



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

**PROPOSED FRAMEWORK FOR THE REALLOCATION OF SPECTRUM IN THE
900 MHz and 1800 MHz FREQUENCY BANDS**

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- PART I: INTRODUCTION**
- PART II: ALLOWABLE USES FOR THE SPECTRUM**
- PART III: AVAILABLE SPECTRUM**
- PART IV: PROPOSED ALLOCATION FRAMEWORK**
- PART V: PROPOSED PRICING**
- PART VI: CONSULTATION ON 800 MHz BAND**
- PART VII: INVITATION TO COMMENT**

PART I: INTRODUCTION

Existing spectrum allocation

1 Spectrum in the 900 MHz and 1800 MHz frequency bands have been allocated for Public Cellular Mobile Telecommunication Services (PCMTS) in Singapore. The “900 MHz” band refers to the paired spectrum bands from 890 MHz to 915 MHz and 935 MHz to 960 MHz, while the “1800 MHz” band refers to the paired spectrum bands from 1710 MHz to 1785 MHz and 1805 MHz to 1880 MHz.

2 The 900 MHz band has been fully assigned to SingTel Mobile Pte Ltd (STM) and MobileOne Ltd (M1) and the 1800 MHz band has been partially assigned to STM, M1 and StarHub Mobile Pte Ltd (SHM) (collectively, “the 2G operators”) in their respective 2G Spectrum Rights. The 2G Spectrum Rights were granted on 1 October 2001 and 1 October 2002 for 7 and 6 year periods respectively, and will expire on 30 September 2008.

3 As described in their respective 2G Spectrum Rights, the 2G operators have rights of use for the following frequencies up to 30 September 2008.

2G Operator	900 MHz	1800 MHz
SHM	-	1739.5 MHz – 1759.7 MHz / 1834.5 MHz – 1854.7 MHz (Channels 659 – 759 inclusive)
STM	901.1 MHz – 914.9 MHz / 946.1 MHz – 959.9 MHz (Channels 56 – 124 inclusive)	1710.1 MHz – 1715.4 MHz / 1805.1 MHz – 1810.4 MHz (Channels 512 – 538 inclusive) 1720.5 MHz – 1730.5 MHz / 1815.5 MHz – 1825.5 MHz (Channels 564 – 613 inclusive)
M1	890.1 MHz – 900.9 MHz / 935.1 MHz – 945.9 MHz (Channels 1 – 54 inclusive)	1759.9 MHz – 1779.9 MHz / 1854.9 MHz – 1874.9 MHz (Channels 761 – 860 inclusive)

Expiry of 2G spectrum rights

4 The expiry of the 2G Spectrum Rights on 30 September 2008 will free up valuable spectrum in the 900 MHz and 1800 MHz frequency bands for reallocation. Existing 2G operators will have no residual rights to use the spectrum allocated to them upon the expiry of their Spectrum Rights.

5 IDA is proposing a framework for the reallocation of the 900 MHz and 1800 MHz for public consultation, considering IDA’s policy objective of ensuring the most efficient use of Singapore’s scarce spectrum resources to promote innovation in, and growth of a vibrant infocomm industry in Singapore. In proposing the framework, IDA is also cognisant of the need to ensure continuity of services that are being provided using those frequency bands.

PART II: ALLOWABLE USES FOR THE SPECTRUM

Technical uses for the spectrum

6 IDA understands that the 900 MHz and 1800 MHz frequency bands have other potential uses besides traditional 2G GSM services. The 900 MHz and 1800 MHz bands could also potentially be used for the provision of: -

