



**DECISION ISSUED BY THE  
INFO-COMMUNICATIONS MEDIA DEVELOPMENT AUTHORITY**

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

**6 February 2017**

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# IMDA'S DECISION AND EXPLANATORY MEMORANDUM ON THE REGULATORY FRAMEWORK AND STANDARDS FOR ITS IN THE 5.9 GHZ (5.875-5.925 GHZ) FREQUENCY BAND

## PART I: INTRODUCTION

1 On 21 December 2015, IMDA issued a public consultation on “Proposed Regulatory Framework and Standards for Intelligent Transport Systems (“ITS”)<sup>1</sup> in the 5.9 GHz (5.875 – 5.925 GHz) Frequency Band” (“Consultation”). The Consultation sought views and comments from the industry on the following:

- i. Opening up of 5.9 GHz band for ITS applications with the proposed RF emission specifications and ITS service band plan;
- ii. Co-existence between ITS and other short range devices;
- iii. Frequency re-assignment of existing service(s) in the 5.9 GHz band;
- iv. Implementation of proposed licensing framework, including the exemption of Vehicular On-Board Units (“OBUs”)<sup>2</sup> from spectrum licensing and adoption of a full licensing approach for Road Side Units (“RSUs”)<sup>3</sup> and non-vehicular installations; and
- v. Adoption of proposed “Technical Specification for Dedicated Short-Range Communications (“DSRC”) standards in Intelligent Transport Systems (“ITS”)

2 The consultation closed on 15 January 2016. At the close of the consultation, IMDA received comments from three respondents:

- i. Cisco Systems (USA) Pte Ltd;
- ii. Singapore Telecommunications Ltd; and
- iii. StarHub Mobile Pte Ltd

IMDA would like to thank all the respondents for their valuable input. The responses have been published on the IMDA website<sup>4</sup>.

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<sup>1</sup> 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 in enabling the transmission of information between vehicles and road infrastructure, and among vehicles.

<sup>2</sup> OBU refers to ITS device to be installed onto the vehicle

<sup>3</sup> RSU refers to ITS device to be installed at the roadside, i.e. roadside infrastructure

<sup>4</sup> <https://www.imda.gov.sg/regulations-licensing-and-consultations/consultations/consultation%20papers/2015/proposed-regulatory-framework-and-standards-for-its>

3 Taking into consideration the comments received, as well as the policy objectives IMDA seeks to achieve, IMDA has finalised the regulatory framework to allow the use of the 5.9 GHz frequency band for ITS applications. This document sets out IMDA’s response to the comments received from the Consultation and IMDA’s decision on the final framework.

## **PART II: SUMMARY OF COMMENTS RECEIVED ON THE PROPOSED REGULATORY FRAMEWORK AND STANDARDS FOR ITS IN THE 5.9 GHZ FREQUENCY BAND**

4 In general, the industry welcomed IMDA’s efforts and was supportive of IMDA’s proposal to open up the 5.9 GHz (5.875 – 5.925 GHz) band for ITS applications in Singapore. A summary of the industry’s response to the key considerations in the proposed framework for the 5.9 GHz band are as follows:

### *Consideration 1: Proposed ITS RF emission specifications and service plans*

5 One respondent commented on possible short range devices (“SRD”) energy spilling into the adjacent ITS (DSRC) spectrum channels and the proposal to adopt a type of “detect and vacate” mechanism<sup>5</sup> in SRD to avoid ITS (DSRC) transmissions.

6 Another respondent commented on the need to reduce the number of DSRC channels.

### *Consideration 2: 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*

7 One respondent requested that existing fixed satellite services (“FSS”) and mobile satellite services (“MSS”) be protected.

### *Consideration 3: Allocation of interim guard bands<sup>6</sup> 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<sup>7</sup> basis*

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<sup>5</sup> <https://www.fcc.gov/ecfs/filing/60001362140/document/60001390484>

<sup>6</sup> For example, 5830 MHz – 5855 MHz and 5925 – 5945 MHz in the initial 3-5 years of ITS deployment

<sup>7</sup> 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.

