

**RESPONSE TO THE PUBLIC CONSULTATION ISSUED BY THE
INFOCOMM DEVELOPMENT AUTHORITY OF SINGAPORE (“IDA”)**

**PROPOSED FRAMEWORK FOR THE REALLOCATION OF SPECTRUM
FOR 4G TELECOMMUNICATION SYSTEMS AND SERVICES**



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PROPOSED FRAMEWORK FOR THE REALLOCATION OF SPECTRUM FOR 4G TELECOMMUNICATION SYSTEMS AND SERVICES

1. M1 is a leading integrated provider of info-communication services in Singapore. Since commercial launch in 1997, M1 has made significant inroads into the info-communications market and achieved an outstanding track record in innovation, service and technical excellence:-

- Feb 2005 - first operator in Singapore to launch 3G services;
- Dec 2006 - launched Singapore's first island-wide wireless broadband service;
- Sep 2009 - launched MiFi, the industry's first ultra portable credit card-sized Intelligent Mobile Hotspot, revolutionizing the way mobile broadband is used;
- Oct 2009 - first operator in Asia Pacific to adopt MIMO (Multiple-Input Multiple-Output) technology for its HSPA+ network and achieved Singapore's fastest download speeds of 28 Mbps;
- Jun 2011 - launched South East Asia's first 4G network or Next Generation Mobile Network ("NGMN").

With an emphasis on network quality, customer service, value and innovation, our mission is to link anyone and anything; anytime, anywhere.

2. M1 welcome this opportunity to submit our views and comments to IDA for its consideration on the proposed framework for the reallocation of spectrum for 4G info-communication services.

INTRODUCTION

3. Technological convergence and the introduction of smartphones and tablets burgeoning with data intensive applications, have led to an unprecedented surge in demand for wireless broadband access ("WBA") or mobile broadband in the last few years. This trend of rapid data growth is set to increase tenfold¹ in light of increased proliferation of data-hungry services/applications, intelligent networks and machine-to-machine interactions. IDA's foresight in its WBA spectrum decisions in Y2005 help foster an environment conducive for the rapid adoption and growth of mobile broadband in Singapore. Today, wireless broadband subscriptions in Singapore have reached 8.1 million in Mar 2012, achieving a population penetration rate of 157%.

4. It is thus clear that spectrum decisions have strategic implications in shaping and promoting investment, innovation and growth in the telecommunications market. Particularly, it is crucial to ensure that sufficient spectrum is made available to meet technical requirements both to achieve optimal spectrum use and market efficiency. This paper evaluates the implications of IDA's proposal and sets out the rationale of our views

¹ Telecomasia, 'Mobile data set to swell tenfold by 2016', 17 May 2012.



on the necessary elements to ensure the success of 4G deployments in Singapore and advocates an evolutionary approach to network upgrades to facilitate smooth transition from 2G/3G to LTE and 4G to fully reap the benefits that these technologies offer to the digital economy.

Guiding Principles in Spectrum Allocation and Technical Requirements

5. We believe an effective spectrum decision is one that achieves the following policy objectives and delivers economic and social benefits to Singapore:-
 - Enhance Singapore's position as a premier digital and info-communications hub;
 - Promote effective and sustainable competition;
 - Provide a stable investment environment;
 - Facilitates seamless migration or transition for customers, minimising any unnecessary service disruption or inconvenience; and
 - Provide flexibility for future growth, development and opportunities.
6. In this regard, the timely allocation of suitable and sufficient spectrum is also of paramount importance for the continued development of mobile communications in the Singapore market. To this end, we would strongly urge IDA to allocate all potentially available spectrum in all the relevant bands, namely 1800MHz, 2.3Ghz and 2.5Ghz and not to reserve any blocks for some possible future use or trial purposes.

Overall 4G Spectrum Requirements

More than 20 MHz bandwidth needed to realize the full potential of 4G

7. While a minimum of 20 MHz of contiguous FDD spectrum allows for optimal LTE performance in the initial phase, it is grossly insufficient to realise the full potential of 4G in Singapore and to satisfy projected traffic demand in high bandwidth mobile services.

Based on 3GPP Release 10, in order for a 4G operator to support the higher throughput performance of 1 Gbps, an aggregation of up to 100 MHz bandwidth will be required. The specifications prescribed techniques for an operator to aggregate 40 MHz bandwidth to maximize throughput performance. In other words, each 4G operator will require at least 40 MHz FDD bandwidth to support 4G deployment. Insufficient spectrum will compromise service performance and impact end-user experience e.g. unable to establish connection, slow speeds, drop calls etc. In the Singapore context, this translates to a requirement of 20 MHz (contiguous) FDD spectrum in the 1800 MHz band and 20 MHz (contiguous) FDD spectrum in the 2.5 GHz band to support full 4G deployment.

