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

PROPOSED REGULATORY FRAMEWORK AND STANDARDS FOR INTELLIGENT TRANSPORT SYSTEMS ("ITS") IN THE 5.9 GHZ (5.875 – 5.925 GHZ) FREQUENCY BAND

21 December 2015

PART I: INTRODUCTION

1 Intelligent Transport Systems ("ITS") consist of a range of diverse technologies designed primarily to improve road safety, ease traffic congestion and reduce pollution. The technologies rely on wireless communications such as Dedicated Short Range Communications ("DSRC") in enabling the transmission of information between vehicles and road infrastructure, and among vehicles. DSRC in the 5.9 GHz band will be an enabler for future ITS developments and deployments in Singapore which include Road Pricing System, Smart Electronic Parking Management, Vehicle-to-Vehicle communications, Autonomous Vehicles ("AV"), Intelligent Fleet Management Systems and Road Juncture Safety System. Considering the above, there are significant benefits for Singapore to open up the 5.9 GHz band for ITS applications, in particular, the 5.875 – 5.925 GHz band.

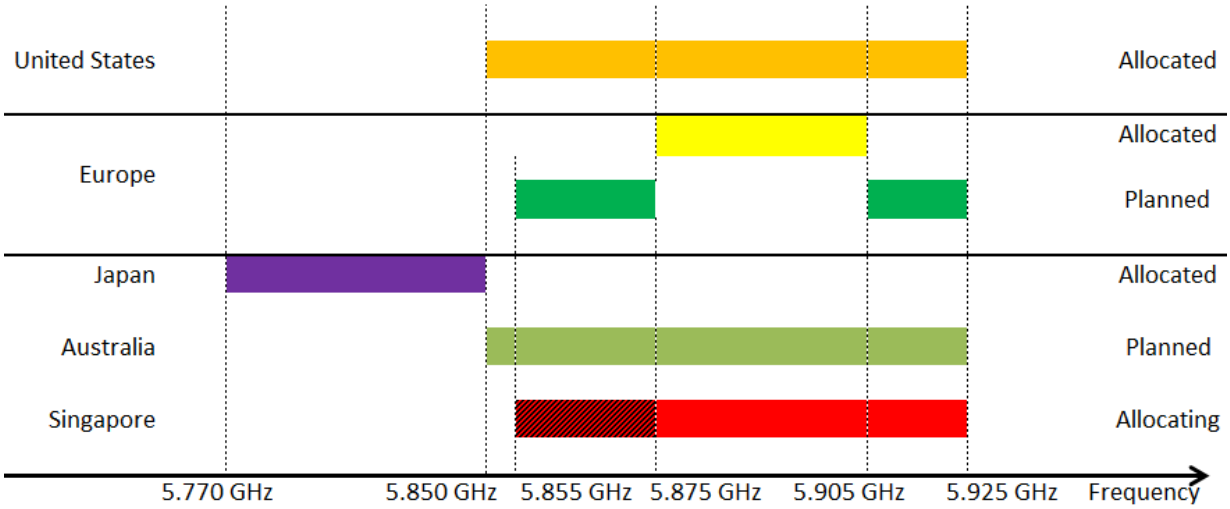
2 Part II and Part III of this paper will focus on consultation of the proposed spectrum allocation, emission limits and regulatory framework for ITS in the 5.875 – 5.925 GHz band. Part IV of this paper will seek public comments on the proposed 5.9 GHz DSRC standards for ITS.

PART II: ITS ALLOCATION IN THE 5.9 GHZ FREQUENCY BAND

3 Globally, the 5.9 GHz band has already been identified for ITS usage. In Europe, the 5.875 - 5.905 GHz band range has been harmonised for ITS road safety applications; while the upper frequency band 5.905 - 5.925 GHz is being considered for future extension of ITS applications.

