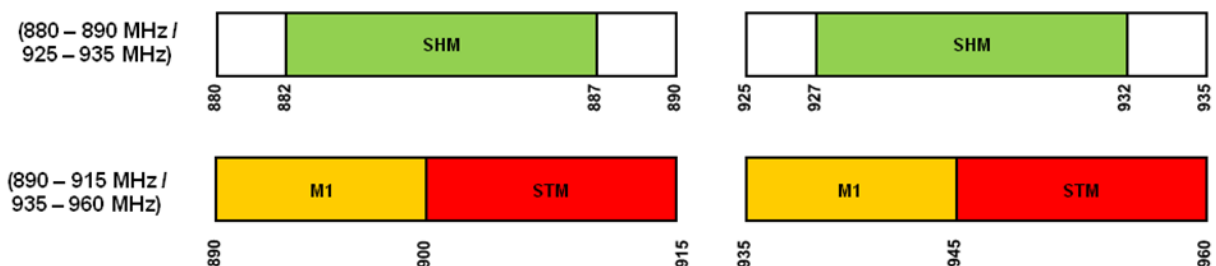
(b) Second, recognising that operators may wish to plan their spectrum portfolios more holistically, while also noting that there may be practical issues with coupling too many spectrum bands in a single allocation exercise, IDA could couple the allocation of the 900 MHz bands with other bands that will potentially be made available at a later stage, such as the 700 MHz band, and/or the 1.9/2.1 GHz bands (which will be available from 1 Jan 2022). If IDA finalises the re-farming of the 800 MHz band by the allocation exercise, the 800 MHz band could also be a candidate band for concurrent allocation. However, such a coupling would mean that long term rights for the 900 MHz band would be allocated at a later date given the existing uncertainties surrounding the 700 MHz and 800 MHz bands. In the interim, IDA could:

- (i) extend the current PCMTS spectrum rights for the 900 MHz band for a market-based fee; or
- (ii) conduct a market-based allocation for short term rights in the 900 MHz band, with rights to use the band extending from 1 Apr 2017 to 2020 or 2021.

While IDA notes that the likelihood of a new MNO entering the market based solely on spectrum in the 900 MHz band may be low, given the asymmetry in spectrum holdings in the 900 MHz band between the existing MNOs (see Figure 3 below), it may be more equitable for operators if a market-based allocation of short term spectrum rights is chosen. This is especially so if IDA decides to re-farm the EGSM band as part of the overall re-farming of the 800 MHz band.

(c) Third, IDA could couple several spectrum bands such as the 900 MHz band, 700 MHz band, and potentially the 1.9/2.1 GHz band in an earlier allocation exercise for long term spectrum rights, e.g., allocating in 2015 or 2016 even though some or all of these spectrum bands may not be available yet. However, as the 700 MHz and 1.9/2.1 GHz bands will only be available later, this would mean that operators will have to make decisions on their long term spectrum portfolios a significant length of time before the actual commencement of some spectrum rights.

**Figure 3: Existing spectrum allocation in the 900 MHz band** (the coloured portions represent the current allocations to existing MNOs)



**Question 3: IDA seeks views on the allocation approach for the 900 MHz spectrum band, particularly:**

- (a) whether the band should be re-allocated as a standalone band in a market-based allocation framework, and if so, the preferred timeframe for such an allocation exercise;**
- (b) whether the band should be coupled with other spectrum bands for allocation, and if so, which bands and the preferred timeframe for such an allocation exercise; and**
- (c) the underlying reasons for your views on the above.**

**Question 4: IDA seeks views and proposals on the technical issues relating to the allocation of the Sub-1 GHz bands for mobile broadband services, in particular, the guard band requirements between the adjacent bands (e.g., 700, 800 and 900 MHz bands) for mobile broadband services.**

#### Above 1-GHz bands

23 This category comprises several bands: the 1.4 GHz; 1.9 GHz and 2.1 GHz (“**3G band**”); 2.3 GHz and 2.5 GHz TDD bands (“**TDD bands**”); and 3.5 GHz band.

#### *1.4 GHz band*

24 With regard to the 1.4 GHz band, there has been growing international interest in this band as a mobile supplemental downlink (“**SDL**”) or TDD for 3G or 4G services. With the Carrier Aggregation feature across different bands (which has been introduced for HSPA+ and LTE in 3GPP Release 9 and Release 10 respectively<sup>9</sup>), next generation wireless products target to use the L-band downlink channels in the 1.4 GHz band in combination with other paired channels available in other paired spectrum bands. While IDA notes that the 1.4 GHz band has the potential to supplement most mobile bands, IDA will continue to monitor technology and market developments and may consider allocating this band for mobile use in future, if the conditions such as industry demand and technical feasibility permit.