No further spectrum of sizable amount for 4G deployment and data expansion

8. If sufficient spectrum is not made available at the outset, the provision of mobile broadband, specifically 4G services, will be at stake. This is the primary reason why regulators globally are releasing large amounts of spectrum for mobile broadband deployment. In Singapore's case, the fact is that there is no further spectrum of sizable amount available in the near future for 4G deployment following this re-allocation



exercise. Although the 700 MHz spectrum bands have also been earmarked for LTE, the band cannot be utilised until the frequency issues with Malaysia’s terrestrial TV services and international roaming are fully addressed².

Market Environment

No new entrant³ for the past 12 years since market liberalisation

9. Since market liberalisation in Y2000, the Singapore mobile/WBA market has been open to new entrants. However, the fact remains that for the past 12 years, there was no new entrant in this market.

Date	Opportunities for New Entrant	Outcome	Implications
Apr 01	3G Spectrum Rights Auction	No new entrant	3G Spectrum reserved for new entrant set aside instead of allocation to existing 3G operators. This led to: <ul style="list-style-type: none"> Higher capital costs for existing mobile operators who needed the additional spectrum Congestion issues due to insufficient spectrum arising from exponential surge in data.
Apr 05	WBA Spectrum Right Auction (currently termed as 4G Spectrum)	No new entrant but: <ol style="list-style-type: none"> Non-serious bids artificially drove up the cost of spectrum lots for serious bidders. Exit of 2 successful bidders and resale of acquired rights 	<ol style="list-style-type: none"> Spectrum costs artificially inflated. Nil/Limited deployment. To-date, only existing mobile operators have successfully deployed nationwide mobile/mobile broadband networks in Singapore.
Feb 08	PCMTS Spectrum Right Auction	No new entrant	-
Jun 10	4G Consultation	No response from any potential new entrant	
Oct 10	3G Spectrum Rights (2010) Auction	No new entrant	

² Telecomasia, ‘1800-MHz as a stopgap solution for APAC LTE’, 7 Dec 2011.

³ New entrant, as defined by IDA, is any operator that does not currently provide nationwide mobile system and service coverage in Singapore. IDA Consultation Paper on ‘Proposed Framework for the Reallocation of Spectrum for Fourth Generation (“4G”) Telecommunication Systems and Services’, 10 Apr 2012.



EVALUATION OF SPECTRUM RE-ALLOCATION OPTIONS

10. There are various options for the re-allocation of spectrum, namely:-

(i) Re-auction of all existing spectrum or “Greenfield allocation”

Without the offer of a first right of refusal, spectrum churning is likely as well as potential loss of some or all of an operator’s existing frequency assignments.

Due to the highly disruptive impact on service continuity and investment, such an approach has rarely been adopted for the allocation of spectrum for existing services, particularly in effectively competitive and advanced markets such as Europe, Hong Kong, Australia etc. It creates an uncertain environment which dampens commercial incentives of existing operators in making new investment and hinders the development of services and technology upgrades in the concerned spectrum band.

(ii) First Right of Refusal (“FROR”) for existing 4G operators

This approach allows the existing 4G operators to exercise the FROR to acquire their existing frequency slots in the 2.3GHz/2.5GHz and 1800 MHz bands upon the expiry of the current term in Y2015/Y2017 respectively. If the existing 4G operators choose not to exercise the right, then the concerned spectrum will be made available for re-allocation.

Such an approach is commonly adopted for advanced markets which are effectively competitive as there is inherent incentive on the part of the operators to ensure efficient utilisation of their existing spectrum to maintain competitiveness and maximize their return on investment. With certainty in the spectrum assignment, the 4G operators can also have greater flexibility in spectrum planning and legacy network migration. From the end users’ perspective, they can be assured of a stable environment for the continued provision/migration of services without unnecessary disruptions or inconvenience.

(iii) Common network infrastructure

Network sharing or common infrastructure inevitably involves multiple parties leading to technical, operational and commercial complexities. Conceptually, common network infrastructure can be advantageous towards managing the efficient use of spectrum. However, in practice, the complexities and costs involved far outweigh the benefits. This is especially so for existing services where networks were already designed using different cell grids and network planning assumptions. These designs/assumptions would have to be revised and there would be extensive optimization efforts needed for seamless inter-systems handover, substantial amount of time and efforts required for multi-vendor interoperability testing, and lengthy/protracted inter-operator commercial negotiations (e.g. ownership, operational and accountability issues, exit agreements etc).