- a. 3G services using IMT-2000 or other technologies. The International Telecommunications Union (ITU) has identified the 900 MHz and 1800 MHz bands for the deployment of 3G technologies. Internationally, operators in certain jurisdictions like Japan and the UK, as well as equipment vendors have also conducted trials on the provision of 3G services in these bands, especially using the 900 MHz band. France's telecommunications regulator, Autorite de Regulation des Communications Electroniques et des Postes, has also put out a fourth 3G licence in the 900 MHz band for tender.
- b. Wireless Broadband applications. IDA notes that some proprietary wireless broadband applications may also be deployed in these bands. Japan's Ministry of Information and Communications has indicated plans to use the 700 MHz and 900 MHz bands for new entrants, possibly to provide wireless broadband services. However, IDA also notes that the WiMAX Forum is not actively considering the use of the 900 MHz or the 1800MHz bands at the moment.
- c. Voice over IP (VoIP) or IP data services via low power GSM. The 1779.9-1785/1874.9-1880 MHz band can be used to deploy GSM picocell base stations to provide in-building or on-site coverage. In 2006, UK's Office of Communications (Ofcom) auctioned off spectrum for such low power operations. Most of the new licensees have also indicated their plan to use the spectrum for fixed mobile convergence (FMC) services.

Question 1

IDA invites views and comments on whether there are any other potential technologies and services that may be deployed in the 900 MHz and/or the 1800 MHz frequency bands in the near term (1 – 5 years), and whether there is demand for low power GSM in Singapore.

Allowable use for the spectrum

7 IDA considered various options to determine the permissible uses for the spectrum. Firstly, IDA considered the approach of spectrum liberalisation, where operators are allowed to deploy any technology and/or provide any type of service using the spectrum, subject to interference coordination and international obligations.

8 The spectrum liberalisation approach is conceptually elegant, allowing the market to drive operators to maximise the value of the spectrum obtained, thus optimising allocation efficiency of the scarce resource. However, IDA is cognisant of its limitations. Firstly, because spectrum is a scarce national resource, it should be

used to fulfil the needs and policy objectives for Singapore. Secondly, it is important for IDA to ensure that the spectrum management plan in Singapore is technically harmonised with that of other key jurisdictions. For example, in-bound roamers whose cellular mobile phones operate in the 900 MHz or 1800 MHz bands might require similar services when visiting Singapore. IDA is also not aware of any jurisdiction that has implemented the spectrum liberalisation approach in full.

9 IDA is of the view that it is important to ensure the continued provision of nationwide mobile telephone services to both businesses and consumers, including inbound roamers. Thus IDA proposes that operators using the 900 MHz and 1800 MHz spectrum should be required to provide PCMTS to the public.

10 However, IDA proposes not to restrict the technologies used to existing 2G technologies, bearing in mind the potential deployment of other technologies capable of providing PCMTS. IDA is of the view that 2G or 3G technologies and other technologies which share a similar platform and allow higher speed data services, such as GPRS, EDGE or HSDPA/HSUPA/HSPA, can be deployed in the frequency bands, as long as the spectrum is used for the provision of PCMTS. IDA notes that separate 3G Spectrum Rights and licences have been issued in 2001 for the provision of 3G services. Nonetheless, bearing in mind technology trends and international developments, IDA considers that allowing 3G in these bands will further enable Singapore to unleash the possibilities of higher speed data services and more innovative mobile applications. In addition, if more mobile subscribers move to 3G and 3G traffic becomes more data-centric, there may be a need for more spectrum for 3G services in future.

11 Further, IDA is aware that there may be other technologies, existing or future, that may not be classified as 2G or 3G technologies or their evolved versions, but yet are capable of providing PCMTS. Should operators wish to deploy these technologies in the frequency bands, IDA will assess such requests on a case-by-case basis, taking into account issues such as the technical interference between these technologies and technologies deployed in the neighbouring frequency bands.

12 While IDA considered that the spectrum could potentially also be used solely for the provision of wireless broadband services, IDA is of the view that there is no need to do so given that spectrum in the 2.3 GHz and 2.5 GHz bands has already been allocated for the provision of wireless broadband access services. Nonetheless, IDA proposes to allow operators to use the spectrum to provide other data services, including wireless broadband access, as long as they have met the requirement to provide PCMTS.

Question 2

IDA invites views and comments on the proposal to allow the 900 MHz and 1800 MHz frequency bands to be used for the provision of nationwide PCMTS using 2G or 3G technologies and other technologies which share a similar platform and allow higher speed data services, such as GPRS, EDGE or HSDPA/HSUPA/HSPA, and whether IDA should allow other services or technologies to be deployed, and the implications of doing so.