**Question 5: IDA seeks an indication of any industry interest in the use of the 1.4 GHz band.**

#### *3G band*

25 Given that the 3G spectrum rights will only expire in 2021, it is premature to discuss the reallocation framework for the 3G band apart from its relation to the spectrum bands that are more readily available for reallocation, such as the 900 MHz band.

26 While 3G subscribers continue to account for the majority of mobile subscriptions, IDA notes that the adoption of 4G is steadily increasing with corresponding declines in 2G and 3G subscriptions. Under the MNOs’ respective 3G

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<sup>9</sup> HSPA refers to High-Speed Packet Access; LTE refers to Long-Term Evolution

spectrum rights issued in 2001 and 2010, MNOs are given rights of use over the 3G bands “for the purposes of operating 3G mobile communication systems... and the provision of 3G services...”. In the “Clarifications to Queries Raised Relating to Auction of 3G Spectrum Rights (2010)”, IDA had stated that the “3G spectrum may only be used for the operation and provision of 3G systems and services”.

27 In IDA’s 4G Interim Decision, IDA explicitly allowed for the flexible use of the PCMTS and WBA spectrum rights for 4G technologies and services. One of the key considerations then was that the 2.3 GHz and 2.5 GHz WBA spectrum bands were the stronger candidate bands for 4G deployment, based on global technology developments and industry feedback. IDA did not include the 3G bands in the flexible-use policy, given that the demand for 3G services was still growing, both globally as well as in Singapore. As one of the MNOs commented in IDA’s public consultation on the “Spectrum Framework for 4G Mobile Communication Systems in Singapore”, the 3G bands were unlikely to be re-farmed for 4G in the foreseeable future as the spectrum band will still be required to support 3G users and inbound roamers. This was also evidenced in the three MNOs’ requests for IDA to allocate the last available 3G spectrum lot for them to expand their 3G network capacity in 2010.

28 Globally, the more popular bands for 4G deployment today appear to be the 800 MHz, 1800 MHz, 2.3 GHz and 2.5 GHz bands<sup>10</sup>. At the same time, IDA notes that the European Commission has mandated EU members to liberalise their 3G spectrum for 4G deployment<sup>11</sup>. UK’s OFCOM has also published a proposal to liberalise all mobile licences in the 900 MHz, 1800 MHz and 2.1 GHz bands to allow the deployment of 4G services<sup>12</sup>.

29 Given technological and international developments, as a policy matter, IDA is prepared to allow the use of the 3G spectrum rights for the deployment of 4G systems and services, in addition to 3G. Operators wishing to do so should seek approval from IDA, which IDA will assess at its sole discretion. While IDA notes that existing MNOs have deployed 4G systems and services using other spectrum bands, according greater flexibility to the MNOs would allow them to respond to consumer demands for higher speed mobile broadband services more quickly. Given that no new MNO entered the market in the 4G auction, IDA’s view is that such flexibility in the use of the 3G bands would not tilt the playing field towards any existing operator in the market.

30 However, in allowing the flexible use of the 3G spectrum, IDA reminds existing MNOs that 3G services and service quality continues to be of significant importance with the majority of subscribers continuing to be on 3G mobile plans. Operators will continue to be required to meet their obligations under the 3G spectrum right and 3G Facilities-Based Operator (“FBO”) Licence, such as the requirement to provide nationwide and tunnel coverage for 3G, as well as to comply with Quality of Service requirements applicable to 3G services.

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<sup>10</sup> Source: July 2012: Global Mobile Suppliers Association, [www.gsma.com](http://www.gsma.com)

<sup>11</sup> Source: “EC clears 2GHz spectrum for LTE refarming”, 5 Nov 2012 (<http://www.telecoms.com/52222/ec-clears-2ghz-spectrum-for-lte-refarming/>)

<sup>12</sup> OFCOM, 2013. Consultation on “Variation of 900 MHz, 1800 MHz and 2100 MHz Mobile Licences”. Available from: [http://stakeholders.ofcom.org.uk/consultations/variation-900-1800-2100/?utm\\_source=updates&utm\\_medium=email&utm\\_campaign=variation900mhz-mob-lib](http://stakeholders.ofcom.org.uk/consultations/variation-900-1800-2100/?utm_source=updates&utm_medium=email&utm_campaign=variation900mhz-mob-lib)

31 For the avoidance of doubt, operators wishing to provide 4G or IMT-Advanced services using the 3G spectrum rights will provide such services under the operators' generic FBO licences, with applicable licence fees.