This option will also involve major network migration, adjustments and thus, likely to cause progressive and extended service disruptions, impacting service quality. Furthermore, there is no sufficient temporary spectrum available to facilitate any network testing/optimization, prior to the migration exercise. IDA has earlier acknowledged the difficulties and limited scope associated with common infrastructure and decided against considering such a policy approach⁴.

- Annex A provides a comparative evaluation of the spectrum allocation options (Greenfield allocation and FROR) against the basic guiding principles set out in Para 5 of this paper.

IMPLICATIONS OF IDA’S PROPOSAL

Reservation of 2x20 MHz FDD spectrum creates an artificial supply constraint for existing 4G Operators to achieve optimal 4G deployment and to deliver the maximum potential and benefits of 4G services

- Operators will require at least 2x20 MHz contiguous FDD spectrum in 1800 MHz band and a further aggregation of 2x20 MHz FDD spectrum in 2.5 GHz band to support nationwide 4G rollout and to realize the maximum potential and benefits of 4G services with higher throughput rates.
- IDA’s proposal to set aside spectrum in the 2.5 GHz band for a possible new entrant creates an artificial supply constraint, leaving insufficient spectrum for existing 4G operators to deliver the maximum potential and benefits of LTE services.

Description	1800 MHz (FDD)	2.5 GHz (FDD)
Minimum bandwidth needed (per operator) to realize full potential of 4G	2x20 MHz	2x20 MHz
Total bandwidth assigned to existing 4G operators	2x70 MHz	2x60 MHz
IDA’s proposed bandwidth for existing 4G operators	2x70 MHz	2x40 MHz (2x20 MHz shortfall)
Spectrum set aside for new entrant	-	2x20 MHz

- Insufficient spectrum for existing 4G operators will lead to limited service deployment options and severely weaken the ability to meet high network service standards and hinder the growth and adoption of 4G services in the longer term. The proposed quantum of spectrum available in the 2.5 GHz band i.e. 2x40 MHz for existing 4G operators is only sufficient for two existing 4G operators. This may result in:-

- Existing operators with fragmented spectrum in 2.5 GHz band that are not ideal for supporting 4G; or
- An unequal playing field that disrupts the competition dynamics in the current highly competitive mobile broadband market. Without sufficient spectrum, the growth

⁴ IDA’s decision on policy approach to 3G infrastructure sharing in Singapore, 3 June 2002.



potential of one of the existing 4G operator would be “capped”. In some countries, operators are considering selling their network if 4G licence terms are not favourable⁵. This effectively reduces the level of competition in the market, which we believe is contrary to IDA’s policy intent in promoting effective and sustainable competition.

15. We would also emphasize that any delayed allocation of necessary spectrum for 4G deployment will only result in service quality issues to customers such as congestion, lower throughput speeds etc. and higher capital costs for existing operators. This is evident from the past reservation of 3G spectrum in Y2001 till the eventual but delayed allocation to the existing 3G operators in Y2010.
16. The fact is that nothing precluded a genuine new entrant from entering the mobile broadband market for the past 12 years or in the upcoming 4G auction. In accordance with the regulatory principles under the Telecoms Competition Code, IDA should not artificially pre-determine:-
 - Any technology that a new entrant may deploy for 4G services; or
 - Any perceived demand without clear evidence of a genuine new entrant (i.e. with firm commitment on nationwide deployment of 4G services).

Framework must not create any “arbitrage”

17. The framework, as currently drafted, creates possible “arbitrage” by independent 3rd parties who may possibly have no intention of achieving nationwide 4G deployment.
18. It is evident from the above that IDA’s proposed reservation of spectrum would create an artificial supply constraint for the existing 4G operators. An independent 3rd party may capitalize on the situation to acquire the reserved spectrum as a “new entrant”, but with the intent to resell the spectrum to existing 4G operators or wholesale the spectrum to existing 4G operators to achieve its nationwide deployment obligations. In the event of such a scenario, Singapore as a nation would gain no benefit whereas the independent 3rd party will be able to reap monetary gains through the transfer of investable resources to itself.