IDA also invites views on the traffic patterns for 3G services going forward, eg. whether traffic is likely to be more data-centric in future. Based on these projections, would the 3G spectrum rights issued in 2001 be sufficient? If not, when would there be a need for additional spectrum for 3G services?

PART III: AVAILABLE SPECTRUM

5 MHz lots

13 With the proposal to allow the deployment of 2G and 3G technologies in the frequency bands, IDA is of the view that the spectrum may be reallocated based on paired 5 MHz spectrum lots. IDA assesses that 5 MHz lots would be suitable to provide higher channel bandwidths, which will be necessary for the provision of 3G services.

Question 3

IDA seeks views and comments on whether the spectrum should be allocated in lots of paired 5 MHz spectrum per lot.

Spectrum to be made available

14 With the expiry of the existing 2G Spectrum Rights, together with spectrum in the 1800 MHz band that is currently unused, there will be 20 lots of spectrum that can potentially be issued, with 5 lots in the 900 MHz frequency band and 15 lots in the 1800 MHz frequency band. In addition to spectrum in the 900 MHz and 1800 MHz frequency bands, some spectrum in the 880MHz to 890MHz and 925MHz to 935MHz band (the Extended GSM or “EGSM” band) is also unused today. A portion of the EGSM band has been assigned and is currently in use.

15 Spectrum is a scarce and limited resource and a balance has to be struck between making spectrum available to the industry for the provision of services, and reserving sufficient spectrum for IDA to respond to new spectrum demand in the future. In order to determine the total number of lots of spectrum to be made available for allocation, IDA seeks feedback on the potential demand for the spectrum in the near term.

16 IDA considered that under the existing 2G Spectrum Rights, all 5 lots of spectrum in the 900 MHz frequency band and 11 lots of spectrum in the 1800 MHz frequency band have been allocated to the 2G operators. The existing 2G operators also have 3G licences and Spectrum Rights to 2 x 15 MHz of spectrum and an unpaired 5 MHz band in the 1900 MHz frequency band for the provision of 3G services. IDA has also not received firm requests by other operators for additional spectrum in the 1800 MHz frequency band or for spectrum in the 1900 MHz frequency band for the provision of PCMTS.

17 IDA’s preliminary proposal is to make available all 5 lots of spectrum in the 900 MHz frequency band, as well as 12 lots of spectrum in the 1800 MHz band for allocation. The proposed available spectrum will be more than the spectrum allocated to existing 2G operators, and will allow IDA to reserve 3 lots of spectrum in the 1800 MHz band, in addition to spectrum in the EGSM band, to meet future demand as well as other requirements such as research and development, equipment testing, etc. In IDA’s view, the spectrum held in reserve will be sufficient for an operator to enter the market in future, to provide PCMTS using 2G or 3G technologies. The reserved spectrum will also provide IDA with the flexibility to respond to industry trends, if new and innovative technologies are made available for these spectrum bands.

Question 4

IDA invites views and comments on the potential demand for spectrum in the 900 MHz and 1800 MHz frequency bands in the next 7 years. In particular, IDA seeks views on:

- (i) the amount of spectrum that existing 2G operators would require for continuity of 2G services or other value-added services;*
- (ii) whether existing 3G operators would require spectrum in these bands for 3G expansion or other value-added services, and if so, the amount of spectrum likely required; and*
- (iii) whether there is potential for new players to enter the market by obtaining spectrum in these bands, and if so, the minimum amount of spectrum required by a new entrant.*

For each of the responses in this question, please provide IDA with the assumptions made to calculate the amount of spectrum.

Guard bands

18 Between different operators' spectrum bands, a 200kHz channel is required as a guard band to ensure that operators' 2G networks do not interfere with one other. However, where operators deploy 3G or other services or technologies, the size of the guard band required to co-exist with the 2G networks may be larger. For the new spectrum allocations, IDA considered several options to provision for the guard band. The first option would be to require the operator that obtains every alternate spectrum lot (e.g., every even lot) to provide the guard band, if the adjacent bands are occupied by another operator. Such an arrangement would allow operators to value the frequency band accordingly, but might require some operators to give up significantly more channels than others. The second option would be to require operators to provide a guard band based on a certain principle, after the new allocations are known. For example, operators could be required to provide a guard band on the left of every contiguous spectrum band they have obtained. IDA's prefers the second option as a fairer arrangement for the provision of guard bands.