32 With regard to potential interference issues, the 3GPP, which is the organisation that provides international standards for mobile network systems, based the development of LTE (4G) on UMTS (3G) systems. 3GPP 8/9 supports mobility between the two systems. Other technical studies<sup>13</sup> have also shown few interference issues regarding the coexistence of 3G and 4G technologies in the existing 3G bands, and do not propose the need for any frequency separation between UMTS channel edge and LTE channel edge. However, should operators wish to deploy 4G or IMT-Advanced technologies in the 3G bands, they will be required to take measures to prevent interference<sup>14</sup> to the existing 3G systems. IDA will also require that operators doing so ensure that their 4G deployments are co-ordinated with the 3G networks at the border areas of neighbouring jurisdictions.

***Question 6: IDA seeks views on IDA's proposal to allow the deployment of 4G and IMT-Advanced systems and services in the 3G bands.***

*TDD bands*

33 The TDD bands are another source of spectrum for mobile broadband connectivity in the longer term. At the end of 2013, China Mobile announced the launch of its commercial Time-Division Long-Term Evolution ("**TD-LTE**") service, with major handset manufacturers like Samsung announcing TD-LTE capable handsets. Much of the TDD bands are currently unassigned, with some portion of the 2.5 GHz TDD band<sup>15</sup> allocated in a WBA spectrum right to an existing MNO.

34 The availability of the TDD bands also brings with it opportunities, including the possibility of deploying small cells as a part of HetNet. The TDD bands have characteristics that are suitable for dense small cell networks which can provide consumers with greater service coverage and capacity. At the same time, TD-LTE's flexible downlink ("**DL**")/uplink ("**UL**") ratio (e.g. 2:1) is able to provide more DL capacity which can better support the increasingly data intensive surfing patterns of consumers. Further, interference issues inherent in overlapping cells (and in a HetNet) may be mitigated with the introduction of enhanced Inter-cell interference coordination ("**eICIC**") and Coordinated Multi-Point features ("**CoMP**") for LTE<sup>16</sup>. These developments thus pave the way for possible deployment of HetNet with a combination of Frequency Division Duplex ("**FDD**") macro and TDD small cells<sup>17</sup>.

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<sup>13</sup> European Conference of Postal and Telecommunications Administrations (CEPT) Report 40, "Compatibility study for LTE and WiMAX operating within the bands 880-915 MHz / 925-960 MHz and 1710-1785 MHz / 1805-1880 MHz (900/1800 MHz bands)".

<sup>14</sup> This can include operator-to-operator coordination, allocating sufficient frequency separation and/or adjusting network parameters.

<sup>15</sup> 2570 MHz to 2600 MHz

<sup>16</sup> LTE-Advanced standardisation in 3GPP release 10 which was completed in early 2011. Carrier Aggregation can be used between cells to enhance the support of small cells in the HetNet, and also enable flexible aggregation of FDD and TDD LTE carriers.

<sup>17</sup> To enable HetNet using TDD, the small cells might be deployed in clusters, isolated from one another, so that the UL/DL frame structure can be adjusted dynamically based on the local traffic demand.

35 On 2 January 2014, IDA issued an Information Paper detailing the “Short Term Allocation Framework for the TDD bands”<sup>18</sup> to indicate that the TDD bands may be made available on a short term basis through existing frameworks, including IDA’s market trial framework or technical trial framework. Short term allocations will allow interested operators to gauge the commercial feasibility of launching TD-LTE services in Singapore. Should there be market interest, IDA is prepared to make available the TDD bands for long term allocation.

36 In relation to the amount of spectrum available in the TDD bands for allocation, IDA noted in the Information Paper mentioned above that the 2.3 GHz band is currently coordinated with neighbouring jurisdictions on a ‘half-band’ sharing basis, i.e. the 2300 MHz to 2350 MHz band is available to Singapore operators for priority access, while the 2.5 GHz band is coordinated on a ‘full-band’ sharing basis, i.e. the 2570 MHz to 2620 MHz band can potentially be allocated in Singapore.

37 In the ITU-R WP5D meeting held in February 2014, the revised draft of a working document on the coexistence issues relating to TDD networks in the 2.3 GHz band with adjacent spectrum bands was tabled<sup>19</sup>. Currently, co-existing TDD networks in the same geographic region may experience mutual interference if they are unsynchronised<sup>20</sup>. Preliminary assessments show that while adjacent band coexistence issues may be managed through the synchronisation of the TDD networks, the feasibility of co-channel coexistence is uncertain unless there is a significant separation distance. The separation distance will vary depending on the scenario in which the base stations are deployed. For example, while two macro base stations deployed outdoors on the same carrier frequency may require a separation distance of more than 100 km, a separation distance of 2 km may only be needed for in-building deployment on the same carrier frequency. These issues would likely be applicable to TDD networks in Singapore. Given Singapore’s geography, co-channel coexistence for outdoor deployment may not be feasible given the need for cross-border coordination. IDA will continue to study the feasibility of TDD deployments in Singapore coexisting with TDD networks in neighbouring jurisdictions and is exploring the following options to maximise the usable spectrum for Singapore:

- (a) Half-band sharing with neighbouring jurisdictions – Singapore will be allocated 50 MHz in the 2.3 GHz band, and 25 MHz in the 2.5 GHz band, with outdoor mobile deployments permissible; and
- (b) Full-band sharing with neighbouring jurisdictions – Primarily for in-building deployment using small cells, subject to coordination with neighbouring jurisdiction.