First rights of refusal necessary to facilitate seamless connectivity

19. It is of paramount importance to ensure continuity of services for customers and to minimize any unnecessary service disruption or inconvenience. IDA’s proposal of “greenfield allocation” would be inappropriate for the reallocation of existing spectrum rights in the 1800 MHz, 2.3 GHz and 2.5 GHz spectrum bands:
 - (a) Unnecessary spectrum churning and network adjustments will occur when existing 4G operators lose/swap out some or all of their existing frequency assignments. As network design and upgrades have always been evolutionary, extensive efforts will be required by the industry to address network integration and interdependency issues for

⁵ Cellular-news, “Hutchison could sell UK Network if 4G License Terms are Not Favorable”, 22 May 2012.



transition and connectivity due to spectrum churning. Lead time will be required for network migration and adjustments, which will inevitably lead to service disruption to some extent, impacting consumers and businesses using customized terminal equipment. Inbound roamers to Singapore will be similarly affected while network redeployment exercise is underway. Any service inconvenience will not reflect well on Singapore's image as an efficient and well-managed country.

- (b) It will be difficult to determine the timeframe required for completion of network migration and adjustments given the complexities involved with the system/technology interdependencies. However, it is clear that it will be a lengthy and complicated process, particularly relating to common telecommunications infrastructure in the Mass Rapid Transit ("MRT"), various road tunnels, as well as in-buildings sites, which are subjected to access approvals from the relevant authorities.
- (c) Majority of existing network equipment (e.g. base stations etc.) does not support multi-band operations. In the event that new spectrum assignments significantly differ from existing spectrum holdings, operators may end up with stranded assets and may have to retrofit existing common telecommunications infrastructure in the MRT/road tunnels and in-building sites. In view of the many constraints and limitations that operators face (e.g. access rights, limitations in space and facilities etc.), this exercise will be technically and operationally challenging, as well as costly.
- (d) "Greenfield allocation" is likely to lead to fragmented spectrum allocation and artificially inflate and distort the cost of spectrum. This will impact and/or hinder nationwide LTE rollout efforts and impose additional costs that are unnecessary in a market that is already operating efficiently. The market would suffer as limitations will impact user experience and additional costs trickle down to the end users.
- (e) Finally, it should be acknowledged that existing 4G operators are committed, long-term investors in Singapore's info-communications market. Significant capital expenditure has been put into network investments in reliance on the Licence together with existing Spectrum Rights and their continuity upon renewal following expiry. It would be unreasonable not to accord Licensees and its investors with basic measure of certainty on the renewals of both the Licence and Spectrum Rights. It is also manifestly inequitable to expect existing 4G operators to make further investments, without any form of certainty on the renewals of Licence and Spectrum Rights. This is particularly so for projects e.g. Thomson Line etc. which are expected to rollout after the expiry of the Licenses. In such instances, the existing 4G operators would not have due opportunity to recoup its investment in the projects if it has to cease operations due to loss of Spectrum Rights or are required to perform costly network adjustments, which can be clearly avoided through an offer of right of first refusal.



Allowable Use of Spectrum

20. IDA's proposal on allowable use of 4G spectrum is unnecessarily restrictive and does not take into account the technical/operational realities of mobile technology. In our view, it would be appropriate to adopt an evolutionary approach towards spectrum management, for harmonisation and interoperability of the networks.

- (a) The mobile industry is characterized by fast changing market dynamics and technological advancements. To limit the use of the spectrum for the provision of 4G services may potentially hinder future technology rollout.
- (b) 4G is the natural evolutionary progression from legacy 2G and 3G technologies, and there is a considerable degree of network integration and interdependencies. The systems are built and optimized to ensure seamless connectivity and inter-systems handover. In essence, the technologies on similar platform complement each other.
- (c) Furthermore, the 4G or Next Generation Mobile networks are likely to be heterogeneous for:-
 - Maximization of spectrum capacity;
 - Flexible, cost-effective management of scarce resources; and
 - Seamless integration with other technologies sharing similar platform.
- (d) 2G services are also expected to remain in commercial demand for the foreseeable future given that it is a long-term viable solution to support voice, enable roaming and support machine-to-machine communication systems. Despite the sophisticated and already mature 3G landscape in Singapore, there remains a 2G subscriber base of about 2 million. Hence, there is a genuine need for existing operators to retain their existing 2G networks and existing operators will need to set aside the prevailing spectrum to ensure continuous provision of 2G services.

The phasing out of 2G services is best left to the marketplace as the business drivers. There is no incentive for existing operators to slow the migration from 2G networks as it is technically challenging and costly to operate/maintain multiple networks. The operators are thus in the best position to manage the process to minimize the impact on the network and service inconvenience to customers.