8 One respondent proposed for interference studies to be conducted to assess the feasibility of co-existence between existing FSS and MSS service and ITS applications.

9 Another respondent commented that guard bands would not address the interference problem if SRDs such as Wi-Fi were intended as a use case.

Consideration 4: Proposed ITS licensing approach

10 Generally, the industry was supportive of IMDA's proposed spectrum regulatory framework, which was consistent with those in other jurisdictions. One respondent recommended to licence-exempt the RSUs and the non-vehicular installations that complied with the Authority's equipment specifications, and operated within the TSAC recommended power limit of 33dBm. One respondent was supportive of IMDA's proposal to further regulate operator(s) providing ITS wide area services, so as to ensure the compliance of minimum service requirements by the Authority.

Consideration 5: Proposed "Technical Specification for Dedicated Short-Range Communications (DSRC) standards in Intelligent Transport Systems (ITS)"

11 One respondent indicated support for IMDA's adoption of DSRC in ITS, based on the 5.9 GHz IEEE<sup>8</sup> 802.11p/1609 Wireless Access in Vehicular Environment (WAVE) standards, as recommended by the TSAC WG TF for ITS standardisation.

12 Another respondent raised concerns on the usage of power Class D devices, where the communication range could reach up to 1km. The respondent was concerned that such devices may pose risk of interference when operating in close proximity to existing fixed satellite services.

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<sup>8</sup> IEEE - Institute of Electrical and Electronic Engineers

### **PART III: IMDA'S VIEWS AND DECISIONS ON THE REGULATORY FRAMEWORK AND STANDARDS FOR ITS IN THE 5.9 GHz FREQUENCY BAND**

13 While developing the regulatory framework and standards for ITS in the 5.9 GHz band to better manage and harmonise devices operating within the band, IMDA was mindful that there would be a balance between encouraging innovation and developments of new technologies and setting stringent regulatory controls in limiting the use of these newer technologies. The following paragraphs set out IMDA's assessment of the key issues in the proposed framework and standards for ITS in the 5.9 GHz band.

#### *Consideration 1: Proposed ITS RF emission specifications and service plans*

14 One respondent had made reference to WiFi devices, which operate at a higher RF transmission power<sup>9</sup>, when providing the comments on possible signal spillage by SRD into the adjacent ITS (DSRC) spectrum channels and the need for SRD to adopt a certain type of "detect and vacate" mechanism<sup>10</sup>. IMDA notes that there are several studies on the co-existence between WiFi and ITS (DSRC) services. However, there has been no conclusive outcome from these studies, including the adoption of the proposed type of "detect and vacate" mechanism, that would support or disprove the co-existence of WiFi and DSRC services. Notwithstanding this, to encourage innovation in ITS technology, IMDA will proceed to adopt the earlier proposal by TSAC, for ITS (DSRC) channels 172 and 174 (5.855 – 5.875 GHz) to operate at an RF output power limit of 100 mW (e.i.r.p.)<sup>11</sup>, which will be aligned to the specifications of the existing 5.8 GHz SRD band with no further "detect and vacate" requirement<sup>12</sup>. Presently, IMDA is also in the process of reviewing the SRD technical specifications document and will incorporate this change for the unlicensed use of 5.850 – 5.875 GHz band, including for ITS purposes, at an RF output power limit of 100 mW (e.i.r.p.) in the SRD technical specifications document revision. In the event that IMDA assesses that spectral separation between WiFi and ITS would not be necessary, IMDA will amend the SRD technical framework in the future, permitting higher powered WiFi to operate within 5.850-5.875 GHz, possibly at an RF output power limit of 1000 mW (e.i.r.p.)<sup>13</sup>.

15 IMDA has also decided against reducing the number of DSRC channels. The 5.855-5.925 GHz (7 channels) band has already been allocated in the United States and South Korea for ITS applications. There are also plans to allocate these 7 channels for ITS applications in Australia and several European countries. In order to align with the global spectrum allocation for ITS, IMDA is of the view that the number of DSRC channels should not be reduced<sup>14</sup>.