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<sup>18</sup> IDA, 2014. Information Paper: Short-Term Assignment of Unassigned Spectrum in the 2.3 GHz and 2.5 GHz TDD Spectrum bands. Available from: [http://www.ida.gov.sg/~media/Files/PCDG/Licensees/SpectrumMgmt/SpectrumAuctAss/ShortTermTD D/Info%20Paper\\_2Jan14.pdf](http://www.ida.gov.sg/~media/Files/PCDG/Licensees/SpectrumMgmt/SpectrumAuctAss/ShortTermTD D/Info%20Paper_2Jan14.pdf)

<sup>19</sup> ITU WP 5D, 2013. Working document towards a preliminary draft new report on coexistence of two TDD networks in the 2300-2400 MHz.

<sup>20</sup> Examples of interference include simultaneous DL and UL, and misalignment of frames despite having similar DL and UL configuration.

**Question 7: IDA seeks:**

- (a) indications of industry interest in the allocation of long term rights in the TDD bands, as well as planned services (including small cells) and target market segments for the use of these bands;**
- (b) views on whether the use of the TDD bands solely for the deployment of in-building TDD systems is feasible, and the underlying considerations thereof;**
- (c) views on whether the use of TDD bands for partial deployment of outdoor and in-building TDD systems is feasible, and the underlying considerations thereof;**
- (d) views on the use of TDD bands for small cell deployment as part of a HetNet;**
- (e) views on the mitigation techniques requirement for co-existence (e.g., separation distance, transmit power, and UL-DL configuration<sup>21</sup>);**
- (f) views on the implication of the TDD bands on a half-band sharing basis with neighbouring jurisdictions; and**
- (g) views on the implication of the TDD bands on a full-band sharing basis (primarily for in-building deployment) with neighbouring jurisdictions.**

**3.5GHz band**

38 ITU has identified the 3.5 GHz band (the extended 'C band' from 3.4 GHz to 3.6 GHz) as a suitable band for IMT systems. However, IDA notes that at this juncture, the use of the 3.5 GHz band for commercial mobile services internationally is low, with limited equipment availability. The band is also currently used for Fixed Satellite Services ("FSS") in neighbouring jurisdictions. In Singapore, the band is currently assigned for FSS and TV Receive-Only ("TVRO") services. IDA notes that in order to re-farm the 3.5 GHz band for commercial mobile services, potential cross-border interference issues with FSS will have to be addressed. IDA has also studied the possibility of a more limited use of the 3.5 GHz band, such as for in-building deployments only, which appears feasible. At this juncture, IDA is monitoring industry interest in the 3.5 GHz band for the deployment of commercial mobile services and may conduct further technical studies should there be interest in such deployment.

**Question 8: IDA seeks:**

- (a) indications of industry interest in the allocation of long term rights in the 3.5 GHz band, as well as planned services and target market segments for the use of these bands;**
- (b) views on whether the use of the 3.5 GHz bands solely for the deployment of in-building mobile systems is feasible, and the underlying considerations thereof;**
- (c) views on possible impact to end users of FSS and TVRO, if (i) the end users do not have to be migrated; or (ii) the end users have to be migrated; and**
- (d) views on possible co-existence issues between TDD systems, and FSS and/or TVRO systems.**

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<sup>21</sup> Reference to 3GPP TS 36.211 v12, 3GPP TS 36.828, CEPT Report 119 and CEPT Report 11(05).

## Other policy considerations for development of HetNet

39 As highlighted in Part 1, IDA's longer term vision is the creation of HetNet to enable seamless connectivity for end users. Besides enabling spectrum for the deployment of various mobile and wireless technologies such as 4G, White Space and Wi-Fi, IDA is studying the need to consider any other policy areas, policy implications or regulatory issues that will arise in the deployment of HetNet. These could be in technical areas such as standards, network-to-network interconnectivity, or radio interference issues, as well as in policy areas such as operator-to-operator interconnection, and end-user Quality of Service levels. Hence, IDA would like to seek views on key policy areas or implications that IDA should consider in enabling the deployment of HetNet.

