



**INFO-COMMUNICATIONS DEVELOPMENT AUTHORITY OF
SINGAPORE**

INFORMATION PAPER:

**SHORT-TERM ASSIGNMENT OF UNASSIGNED SPECTRUM IN THE
2.3 GHz AND 2.5 GHz TDD SPECTRUM BANDS**

23 JANUARY 2015

Important Notice

This Information Paper is for informational purposes only and should be read together with the Radio Spectrum Master Plan and the Singapore Spectrum Management Handbook. The Radio Spectrum Master Plan serves to inform the industry and interested parties on the availability of spectrum in the coming years, the technological trends in the use of spectrum and IDA's policy direction with regard to spectrum allocation and re-allocation for public communications networks. The Singapore Spectrum Management Handbook serves to provide information on Spectrum Management activities, assignment policies and the application procedures for the various radio-communication services including mobile, fixed, satellite, short-range devices and broadcasting services.

All information contained in this Information Paper may be updated or amended at any time.

INTRODUCTION: 2.3 GHZ AND 2.5 GHZ SPECTRUM BANDS

1 The 2.3 GHz spectrum band refers to the spectrum band from 2300 MHz to 2400 MHz while the 2.5 GHz spectrum band (also known as the “2.6 GHz spectrum band” in Europe) refers to the spectrum band from 2500 MHz to 2690 MHz.

2 Within the 2.5 GHz spectrum band, the 2570 MHz to 2620 MHz band is typically used for Time Division Duplex (“**TDD**”) technologies based on the ECC/DEC/(05)05 Decision. The 2.3 GHz spectrum band can be used for TDD technologies. However, as the 2.3 GHz band has been currently coordinated with neighbouring jurisdictions on a sharing basis, only part of the band is available for priority access by Singapore operators. Collectively, the 2300 MHz to 2400 MHz and 2570 MHz to 2620 MHz bands will be termed the “**TDD Bands**” for the purposes of this Information Paper.

3 This Information Paper seeks to provide clarity in IDA’s framework for short-term assignment of the TDD Bands that are unassigned.

Use and assignment of spectrum bands

4 The TDD bands had been earmarked at previous World Radiocommunications Conferences (“**WRC**”) for the implementation of the International Mobile Telecommunications (“**IMT**”) standard. In 2005, IDA auctioned some spectrum in both bands for the provision of Wireless Broadband Access (“**WBA**”) services in spectrum rights expiring on 30 June 2015.

5 In its Interim Decision on the Spectrum Framework for 4G Mobile Communications in Singapore issued on 24 January 2011 (“**4G Interim Decision**”), IDA clarified that the WBA Spectrum Rights can be used to deploy 4G systems and services based on technologies like WiMAX or LTE, or their advanced versions, as long as the spectrum continued to be used for any part of a WBA network that provides publicly available WBA telecom service to end-users.

6 IDA also clarified in its Decision on the Framework for Reallocation of Spectrum for 4G Telecommunication Systems and Services issued on 16 January 2013 (“**4G Decision**”) that IDA had obtained in-principle agreement with our neighbouring countries on the full-band sharing arrangement for the 2.5 GHz Frequency Division Duplex (“**FDD**”) band. The 2.5 GHz FDD band full-band sharing arrangement has since commenced.

Available TDD spectrum for short-term assignment

7 In the 4G Decision, IDA decided to reserve spectrum in the TDD Bands and delink their allocation from the 4G auction in view of low market interest reflected in the responses to the public consultation for the 4G auction then. IDA stated that it would continue to monitor market interest and technology development, and allocate the TDD Bands when there was greater market interest in commercial deployment using these bands. Notwithstanding the 4G Decision, IDA notes that there may be industry interest in using the TDD Bands to test technologies such as TD-LTE or

other TDD technologies to determine their suitability for commercial deployment in the longer term.

8 A part of the TDD Bands, in particular the 2570 MHz to 2600 MHz band, is currently assigned by way of Wireless Broadband Access (“**WBA**”) Spectrum Rights which will expire on 30 June 2015. Of the remaining TDD Bands, 5 MHz of spectrum in the 2.5 GHz band is needed as guard band between the FDD and TDD networks, while 2335 MHz to 2400 MHz are constrained frequencies. The constrained frequencies in the 2.3 GHz band will not be available for assignment due to potential interference with other networks currently deployed in Singapore. This means that of the TDD Bands, only the 2600 MHz to 2615 MHz band and the 2300 MHz to 2335 MHz band are currently not assigned by way of a WBA Spectrum Right, while spectrum in the 2570 MHz to 2600 MHz will become available from 1 July 2015 (“**Unassigned Spectrum**”).