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<sup>9</sup> In Singapore, under unlicensed usage, there are two permissible RF output power limits for the existing 5.725 – 5.850 GHz band - 100 mW (e.i.r.p.) for general SRD applications and 1000 mW (e.i.r.p.) for WiFi applications.

<sup>10</sup> <https://www.fcc.gov/ecfs/filing/60001362140/document/60001390484>

<sup>11</sup> IMDA may also consider lowering the SRD operating power limit of 100 mW (e.i.r.p.) in 5.850 – 5.875 GHz to a lesser power, should it be found that SRD will affect future adjacent DSRC applications.

<sup>12</sup> As proposed by the respondent in the public consultation.

<sup>13</sup> To align with the existing permissible WiFi RF output power limit for the existing 5.725 – 5.850 GHz band.

<sup>14</sup> Further to that, in Singapore, the 5.855 – 5.875 GHz band (2 of the 7 identified channels) will be opened for SRD usage, and not strictly for DSRC applications only.

Consideration 2: 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

16 IMDA notes the concern of potential interference by the new ITS applications onto satellite services. IMDA has assessed that it would be very unlikely for the new ITS applications to interfere with the existing satellite users, considering that this band is used by satellite services for satellite uplink, where the transmission would be of higher power than that from ITS applications.

Consideration 3: Allocation of interim guard bands 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 basis

17 As per the assessment in Consideration 1, IMDA will adopt the TSAC's proposal for ITS (DSRC) channels 172 and 174 (5.855 – 5.875 GHz) to operate at a RF output power limit of 100 mW (e.i.r.p.), which is aligned with the specifications of the 5.8 GHz SRD band. Should IMDA assess that spectral separation between WiFi and ITS would be unnecessary, IMDA will amend the SRD technical framework subsequently to also allow higher powered WiFi to operate within 5.850-5.875 GHz, possibly at an RF output power limit of 1000 mW (e.i.r.p.).

18 In order to enable future smart transportation systems in support of Singapore's smart nation vision, IMDA will stop assigning new fixed satellite services within the 5.875-5.925 GHz band in Singapore. All existing fixed satellite users can remain within the 5.875-5.925 GHz band, unless it is subsequently found that these satellite systems will cause interference to the new ITS systems.

19 While ITS should incorporate sufficient filtering and other interference mitigation mechanism(s) to protect itself from possible adjacent channel interference, IMDA notes that ITS systems are still in the infant phase of development globally and the technical specifications may not be fully defined. To further minimise potential adjacent channel interference, IMDA has decided to stop new<sup>15</sup> assignments for radiolocation service in the 5.830-5.850 GHz band and fixed service in the 5.925-5.945 GHz band for an interim period of 3 years with effect from 1 April 2017 to protect the initial emerging ITS applications against possible adjacent channel interference from radiolocation and fixed services. IMDA will review this decision when the ITS technology landscape is more mature. The allocation for new services with effect from **1 April 2017** are as shown in the table below.

<b>Existing Singapore Allocation (in MHz)</b>	<b>New Singapore Allocation (in MHz)</b>
5 725-5 830 FIXED	5 725-5 830 FIXED

<sup>15</sup> Existing radiolocation and fixed service users residing in the respective 5.830 – 5.850 GHz and 5.925 – 5.945 GHz band can remain within their existing frequency assignment.

RADIOLOCATION SRD	RADIOLOCATION SRD
5 830-5 850 FIXED <b>RADIOLOCATION</b> SRD	5 830-5 850 FIXED SRD
5 850-5 875 FIXED-SATELLITE	5 850-5 875 FIXED-SATELLITE <b>SRD</b>
5 875-5 925 FIXED <b>FIXED-SATELLITE</b>	5 875-5 925 FIXED <b>MOBILE</b> <sup>16</sup>
5 925-5 945 FIXED-SATELLITE <b>FIXED</b>	5 925-5 945 FIXED-SATELLITE
5 945-6 700 FIXED FIXED-SATELLITE	5 945-6 700 FIXED FIXED-SATELLITE

20 Notwithstanding the above service allocation, local ITS deployment(s) will have operate on a non-protection and non-interference basis, which means they will have to co-exist with the other radio transmission(s) from the above mentioned existing services in its operating vicinity.