### **Question 9: IDA seeks:**

- (a) views on key policy areas related to technical, service provisioning or end-user impact that should be considered in the deployment of HetNet; and**
- (b) other policy implications that may arise with HetNet.**

### **PART III: OPTIONS TO ENHANCE MOBILE COMPETITION AND SERVICE INNOVATION**

40 IDA's key policy objective in spectrum management is to ensure the efficient allocation of Singapore's spectrum resource, while maintaining other policy outcomes including the competitiveness of the mobile market in Singapore.

41 IDA has always actively developed the mobile market. In the 2013 4G spectrum auction, IDA set aside 2 x 20 MHz of spectrum in the 2.5 GHz band at the reserve price for any new entrant that wished to deploy a 4G network in Singapore. However, no new entrant expressed interest in the set-aside spectrum by the stated deadline.

42 IDA remains interested to explore measures to increase consumer welfare through better price and non-price terms, and benefit the overall economy through increased service innovation brought about by greater competition in the mobile market. This is especially important as wireless and mobile connectivity will underpin the future of communications, with trends like the Internet of Things, the deployment of sensors and wearable technology emerging at the forefront of technological developments<sup>22</sup>. Hence, while IDA remains open to having interested parties entering the local market as MNOs, IDA would like to explore other policy options in facilitating greater competition in the mobile market.

#### Introduction of MVNO

43 In 2001, IDA considered the regulatory framework for MVNOs in Singapore, particularly in the context of 3G. Then, IDA's conclusion given market developments at that time was that *"MVNOs wishing to offer 3G services must negotiate commercially with the 3G mobile network operators for access to their networks, with IDA intervening only in cases of 'unduly restrictive or anti-competitive practices', in accordance with the provisions under the Telecom Competition Code."*<sup>23</sup>

44 Since then, the size of the mobile market and the potential for service innovation has significantly increased. IDA recently studied the feasibility of increased services-based competition in the mobile market through the potential introduction of MVNOs in the market, and found that the introduction of MVNOs will potentially bring about significant increases in consumer surplus and potential net benefits to Singapore such as through more competitive prices. While MNOs may commercially enter into wholesale arrangements with MVNOs today, the number and market share of MVNOs in Singapore today is small, at less than 1%, and catering to very niche markets. For example, Philippine Long Distance Telephone Company ("**PLDT**"), an MVNO in Singapore, offers prepaid SIM cards with a broad range of value-added services targeted at Filipinos. Thus, while IDA has included a general duty to negotiate in good faith with MVNOs as a condition of the 2013 4G spectrum auction, IDA is exploring additional measures to encourage the hosting of MVNOs by MNOs.

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<sup>22</sup> Cisco predicts that there will be 177 million wearable devices by 2018 globally, growing eight-fold from 22 million in 2013 at a CAGR of 52%. Data traffic from wearable devices is also forecasted to grow 36-fold to 61 petabytes per month by 2018 at a CAGR of 105%. (Source: Cisco VNI Mobile, 2014)

<sup>23</sup> IDA, 2001. Decision on Proposed Regulatory Approach for 3G MVNOs. Available from: [http://www.ida.gov.sg/~media/Files/Archive/Policies%20and%20Regulation/Policies\\_and\\_Regulation\\_Level2/MVNOs/3G\\_MVNO\\_Framework.pdf](http://www.ida.gov.sg/~media/Files/Archive/Policies%20and%20Regulation/Policies_and_Regulation_Level2/MVNOs/3G_MVNO_Framework.pdf)



45 Internationally, IDA notes that MVNOs have the potential to catalyse increased competition in the mobile market. While MVNOs have less room to differentiate as compared to a new MNO, evidence from markets where MVNOs have been successful such as the UK and the Netherlands show that MVNOs have provided service innovation and have caused a reduction in market prices<sup>24</sup>, with MVNOs growing to account for more than 10% of the mobile market share. In some markets, new entrants have used the MVNO model as a stepping stone to full-fledged infrastructural deployment.

46 Given that MVNOs offer services using the host MNO's network, MVNOs typically differentiate in other aspects, such as pricing, customer service, value added services, among others. There are multiple business models available to an MVNO; internationally, these include MVNOs tied to retailers such as Tesco Mobile in the UK, Community MVNOs focused on providing value added services to niche migrant communities such as LycaMobile; and MVNOs linked to Internet-Service Providers ("ISPs") such as ONO in Spain. While other value propositions may be adopted by MVNOs, IDA has assessed that the business case for these three types of MVNOs are the most feasible based on Singapore's market conditions.

47 In particular, the nationwide deployment of an open access Next Generation Nationwide Broadband Network ("**Next Gen NBN**") has introduced several new ISPs into the residential consumer market, offering competitive high speed broadband services to consumers. With the industry structure and regulatory framework for the Next Gen NBN lowering the barriers to entry of new ISPs, a framework to enable MVNO market entry would accord these new entrants the opportunity to offer bundled triple-play service offerings, deepening competition in both the fixed line and mobile broadband markets. In addition, IDA notes that other types of MVNOs, such as Retailer MVNOs and Community MVNOs could benefit from the reach, distribution channels and scale of already-established players in the corresponding sector.