4 In the United States, the Federal Communications Commission ("FCC") has adopted the recommendation to establish licensing and service rules for 5.850 - 5.925 GHz DSRC services designed for automotive use. The FCC regulation also requires safety-of-life and public-safety related communications to receive priority access over all other DSRC communications within the 5.850 - 5.925 GHz band. In Australia, the Australian Communications and Media Authority ("ACMA") has issued an embargo which prevents the assignment of any new services in the portion of the 5.850 – 5.925 GHz band reserved for future use by ITS. **Figure 1** below illustrates the spectrum bands allocated by various countries around the 5.9 GHz band for ITS applications.

Figure 1: Spectrum bands allocated by various countries for ITS applications



5 In Singapore, the 5.875 – 5.925 GHz band has been identified as the 5.9 GHz spectrum band for use by ITS. In recent years, IDA has also been receiving feedback from the industry indicating interest in bringing ITS commercial equipment that operates in the 5.875 – 5.925 GHz band into Singapore. For the opening of the identified 5.9 GHz spectrum for ITS applications, IDA has considered the existing radio services within and adjacent to the 5.875 – 5.925 GHz band. These include radiolocation services and Short Range Devices ("SRD") in the band adjacent to 5.9 GHz; and fixed services and fixed satellite services within and adjacent to the 5.9 GHz band. **Table 1** below illustrates the allocation of existing services in the 5.9 GHz band and its adjacent bands.

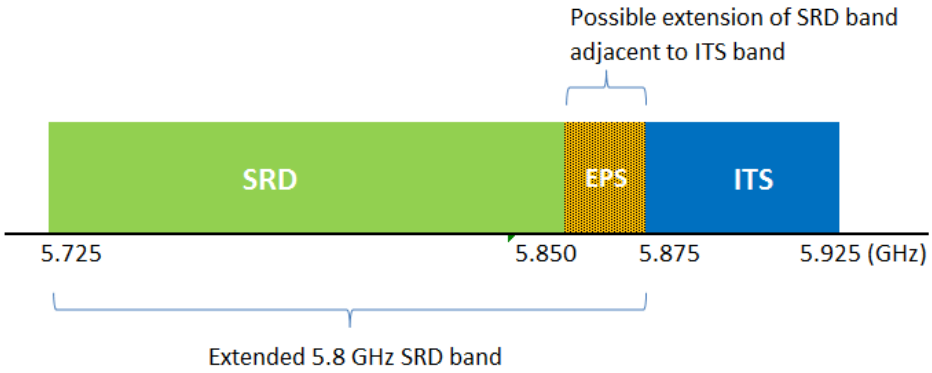
Table 1: Allocation of Existing Services in the 5.9 GHz and adjacent bands

Existing Singapore Allocation (in MHz)
5 650-5 725 FIXED[1] RADIOLOCATION
5 725-5 830 FIXED RADIOLOCATION SRD
5 830-5 850 FIXED RADIOLOCATION SRD
5 850-5 875 FIXED-SATELLITE
5 875-7 075 FIXED FIXED-SATELLITE

[1] Fixed Service refers to fixed point to point wireless communications.

6 While IDA is aware, from the studies conducted by the European Conference of Postal and Telecommunications ("CEPT"), that compatibility between ITS systems and other existing services can be achieved[2] within the 5.855 – 5.925 GHz band, IDA is considering the possibility of relocating some of the existing services[3] during the initial years of ITS deployment, to promote better harmonised spectrum usage between ITS applications and other existing services. To encourage the proliferation of ITS applications, IDA is also considering the possible extension of the existing local 5.8 GHz SRD band from 5.725 - 5.850 GHz to 5.725 - 5.875 GHz[4] for facilitating the co-use of ITS in the newly extended SRD segment (5.855 GHz to 5.875 GHz). The ITS equipment that complies with the 5.8 GHz band SRD technical specifications will be exempted from spectrum and station fees. **Figure 2** below illustrates the possible extension of the SRD band adjacent to the 5.9 GHz ITS band.