Question 5

IDA seeks views and comments on the minimum size of the guard band required in cases where 2G networks co-exist with 3G networks and/or other services or technologies such as WiMax, in order to ensure minimal risk of interference among networks. IDA also seeks views and comments on the proposed arrangement for the provision of guard bands.

PART IV: PROPOSED ALLOCATION FRAMEWORK

'Greenfield' allocation

19 The proposed allocation framework considers IDA's policy objective of ensuring economically efficient use of the scarce spectrum resource as well as the need to ensure service continuity for end users.

20 IDA is aware that unlike the allocation of new unused spectrum bands, the allocation exercise for the 900 MHz and 1800 MHz frequency bands will have an added consideration of ensuring that existing end user services are not unduly disrupted, since some of the spectrum is being used for the provision of services today.

21 IDA therefore considered whether existing 2G operators should be granted a preference in the allocation exercise, bearing in mind the above objectives. Internationally, IDA notes that regulators in some jurisdictions accord incumbent operators some form of preference when reallocating spectrum in certain bands. For example, incumbent GSM and Public Cellular Mobile operators in Hong Kong were given the first right of refusal when their licences expired in 2005/2006. In New Zealand, subject to case-by-case assessment, replacement rights will be offered to existing commercial spectrum rights holders five years before expiry, at a price calculated using a price-setting formula. IDA considered whether a similar or hybrid approach should be implemented to accord existing 2G operators the first right of refusal to some spectrum reserved for each operator, meaning that operators would not have to contest with other market players for the reserved spectrum.

22 The option of granting existing 2G operators the first right of refusal to some reserved spectrum would provide greater assurance and certainty to the existing operators, and mitigate the risks of disruption to existing end user services. Nevertheless, IDA is of the view the option should not be pursued for the following reasons:

- a. *Opportunity for interested buyers to procure a scarce resource* – Spectrum is a scarce resource with an inherent economic value. Existing 2G operators have benefited from the value of the Spectrum Rights for the duration of the rights. New entrants, or existing 2G operators that have interest in a spectrum band currently not allocated to them, should be given the opportunity to procure the right to use that spectrum and reap the associated benefits;
- b. *Avoid perpetuating legacy imbalances* – The distribution of spectrum in each of the existing 2G Spectrum Rights is different, with each operator having rights to different amounts and different bands of spectrum. Such differences were maintained for the duration of the Spectrum Rights. Any further preference accorded to each operator, based on its historical allocation, may perpetuate legacy imbalances and distortions beyond the duration of the Spectrum Rights. For example, STM and M1 have existing rights to use spectrum in the 900 MHz frequency band, but not SHM. If the first right of refusal were granted to each operator to reserve some spectrum currently in use by them, SHM would not be accorded the same preference as the other two operators;

- c. *Ensure most efficient use of spectrum* – Reallocating the spectrum based on market demands rather than historical allocations will ensure that operators acquire as much spectrum as necessary based on their commercial considerations, at the market value of the spectrum, thereby providing the economic incentives for operators to optimise usage of the spectrum;
- d. *Part of normal business risks* – The expiry of the Spectrum Rights without any residual right to the spectrum has been made known to the operators since the Spectrum Rights were issued. The business risks that existing 2G operators have to bear by having to acquire spectrum in the allocation exercise rather than through a preference given by IDA is part of the normal business risks of the operator. Nonetheless, IDA expects operators to ensure that they would be able to provide service continuity to existing customers.

23 IDA is thus proposing that the spectrum be allocated as a ‘greenfield’ with no reservation of spectrum for existing 2G operators. In a ‘greenfield’ allocation, there is a possibility that existing 2G operators may not obtain the same frequency bands, or the same amount of spectrum as what they have today. They might in turn need to adjust their networks according to their new spectrum allocation. Nevertheless, IDA views the resultant impact of a ‘greenfield’ allocation as part of the risks that operators will have to bear in their operations, similar to the business risks associated with leasing or acquiring other input products or as a result of market competition or change in market environment. A ‘greenfield’ allocation would be more effective in ensuring that the spectrum is used efficiently, for the long term benefit of the market.