**Question 10: IDA seeks:**

- (a) views and comments from potential MVNOs on their level of interest to enter the mobile market and the target market segments of potential MVNOs (e.g. pre-paid or post-paid, niche or general consumer segments); and**
- (b) views from the industry on the interest and viability for a new MNO to enter the market, and whether the market environment, or technology or spectrum developments have changed since the 2013 4G spectrum auction that have made the business case attractive for a new MNO to enter.**

48 IDA notes that the business models of potential MVNOs would also depend on the degree of control that the MVNO would have over its network and its corresponding reliance on its host-MNO's network, as illustrated in the diagram below. While all types of MVNOs will catalyse competition to some extent, an MVNO with more extensive control over certain aspects of its network and service delivery will be able to offer more differentiated services to end users. However, this is likely to require larger fixed asset investments by MVNO entrants.

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<sup>24</sup> In the UK, the entry of various MVNOs since 2000 saw the Average Revenue Per User ("**ARPU**") declining from around US\$45 per month to US\$27 per month in 2013. (Source: Analysys Mason, 2014)

**Figure 4: MVNO control network and service elements (Source: Analysys Mason, 2014)**

	Access	Core			Service platform				Customer				
<b>Branded reseller</b>	Access network	MSC	HLR	GMSC	Charging & billing	Numbering	Service delivery	CRM	Pricing	Customer care	Contract	Branding	Distribution
<b>Light MVNO</b>	Access network	MSC	HLR	GMSC	Charging & billing	Numbering	Service delivery	CRM	Pricing	Customer care	Contract	Branding	Distribution
<b>Medium MVNO</b>	Access network	MSC	HLR	GMSC	Charging & billing	Numbering	Service delivery	CRM	Pricing	Customer care	Contract	Branding	Distribution
<b>Heavy/ Full MVNO</b>	Access network	MSC	HLR	GMSC	Charging & billing	Numbering	Service delivery	CRM	Pricing	Customer care	Contract	Branding	Distribution

**Legend**  
**Responsibility of:** Host (blue), Host or partner (light blue), Host or shared (red), Shared (pink), Partner (white)

49 IDA is aware, as evidenced from the diagram above, that the pricing of wholesale access to the MNO’s access network will be a key factor driving the business case of MVNOs. Apart from wholesale pricing, there may be other critical factors to an MVNO’s sustainability from a cash flow and financing perspective. IDA is interested to hear from potential MVNOs what these critical success factors would be.

**Question 11: IDA seeks views on the ‘depth’ of MVNO deployment envisaged by new entrants, in particular, the viability of a ‘Heavy/Full’ MVNO deployment model versus the other models, given that the former would have the most flexibility to differentiate its services to compete with the MNOs.**

Framework to encourage MVNO-hosting

50 Regulators and governments internationally such as Hong Kong and France have taken different measures to encourage the market entry of MVNOs. Broadly, some of these approaches that have been contemplated or enforced include imposing regulatory or spectrum obligations (e.g., wholesale price regulation, setting aside of minimum amount of network capacity for MVNOs, etc) and incentivising voluntary commitments on the part of MNOs to host MVNOs (e.g., with discounts or rebates off fees for MNOs).

51 IDA notes that both regulatory/spectrum/licence conditions and voluntary commitments could be employed as complements. Given the upcoming pipeline of spectrum to be allocated for commercial mobile services, the use of spectrum auctions or spectrum licensing conditions could potentially be means for IDA to implement a framework to facilitate hosting of MVNOs. For example, the re-allocation of the 900 MHz band could be a basis for IDA to implement an MVNO-hosting framework, where MNOs wishing to acquire re-allocated spectrum in the 900 MHz band are subject to targets tied to the hosting of MVNOs on their existing mobile

networks. Given the near-immediate availability of the TDD bands, the allocation of the TDD bands could also be used in conjunction with the re-allocation of the 900 MHz band to align MNOs with MVNO-hosting targets.

52 IDA is also exploring other options, such as the use of government demand for wireless connectivity to incentivise MVNO-hosting.

**Question 12: IDA seeks views on:**

- (a) possible mechanisms to implement an MVNO-hosting framework, and the relative merit and usefulness of each of these approaches; and**
- (b) the viability of a regulatory and/or voluntary commitment approach for MVNO-hosting, and the kinds of regulatory or incentives required and which spectrum bands to tie-in the MVNO-hosting incentives.**

53 In structuring a framework to encourage MVNO-market entry, IDA is keen to explore how to encourage MNOs to host MVNOs, particularly non-affiliated MVNOs. At the same time, the output and outcome indicators required of MNOs under the MVNO hosting framework should be useful for MVNOs. It is thus important that the output and outcome indicators to measure the level of MVNO-hosting be relevant for the industry.