Figure 2: Proposed extension of the SRD band adjacent to the 5.9 GHz band



7 In June 2014, IDA had invited local industry players and relevant authorities to form an ITS task force within the IDA Telecommunications Standards Advisory Committee ("TSAC")[5], to propose and formulate local ITS technical specifications to facilitate the operation of ITS equipment in the 5.875 – 5.925 GHz band. The key deliverable of the ITS task force is to propose the 5.9 GHz DSRC standard for possible adoption by IDA, which will enable future smart transportation systems in support of Singapore's smart nation vision. The proposed ITS standards and technical specifications recommended by the ITS task force can be found in the **Annex**.

8 Although several countries have already allocated the 5.9 GHz band for ITS uses, they have specified different technical requirements. IDA is proposing the use of ITS applications in the 5.875 – 5.925 GHz band based on the RF emission power limits and service band plans recommended by TSAC. **Figure 3 and Table 2** below summarise the proposed maximum permissible RF emission specifications (E.I.R.P.) and the proposed service band-plan for ITS deployments in Singapore.

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[2] The report indicated that ITS will not suffer from excessive interference from other services. It further found that ITS systems are compatible with all services in the band 5.855–5.925 GHz provided that ITS systems comply with certain emission limits.

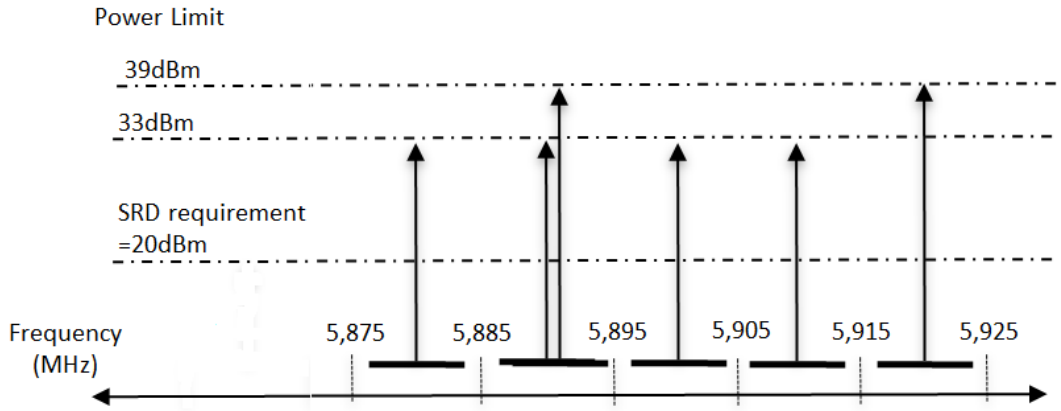
[3] Such as Radiolocation, Fixed and Fixed-Satellite services.

[4] This will fully align Singapore's 5.8 GHz SRD band with ITU's designated industrial, scientific and medical ("ISM") applications for 5.8 GHz band.

[5] The TSAC advises IDA on the setting of ICT standards as well as on the development of specifications, standards, guidelines and other forms of documentation for adoption by the Singapore ICT industry.

9 While the recommended RF emission specifications and service band-plan take reference from the United States' band plan, which is understood by the local industry to be more developed at this juncture; the proposed specifications had been further revised to suit the local transportation environment with considerations of the smaller geographical size of Singapore.

Figure 3: Proposed maximum permissible RF emission specifications (E.I.R.P.) for ITS deployments in Singapore



Question 1
IDA seeks views and comments on the proposed RF emission specifications for ITS deployments in Singapore.

Table 2: Proposed service band plan for ITS

Channel No.	Centre Frequency (MHz)	Channel Name	Channel Type
172	5860	ISM Band Public/Private Channel (ISM-SCH1)	Service Channel
174	5870	ISM Band Public/Private Channel (ISM-SCH2)	Service Channel
176	5880	V2V Safety Channel (SfCH)	Service Channel
178	5890	Control Channel (CCH)	Control Channel
180	5900	Public/Private Channel (PP-SCH)	Service Channel
182	5910	Road Pricing Channel (RP-SCH)	Service Channel
184	5920	Long Range Channel (LR-SCH)	Service Channel

Question 2
IDA seeks views and comments on the proposed 5.875 – 5.925 GHz (5.9 GHz) ITS service band plan in Table 2 above.