Heterogeneous Network (“HetNet”) Trials

9 IDA has received interests from the industry to use the TDD bands for technical trials for deploying HetNet in Singapore and/or to gauge the commercial feasibility of launching TD-LTE services in Singapore. The TDD bands may be used to deploy small cells to create a HetNet. The TDD bands have characteristics that are suitable for dense small cell networks that can provide consumers with greater service coverage and capacity. At the same time, the flexible downlink /uplink ratio (e.g. 2:1) of TD-LTE may provide more downlink capacity which may better support the increasingly data intensive usage patterns of mobile service users. Further, interference issues inherent in overlapping cells (and in a HetNet) may be mitigated by the introduction of enhanced Inter-cell Interference Coordination (“**eICIC**”) and Coordinated Multi-Point features (“**CoMP**”) for LTE¹. These developments pave the way for possible deployment of HetNet using a combination of Frequency Division Duplex (“**FDD**”) macro and TDD small cells².

10 In the Public Consultation on Proposed Allocation of Spectrum for IMT and IMT-Advanced Services and Options to Enhance Mobile Competition issued on 22 April 2014 (“**Public Consultation**”), IDA sought views on the implication of the TDD bands on a half-band or full-band sharing basis with neighbouring jurisdictions. Given that most respondents have indicated their preference for the TDD bands on full-band sharing basis, IDA will continue to work towards the full-band sharing principles agreed with neighbouring jurisdictions and facilitate trials using the TDD bands to study impact on co-existence.

11 In view of the industry’s interest in conducting technical and market trials using the TDD bands as part of the development of HetNet, in particular for the deployment of TD-LTE and on a full band sharing basis, IDA will make available, in the short-term, the Unassigned Spectrum in the 2.5 GHz band for trial on a full-band

¹ 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.

² To enable HetNet using TDD, the small cells might be deployed in clusters, isolated from one another, so that the uplink/downlink frame structure can be adjusted dynamically based on the local traffic demand.

sharing basis with neighbouring jurisdictions, and the Unassigned Spectrum in the 2.3 GHz band for trial on a half-band sharing basis, before allocating the spectrum on a long-term basis through the issuance of spectrum rights.

SHORT-TERM ALLOCATION OF SPECTRUM IN TDD BANDS

Unassigned Spectrum

12 Existing frameworks applicable to the short-term allocation of the Unassigned Spectrum in the 2.3 GHz and 2.5 GHz TDD Bands include IDA's frameworks for Technical Trial ("TT"), Market Trial ("MT"), and the Temporary or Occasional Use of Radio Frequencies³.

13 Broadly, TTs may be conducted for the purpose of equipment testing and R&D for any telecommunication service, while MTs may be conducted to assess the commercial potential of a new technology, service or product that is not commercially deployed or offered in Singapore. As such, TTs must be non-commercial, i.e., trial participants shall not be charged for any service or equipment made available to them during the trial, and where it requires the allocation of frequency spectrum by IDA on an ad-hoc temporary basis, the TT shall not last more than 90 days. On the other hand, under the MT framework, operators may commercially charge participants for trial services and each MT licence shall be valid for a period of 6 months from the date of issue. TTs are also limited to localised testing, subject to IDA's approval.

14 IDA had previously indicated that the duration of any trial or temporary use of the Unassigned Spectrum shall not extend beyond 30 June 2015 so as to coincide with the expiry of the existing WBA Spectrum Right. Nonetheless, IDA recognises that the HetNet trials may require a period of six to nine months in order to attain meaningful results. Therefore, IDA will allow the TT and MT frameworks to be extended until 30 September 2015 or the day before the Spectrum Right starts, whichever is later.

15 In addition to the conditions for MTs, TTs, or temporary use prescribed under the respective frameworks, IDA will also impose the following conditions on successful applications in addition to the conditions already applicable under the respective frameworks:

- a) The successful applicant will be required to take measures to prevent interference, including but not limited to setting aside appropriate guard bands in respect of all authorised networks of IDA. IDA will also require the successful applicant to ensure that their deployments are coordinated with authorised networks deployed at the border areas of neighbouring jurisdiction;

³ The frameworks can be accessed at: <http://www.ida.gov.sg/Policies-and-Regulations/Industry-and-Licencees/Licensing/Framework-and-Guidelines/Guidelines-on-Licensing-Schemes>

- b) Where required by IDA, the successful applicant shall cease its operations and usage of the allocated Unassigned Spectrum during national events;
- c) Trial participants and/or end-users of the service being offered by the applicant using the allocated Unassigned Spectrum must be informed at the point of participation of the temporary nature of the service and all the risks and limitations of subscribing to the service such as the limited service period and possible service discontinuation; and
- d) Successful applicants may be required to submit information on the trial or temporary use in order to ascertain its benefits.

16 Interested parties may apply under the relevant frameworks for the Unassigned Spectrum, which application shall be subject to IDA's approval. For the avoidance of doubt, IDA reserves all of its rights, including, without limitation, the right to determine whether to administratively assign any frequency from the Unassigned Spectrum at its sole discretion. In assessing any application, IDA may consider the likely competing demand for short-term assignment of the Unassigned Spectrum to determine the amount of spectrum to be assigned, if IDA decides to grant the application.