54 In terms of output or outcome indicators for MNOs, IDA notes that measures may include a combination of the following:

- (a) Publication of wholesale offers with service level guarantees;
- (b) Minimum percentage of network capacity set aside for non-affiliated MVNOs<sup>25</sup>;
- (c) Number of non-affiliated MVNOs hosted on MNO's network;
- (d) Market share of non-affiliated MVNOs hosted on MNO's network;
- (e) Minimum regulatory requirements, limitations or prohibitions on wholesale access terms, ranging from general duties to negotiate in good faith to specific conditions around:
  - (i) Wholesale pricing;
  - (ii) Minimum contract durations, exclusivity or priority clauses;
  - (iii) Minimum commitments (by revenue or other measures);
  - (iv) Sharing of commercially confidential information with the MNO; or
  - (v) Pre-emption and preference requirements on the MVNO's assets.

55 At the same time, depending on the needs of MVNOs, IDA notes that there may be some users that require different classes or services or priorities in traffic handling, for example where the MVNO is (or is serving) an entity providing connectivity for government agencies' communications.

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<sup>25</sup> OFTA, 2001. Press Release: Licensing of Third Generation Mobile Services. Available from: [http://tel\\_archives.ofca.gov.hk/en/press\\_rel/2001/jul\\_2001.html](http://tel_archives.ofca.gov.hk/en/press_rel/2001/jul_2001.html)

**Question 13: IDA seeks feedback on:**

- (a) the output/outcome indicators to be imposed on MNOs that would be relevant for MVNOs;**
- (b) the level of wholesale pricing to the MNO's access network (in unit rates) that would justify the business case for market entry;**
- (c) the non-price terms and conditions imposed by MNOs, such as minimum volume or revenue commitments, that would be acceptable for a positive MVNO business case;**
- (d) details of the business and financial model of potential MVNOs;**
- (e) the ability of MNOs to differentiate classes of service and allow priorities to cater to the needs of government demand or other MVNOs; and**
- (f) any other relevant considerations that IDA should take into account in structuring a framework to encourage the hosting of MVNOs.**

## **PART IV: SUMMARY**

56 This consultation seeks industry viewpoints on the technical issues surrounding the allocation of spectrum bands for mobile services, technical issues and business models related to spectrum bands that are preferred by the industry (alone or together), as well as market interest in and suggestions on how an MVNO-hosting framework might operate.

57 Specifically, IDA would like to seek views and proposals on the following:

### 700 MHz

- (a) *Whether the 700 MHz band should be allocated as a standalone, or coupled with other bands such as the 900 MHz, 800 MHz or the 1.9/2.1 GHz bands.*

### 800 MHz

- (a) *Whether the 800 MHz band should be re-farmed for mobile services;*
- (b) *The band plan that should be preferred by Singapore and the underlying reasons;*
- (c) *Details of transitional issues to migrate existing services and systems in the 800 MHz band to the revised band plan;*
- (d) *Possible impact to end users of digital trunked radio and SRD, if, as a result of the eventual 800 MHz band plan: (i) the end users do not have to be migrated but will have to coexist with mobile broadband services; or (ii) the end users have to be migrated; and*
- (e) *Possible co-existence issues between mobile broadband, and digital trunked radio and SRD/RFID.*

### 900 MHz

- (a) *Whether the band should be re-allocated as a standalone band in a market-based allocation framework, and if so, the preferred timeframe for such an allocation exercise;*
- (b) *Whether the band should be coupled with other spectrum bands for allocation, and if so, which bands and the preferred timeframe for such an allocation exercise; and*
- (c) *The underlying reasons for your views on the above.*

### Sub-1 GHz bands

- (a) *The technical issues relating to the allocation of the Sub-1 GHz bands for mobile broadband services, in particular, the guard band requirements between the adjacent bands (e.g., 700, 800 and 900 MHz bands) for mobile broadband services.*

### 1.4 GHz

- (a) *Indication of any industry interest in the use of the 1.4 GHz band.*

### 3G bands

- (a) *To allow the deployment of 4G and IMT-Advanced systems and services in the 3G bands.*