Question 3
IDA seeks views and comments on the proposed plans for:

(i) co-existence between ITS and other short range devices, such as WLAN, broadband access devices, etc. in the 5.850 – 5.875 GHz band; and

(ii) operation of ITS in the 5.850 – 5.875 GHz band, which needs to comply with the existing 5.8 GHz SRD technical specifications[6], and to operate without spectrum fees, under non-protection[7] and shared-use basis[8]

should the existing local 5.8 GHz SRD band be extended to 5.725 – 5.875 GHz.

10 IDA notes that many countries have adopted similar regulatory frameworks, where the use of ITS applications in the 5.9 GHz band cannot claim protection from other existing services. Nevertheless, in order to support the national Smart Nation Vision and to spur the use of innovative intelligent transport applications in Singapore, IDA is exploring the possible (i) frequency reassignment[9] for existing services, such as fixed and fixed satellite services, that operate in the 5.875 – 5.925 GHz band; and (ii) allocation of guard bands adjacent to the 5.9 GHz ITS band, during the initial years[10] of ITS deployment, to promote better harmonised spectrum usage between ITS applications and other existing service(s)[11]. IDA plans for the migration of the existing services in the 5.875 – 5.925 GHz band and those within the adjacent guard bands to be completed in the next 3-5 years.

Question 4
IDA seeks views and comments on the frequency reassignment for existing service(s), such as fixed services and fixed satellite services, that are residing within the 5.875 – 5.925 GHz band, to facilitate the introduction of ITS; or alternatively, whether the existing services could operate on a non-protection basis.

Question 5
IDA seeks views and comments on the allocation of interim[12] guard bands, i.e. 5830 MHz – 5855 MHz and 5925 – 5945 MHz, to promote better harmonised spectrum usage between the initial emerging ITS applications and other existing service(s); or alternatively, whether these existing services in the mentioned guard bands could operate on a non-protection and non-interference[13] basis.

[6] This refers to the technical specifications for the existing 5.725 – 5.850 GHz SRD band.
[7] This means that there is no guarantee that the user's use of the Station at the operating frequency will be free from interference.
[8] This means that there are (or could be) other licensees who are also assigned the same frequency, and who may also use the same frequency.
[9] To reassign frequencies within the existing allocation of 5.875 – 7.075 GHz band for fixed services and 5.850 – 7.075 GHz band for fixed satellite services.
[10] The interim guard bands are to be removed in the later stage when the global ITS standards development is more matured.
[11] These include radiolocation services, fixed services and fixed satellite services.
[12] For the initial 3-5 years of ITS deployment.
[13] The wireless equipment to be used should not cause interference to any other licensed or authorised stations or networks or telecommunication installation or equipment which may be lawfully owned, used or operated by any other person.

PART III: TECHNICAL CONDITIONS AND REGULATORY APPROACH

11 Taking into consideration the various frameworks implemented by other countries, IDA is proposing the following regulatory approach for the 5.9 GHz ITS band.

12 To promote the adoption of ITS in Singapore, as well as to facilitate future ITS Vehicle-to-Vehicle ("V2V") communications, an exemption from spectrum licensing is being considered for Vehicular On-Board Units ("OBUs"). In the proposed spectrum framework, while all ITS devices to be deployed in Singapore are required to be registered with IDA under the General Equipment Registration ("GER") scheme[14]; the use of registered OBUs will not require an operating licence from IDA and there will be no spectrum fees incurred.

13 For Road Side Units ("RSUs") and non-vehicular installation cases, spectrum fee charges based on ITS service channelling of 10 MHz will apply. Besides the spectrum charges for ITS service channels, the use of the control channel[15] by the RSU/non-vehicular installation will also be charged separately. Users will need to apply for the relevant FBO or SBO licence(s) if there is a need to form wide area network(s) for service provisioning to other third parties. **Table 3** below summarises the proposed licencing requirements and charging mechanisms for both OBU and RSU (non-vehicular installation).

Question 6
IDA seeks views and comments on IDA's proposal to exempt Vehicular OBUs from spectrum licensing and adopt a full licensing approach for RSUs and non-vehicular installations.