Question 6

IDA seeks views and comments on the pros and cons for both new entrants and existing rights holders of a ‘greenfield’ allocation of the spectrum. IDA also seeks comments on how the concerns set out in paragraphs 22(a), (b) and (c) can be adequately addressed if a ‘greenfield’ allocation of spectrum approach is not pursued.

24 In a ‘greenfield’ allocation, IDA notes that, depending on the demand of each frequency band, existing 2G operators might not obtain the same frequency bands as their existing spectrum rights. Depending on the frequency bands that each existing 2G operator finally obtains, some network adjustment might be needed.

Question 7

IDA seeks operators’ feedback on the implications of such network adjustment, and how IDA can mitigate such network adjustment and minimise disruption to end users, bearing in mind IDA’s policy objective of ensuring efficient use of the spectrum. In particular, IDA seeks operators’ feedback on the timeframe and processes of cutting over from the operators’ existing frequency bands to its new frequency bands, whether additional temporary use frequencies are required for such cut over, and if so, the minimum amount of temporary use spectrum required.

Allocation by specific frequency bands

25 While all frequency bands in the 900 MHz and 1800 MHz spectrum band may be used to provide mobile services, IDA notes that operators' may prefer particular frequency bands depending on various factors, like their existing network configuration. This means that the value of each frequency band might differ, even though the potential use of each band is similar.

26 To cater to such differentiation, IDA is of the view that operators should be allowed to indicate their interest of specific 5 MHz lots, instead of anonymous lots. Bearing in mind that operators may wish to obtain alternative spectrum lots if they are unable to acquire their preferred lots, IDA will proceed with an auction for all spectrum lots in both the 900 MHz and 1800 MHz bands if more than one operator wishes to acquire any spectrum lot in either the 900 MHz or the 1800 MHz bands.

Question 8

IDA seeks views and comments on whether operators should be allowed to indicate interest for specific spectrum lots, as opposed to anonymous spectrum lots.

Duration of spectrum right

27 IDA is proposing a 7 year duration for the new spectrum right upon expiry of the existing spectrum rights. The 7 year duration is similar to the duration of the existing 2G spectrum rights. While IDA notes that longer spectrum rights would provide more investment certainty for operators, and also that other spectrum rights like those for the 2.3 GHz and 2.5 GHz bands have been issued for longer durations, it is also necessary for IDA to retain flexibility to re-farm the spectrum for new innovations and technologies that might be introduced in these frequency bands. Furthermore, given that 2G and 3G are existing technologies with more predictable market characteristics, a 7 year duration should be sufficient to provide operators with the investment certainty required.

Question 9

IDA seeks views and comments on whether a 7 year duration for the new spectrum rights is reasonable.

Need for FBO licence

28 Operators that successfully obtain any new spectrum right should apply for an FBO licence for the provision of PCMTS (if they do not already have one). For clarity, such operators will be subject to the same specific licence conditions for the provision of PCMTS as other licensed providers of PCMTS, such as the obligation to provide coverage for the whole island of Singapore (including MRT underground stations/lines and road tunnels), the offshore islands and the territorial waters up to 15km from the coast line of the island of Singapore.

29 As explained at paragraph 10, IDA is of the view that operators should be allowed to deploy 3G technologies using the new spectrum rights to be issued in the 900 MHz and 1800 MHz spectrum bands for the provision of PCMTS. 3G Licensees will have to seek IDA's approval to amend their existing 3G FBO Licences and Radio-Communications Network Licences before providing 3G services using the new spectrum rights.

PART V: PROPOSED PRICING

Fees for allocation and use of new spectrum rights

30 In allocating the new spectrum rights, IDA will require operators to pay a spectrum management fee for the issue of the new spectrum rights, as well as an FBO licence fee for the provision of telecommunication services using the new spectrum. In addition, if IDA conducts an auction to allocate the new spectrum rights additional fees determined by the auction will be paid to IDA as a one time upfront charge. These fees are elaborated below.