21. In view of the above, we strongly recommend that IDA continues to adopt a technology neutral approach for use of the 4G spectrum, similar to its past spectrum decisions where grantee can use the acquired spectrum for technologies which share similar platform. This is also in line with international policies and best practices (e.g. UK, Hong Kong etc).



Proposed pricing structure

22. While spectrum prices need to be set at levels to promote economic and technical efficiency for the use of scarce spectrum resources, overpricing of spectrum will present a major disincentive for future investment in Singapore’s info-communications sector.
23. The pricing structure for previous 2G, 3G, and proposed 4G Licence cum Spectrum Rights is summarized as follows:-

Technology	One-time	Recurrent
2G	Administrative allocation	1% Annual Gross Turnover (Recurrent fee)
3G	Spectrum Price through Auction (Upfront fee)	-
4G	Spectrum Price through Auction (Upfront fee)	1% Annual Gross Turnover (Recurrent fee)

24. IDA’s proposed combination of 2G and 3G pricing structure imposes additional costs on the operators. IDA should ensure that the respective quantum be set at reasonable levels so as not to undermine the operators’ ability to invest in 4G network and services.
25. In addition, there are genuine concerns in relation to IDA’s proposed customised framework for a possible new entrant. We would emphasize that any pricing structure or regulation must be consistent, equitable and transparent irrespective of whether the interested party is a new entrant or an existing 4G operator.

Timeline for 4G Nationwide rollout

26. IDA must recognize that the operators do not have full control over 4G rollout for in-building and MRT/road tunnels as the provisioning of 4G coverage is dependent on multiple parties (i.e. the appointment of the service provider(s) and their proposed schedule, grant of approval for works and access from the relevant authorities etc.). Furthermore, in view of the complexities involved, current safety concerns and the constraints/limitations for installation works in operational tunnels, it may take several years to rollout 4G coverage in tunnels. Greater direct assistance and support from the IDA would be needed to tackle the challenges facing operators in 4G nationwide deployment. In light of the above, it is not possible for operators to commit to rollout timelines in MRT/tunnels as there is little control over access to these infrastructure.

Auction format

27. The mechanics of the auction may be adjusted or refined to address potential issues so as to attain efficient outcomes in a fair and transparent manner. For example, the possible limitation of “fragmented spectrum” or “unwanted subsets” for the Simultaneous Multiple Round Action (“SMRA”) can also be addressed by packaged bid or subsets. Our view is that it is far more important to ensure that the principles for auction rules/format are in line with those of an effective spectrum decision as set out above in Para 5 of this paper.



28. Specifically, the following principles would be important in the auction design:-

Key Principles	Rationale
Transparency	Transparency is clearly important to Bidders, both in respect of the identity of bidders as well as the amount of <u>all</u> bid submissions including <u>all intermediate</u> bids. Such information would influence bid submission, finance strategy, bidding strategy etc. and facilitate responses, which should improve the overall efficiency of the auction. The principle of transparency is also in line with international best practices.
Exclusion of non-serious Bidders to prevent predatory bidding	Non-serious bidders could take advantage of potential loop holes in the allocation framework to artificially inflate the cost of the spectrum or reap gains through an “arbitrage” situation.
Provide basic level of certainty to facilitate Bidder’s investment decisions/approval process	A basic level of structure and certainty is important in facilitating investment decisions or approval process. As such, pre-determined bid increment for respective auction rounds instead of free bidding would be more favourable.

CONCLUSION

29. The IDA should recognize the significant investments made by the existing operators to build out their networks and the importance of long-term certainty that the industry requires to provide a stable investment climate. At the same time, the timely availability of sufficient and suitable spectrum is a prerequisite towards realising the full benefits of 4G deployment in the Singapore market. In summary:-

- The IDA’s proposal present significant deployment issues that far outweigh the “perceived” benefits (if any). Granting first rights of refusal to existing 4G operators will be a better approach from a holistic perspective.
- There must be sufficient spectrum made available (i.e. 2x40 MHz per operator) to realise the full potential of 4G. The proposed reservation of 2x20 MHz FDD spectrum creates an artificial supply constraint for optimal 4G deployment.
- In line with international best practices, the allowable use of 4G spectrum should include other technologies sharing similar platform.

The IDA’s regulatory focus should be on the principles and policy objectives in the spectrum allocation, to guide its decision on the spectrum policy.