Table 3: Proposed frequency allocations and regulatory framework

Description	Vehicular OBU	RSU and Non-Vehicular Installation
Spectrum	5.875 – 5.925 GHz ("5.9 GHz band")	
Technical Requirement	Compliance with the IDA adopted TSAC recommended standards	
Equipment Registration Scheme	General Equipment Registration	
Licence Approach[16]	Licence exempt	Localised Radio-Communication Station Licence/ Wide Area Private Network Licence
Spectrum Fees	NA	Yes

[14] ITS Devices that do not comply with the 5.9 GHz ITS standards adopted by IDA will not be permitted to operate within Singapore.
[15] For shared use among various ITS applications.
[16] Where these devices are used to form a wide area network for service provisioning to third parties, the applicant shall have to apply for FBO or SBO licences.

Shared Use[17]	-	Chargeable shared-use annual frequency management fee[18] based on per 10 MHz usage*
Exclusive Use (where applicable)	-	Chargeable exclusive-use annual frequency management fee based on per 10 MHz usage* * Includes one time Application and Processing fee[19]

Question 7
IDA seeks any other views and comments on IDA's proposed ITS licensing framework.

14 Singapore will be one of the earlier adopters of ITS in the 5.9 GHz band. The adopted ITS standards could require further revisions in the future in order to align with global ITS technology developments[20] and advances in the pipeline. While IDA understands that some countries allow both OBUs and RSUs to be licence-exempted for full compliance to their adopted standards, IDA is of the view that there is a need to coordinate the use of RSU and non-vehicular installations for now, where they will generally operate at a higher RF transmission power. IDA may consider licence-exempt RSU and non-vehicular installations which fully comply with IDA's adopted standards, when the technology and deployment of ITS DSRC in the 5.9 GHz band are more established in Singapore.

PART IV: 5.9 GHZ DSRC STANDARDS FOR ITS

15 IDA had invited local industry players and relevant authorities, through the work of TSAC, to develop the proposed 5.9 GHz DSRC standards for ITS. As a further platform for the public to feedback on the technical requirements developed, IDA invites comments from the public on the "*Technical Specification of Dedicated Short-Range Communications (DSRC) standards for Intelligent Transport Systems (ITS)"* attached in the **Annex**.

Question 8
IDA seeks views and comments on the proposed "Technical Specification of Dedicated Short-Range Communications (DSRC) standards for Intelligent Transport Systems (ITS)".

[17] The use of the control channel (shared-use) by RSU and non-vehicular installation will be charged separately from the spectrum used for ITS service/ application channel.
[18] Reference to existing spectrum charging framework for annual renewal frequency usage, the annual frequency management fees for 10 MHz of spectrum will be $3,500 for shared use and, where applicable, $14,700 for exclusive use.
[19] Reference to existing spectrum charging framework, the one-time application and processing fees for 10 MHz spectrum usage will be $2,700.
[20] For example, the possible introduction of future co-existence and/or band sharing techniques between DSRC with Wi-Fi devices in the 5.9 GHz band.

PART V: INVITATION TO COMMENT

16 IDA would like to seek the views and comments from the industry and members of the public on the matters stated in the above paragraphs, and any other related issues not covered in this consultation document but which are considered to be relevant to the formulation of the regulatory framework and standards for ITS in the 5.9 GHz band.

17 IDA reserves the right to make public all or parts of any written submissions made in response to this consultation, and to disclose the identity of the respondent. Any part of the submission which the respondent considers to be commercially sensitive must be clearly marked and placed as a separate annex to the comments raised. IDA will take this into consideration when disclosing the information submitted.

18 All views and comments should be submitted in soft copies (Microsoft Word or PDF Format), and should reach IDA by **12 noon, 15 January 2016**. Respondents are required to include their personal or company particulars, correspondence address, contact number and email address in their submissions. All views and comments should be addressed to:

Ms Aileen Chia
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 “Proposed Regulatory Framework and Standards for Intelligent Transport Systems in 5.9 GHz Frequency Band” via email to IDA_consultation@ida.gov.sg.