31 For the existing 2G spectrum rights, IDA imposed an annual recurrent spectrum management fee starting with S\$120,000 per spectrum lot, with a compounded 2.5% increment per year to account for inflation. This works out to S\$139,163.21 per spectrum lot for the final year of the spectrum right beginning in September 2007. For the new spectrum rights to be issued, IDA proposes to impose a recurrent spectrum management fee of S\$140,000 per spectrum lot per year, without a compounding increment.

32 As mentioned at paragraph 26, operators will be asked to indicate their interest for specific spectrum lots. If demand for any spectrum lot exceeds supply, *i.e.*, where more than one operator wishes to acquire a particular spectrum lot, IDA will proceed with an auction for every spectrum lot in the 900 MHz and 1800 MHz frequency bands. If an auction proceeds, additional fees determined by the auction will be paid to IDA as a one-time upfront charge. For clarity, these additional fees payable because of the auction are over and above the annual spectrum management fee of S\$140,000 per spectrum lot, operators' FBO licence fees and any other licence or administrative fees that may be payable.

33 Revenue generated from services provided using the new spectrum rights to be issued in the 900 MHz and 1800 MHz spectrum bands will be subject to FBO licence fee payments of 1% of the Annual Gross Turnover (AGTO).

34 The fees stated in paragraphs 31 to 33 above will similarly apply where the new 900 MHz and 1800 MHz spectrum rights are used to provide 3G services.

35 In this respect, IDA is aware that 3G Licensees are not required to pay any fee¹ under their existing 3G FBO Licence using their existing 1900 MHz 3G Spectrum Rights allocated on 23 April 2001. Therefore, in order to implement the different licence fee structures for the provision of 3G services depending on which spectrum bands are utilised, one option would be for IDA to account for 3G revenues using network usage as a proxy, for example the ratio of 3G traffic carried on the 900 MHz and 1800 MHz spectrum bands as compared to the amount carried on the 1900 MHz spectrum band in the 3G spectrum right.

Question 10

IDA seeks views and comments on the proposed fee structure for successful bidders of the new 900 MHz and 1800 MHz spectrum rights.

¹ Other than a one-time upfront fee of S\$100 million per operator for their 3G Licence and spectrum rights in the 1900 MHz Band.

Question 11

IDA seeks views and comments on the proposed approach, and suggestions on alternative approaches, to differentiate services provided over the existing 3G spectrum rights from those provided over other spectrum bands like the 900 MHz or 1800 MHz bands for the purposes of licence fee collection.

PART VI: CONSULTATION ON 800 MHz BAND

Use of 800 MHz band

36 Besides the 900 MHz and 1800 MHz spectrum bands, and the spectrum bands assigned for 3G spectrum rights, there are other spectrum bands designated for PCMTS in IDA's Radio Spectrum Masterplan such as the 800 MHz spectrum band (824 MHz – 842.5 MHz paired with 869 MHz – 887.5 MHz). While IDA is not proposing to include the 800 MHz spectrum in the current allocation exercise, IDA will review the potential uses for the 800 MHz spectrum band, as well as the allocation framework if there is interest in the band.

Question 12

IDA seeks views and comments on the potential uses of the 800 MHz spectrum band, whether there is industry interest in the band and the potential for new entrants obtaining spectrum in the band.

PART VII: INVITATION TO COMMENT

35 IDA would like to seek the views and comments from the industry and members of the public on whether the proposed framework for reallocation of spectrum in the 900 MHz and 1800 MHz suitably meets the policy objective and addresses the concerns raised in this consultation. IDA would also like to seek views and comments on the use of the 800 MHz band. This will allow IDA to have a better understanding of the issues and the different needs and requirements of various interested parties.

36 All views and comments should be submitted in writing and in both hard and soft copies (Microsoft Word Format), and should reach IDA by **12 noon, 27 July 2007**. Respondents are required to include their personal or company particulars, correspondence address, contact number and email address in their submissions. IDA will make all or parts of any submissions made in response to this consultation paper public and disclose the identity of the source. Any part of the submission which is considered commercially sensitive must be clearly marked and placed as an annex to the comments raised. IDA will take this into account in its review. All comments should be addressed to:

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