17 Finally, in relation to the constrained frequencies in the 2335 MHz to 2400 MHz band, they will not be available for assignment due to potential interference with other networks currently deployed in Singapore. However, if there is interest in using these frequencies for commercial use by way of IDA's "Framework for Assignment of Frequencies on Non-Interference and Unprotected Basis" or by way of MT licences in the short term, IDA will consider these applications only if applicants can demonstrate the use of the spectrum will not interfere with other existing users.

WBA Spectrum Right expiring on 30 June 2015

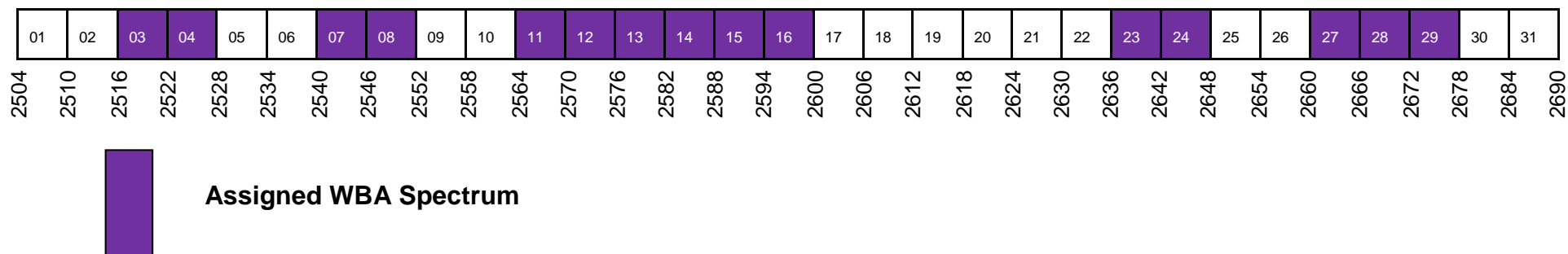
18 Radio spectrum from 2570 MHz to 2600 MHz in the 2.5 GHz TDD band currently assigned by way of the WBA Spectrum Rights will expire on 30 June 2015. There may be a time gap between the expiration of the existing WBA Spectrum Right and the next long-term allocation of spectrum in the TDD bands. During this period, spectrum may not be utilised.

19 In the same interest of allowing efficient use of spectrum and facilitating TDD trials on a full-band sharing basis, IDA will allow the existing Spectrum Right holder to apply for short-term use of its spectrum until the start of the new spectrum right to be assigned for the 2.5 GHz TDD band, subject to similar conditions and considerations as set out in paragraphs 15 and 16 of this Information Paper.

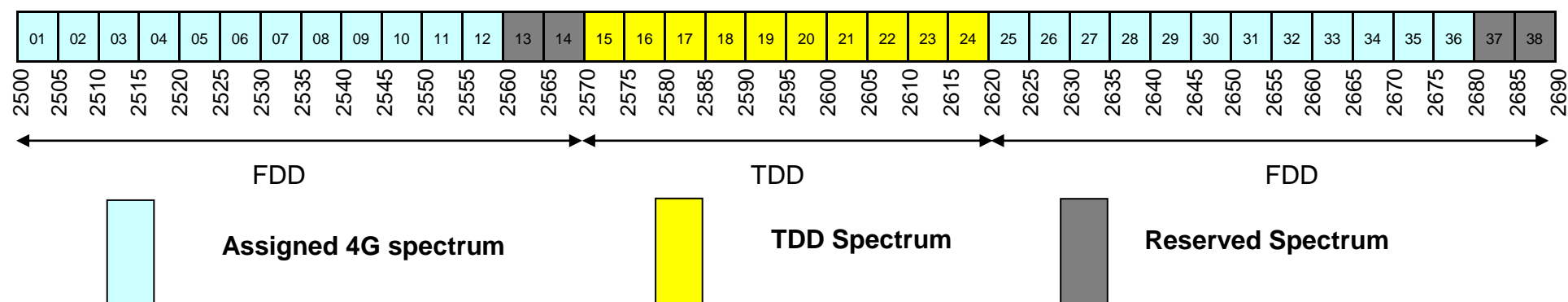
CONCLUSION

20 IDA will allow the TDD bands to be used for trials and on a short-term basis with immediate effect. For further clarifications on this, please direct your written queries to Li_Juelei@ida.gov.sg.

CURRENT CHANNELLING PLAN FOR THE 2.5GHz BAND BEFORE 2015



NEW CHANNELLING PLAN FOR THE 2.5GHz BAND AFTER 2015



SHORT-TERM ASSIGNMENT OF UNASSIGNED SPECTRUM IN THE 2.3 GHz AND 2.5 GHz TDD SPECTRUM BANDS

2.3 GHz Band



2.5 GHz Band