### TDD bands

- (a) *Indications of industry interest in the allocation of long term rights in the TDD bands, as well as planned services (including small cells) and target market segments for the use of these bands;*
- (b) *Views on whether the use of the TDD bands solely for the deployment of in-building TDD systems is feasible, and the underlying considerations thereof;*
- (c) *Views on whether the use of TDD bands for partial deployment of outdoor and in-building TDD systems is feasible, and the underlying considerations thereof;*
- (d) *views on the use of TDD bands for small cell deployment as part of a HetNet;*
- (e) *Views on the mitigation techniques requirement for co-existence (e.g., separation distance, transmit power, and UL-DL configuration);*
- (f) *views on the implication of the TDD bands on a half-band sharing basis with neighbouring jurisdictions; and*
- (g) *views on the implication of the TDD bands on a full-band sharing basis (primarily for in-building deployment) with neighbouring jurisdictions.*

### 3.5 GHz

- (a) *Indications of industry interest in the allocation of long term rights in the 3.5 GHz band, as well as planned services and target market segments for the use of these bands;*
- (b) *Views on whether the use of the 3.5 GHz bands solely for the deployment of in-building mobile systems is feasible, and the underlying considerations thereof;*
- (c) *Views on possible impact to end users of FSS and TVRO, if (i) the end users do not have to be migrated; or (ii) the end users have to be migrated; and*
- (d) *Views on possible co-existence issues between TDD systems, and FSS and/or TVRO systems.*

### Other policy considerations for development of HetNet:

- (a) *Views on key policy areas related to technical, service provisioning or end-user impact that should be considered in the deployment of HetNet; and*
- (b) *Other policy implications that may arise with HetNet.*

### Options to enhance mobile market competition

- (a) *Views and comments from potential MVNOs on their level of interest to enter the mobile market and the target market segments of potential MVNOs (e.g., pre-paid or post-paid, niche or general consumer segments);*
- (b) *Views from the industry on the interest and viability for a new MNO to enter the market, and whether the market environment, or technology or spectrum developments have changed since the 2013 4G spectrum auction that have made the business case attractive for a new MNO to enter;*
- (c) *The 'depth' of MVNO deployment envisaged by new entrants, in particular, the viability of a 'Heavy/Full' MVNO deployment model versus the other models, given that the former would have the most flexibility to differentiate its services to compete with the MNOs;*
- (d) *Possible mechanisms to implement an MVNO-hosting framework, and the relative merits and usefulness of each of these approaches;*
- (e) *The viability of a regulatory and/or voluntary commitment approach for MVNO-hosting, and the kinds of regulatory or incentives required and which spectrum bands to tie-in the MVNO-hosting incentives;*

- (f) *The output/outcome indicators to be imposed on MNOs that would be relevant for MVNOs;*
- (g) *The level of wholesale pricing to the MNO's access network (in unit rates) that would justify the business case for market entry;*
- (h) *The non-price terms and conditions imposed by MNOs, such as minimum volume or revenue commitments, that would be acceptable for a positive MVNO business case;*
- (i) *Details of the business and financial model of potential MVNOs;*
- (j) *The ability of MNOs to differentiate classes of service and allow priorities to cater to the needs of government demand or other MNVOs; and*
- (k) *Any other relevant considerations that IDA should take into account in structuring a framework to encourage the hosting of MVNOs.*

## **PART V: INVITATION TO COMMENT**

58 IDA would like to seek the views and comments from the industry and members of the public on the proposed spectrum allocation options and the options to enhance mobile competition set out in this document.

59 Respondents that submit their views or comments regarding the issues identified in this consultation document should organise their submission as follows: (a) cover page (including their personal/company particulars and contact information); (b) table of contents; (c) summary of major points; (d) statement of interest; (e) comments; and (f) conclusion. Supporting materials may be placed as an annex to the comments raised.

60 All views and comments should be submitted in both hard and soft copies (Microsoft Word or PDF Format), and should reach IDA by **12 noon, 20 May 2014**. All views and comments should be addressed to:

Ms Aileen Chia  
Deputy Director General (Telecoms and Post)  
Infocomm Development Authority of Singapore  
10 Pasir Panjang Road  
#10-01 Mapletree Business City  
Singapore 117438

Fax: (65) 6211 2116

### **AND**

Please submit your soft copies, with the email header “Public Consultation on Spectrum Allocation for IMT and IMT-Advanced Services and Options to Enhance Mobile Competition” via email to [IDA\\_consultation@ida.gov.sg](mailto:IDA_consultation@ida.gov.sg).

61 IDA reserves the right to make public all or parts of any written submission and to disclose the identity of the source. Respondents may request confidential treatment for any part of the submission that the respondent believes to be proprietary, confidential or commercially sensitive. Any such information should be clearly marked and placed in a separate annex. If IDA grants confidential treatment it will consider, but will not publicly disclose, the information. If IDA rejects the request for confidential treatment, it will return the information to the party that submitted it and will not consider this information as part of its review. As far as possible, parties should limit any request for confidential treatment of information submitted. IDA will not accept any submission that requests confidential treatment for all, or a substantial part, of the submission.