Consideration 4: Proposed ITS licensing approach

21 As part of the IEEE WAVE protocols, a typical ITS device is required to switch between the common control channel and its intended service channel(s). IMDA has decided to charge RSUs and non-vehicular installations only for the spectrum used for the ITS application service channel, and not for the common control channel.

22 IMDA has decided to adopt the spectrum regulatory framework set out below.

Description	Vehicular OBU	RSU /Non-Vehicular Installation
Spectrum	5.875 – 5.925 GHz (“5.9 GHz band”)	
Technical Requirement	Compliance with the IMDA adopted TSAC recommended standards <sup>17</sup>	
Equipment Registration Scheme	General Equipment Registration	

<sup>16</sup> Aligned to ITU Region 3 allocation

<sup>17</sup> The IMDA has adopted TSAC recommended standards, “TSAC Technical Specification for Dedicated Short-Range Communications in ITS”.

Licence Approach <sup>18</sup>	Licence exempt	Localised Radio-Communication Station Licence/ Wide Area Private Network Licence
Spectrum Fees	NA	Yes
Shared Use	-	Chargeable shared-use annual frequency management fee of \$2,500* (based on per 10 MHz usage)
Exclusive Use (where applicable)	-	Chargeable exclusive-use annual frequency management fee of \$9,200* (based on per 10 MHz usage)
		* Includes chargeable one-time application and processing fee of \$300. The use of control channel <sup>19</sup> (5.885 – 5.895 GHz) by RSU or non-vehicular installation will <b>not</b> be charged

*Consideration 5: Proposed “Technical Specification for Dedicated Short-Range Communications (DSRC) standards in Intelligent Transport Systems (ITS)”*

23 IMDA notes that industry players largely regard the DSRC development by IEEE in the WAVE standards as more mature, and initiatives have been ongoing to further enhance the coexistence of DSRC systems with other devices operating in the 5.9 GHz band. IMDA assures respondents that the TSAC ITS standardisation programme, which is still ongoing, will continue to be aligned with the international harmonisation effort that has begun in 2012 with the formation of the EU-US ITS Task Force (comprising ETSI<sup>20</sup>, IEEE and ISO<sup>21</sup>). TSAC is tracking this global ITS standardisation effort closely, and will conduct regular reviews to ensure that the ITS standards adopted are up-to-date and relevant for Singapore’s implementation of ITS.

24 As noted in paragraph 16, the scenario of DSRC interfering with satellite uplink services in the 5.9 GHz frequency band is unlikely. Nevertheless, a note restricting the use of Class D DSRC devices to public safety related services has been added to the final IMDA TS DSRC.

<sup>18</sup> Where these devices are used to form a wide area network for service provisioning to third parties, the applicant will have to apply for FBO or SBO licences.

<sup>19</sup> The use of the control channel (shared-use) by RSU and non-vehicular installation for ITS application under the IMDA TS DSRC will not be charged.

<sup>20</sup> ETSI – European Telecommunications Standards Institute

<sup>21</sup> ISO – International Organization for Standardization



## **PART IV: CONCLUSION**

25 After careful consideration of all the responses received from the public consultation, IMDA has decided to open up the 5.9 GHz band for ITS applications under mobile service allocation. A summary of the frequency allocations and licensing framework is set out in **Annex A**.

26 The ITS applications shall operate in accordance to the TSAC recommended standard on “Technical Specification for Dedicated Short-Range Communications in Intelligent Transport Systems” indicated in **Annex B**.

27 To give effect to the (i) operation of ITS (DSRC) OBUs on a spectrum licence-exempt basis; and (ii) spectrum licence exemption of Control Channel (5.885 – 5.895 GHz) for ITS (DSRC) RSUs, IMDA will be amending the Notification and Regulations for publication in the Government Gazette on Telecommunications (Exemption From Section 33, 34(1)(b) and 35) (Amendment) Notification, to effect the revisions from **1 April 2017**.

28 To provide the industry a better indication of the other identified ITS spectrum, such as those for use by vehicular radars, the existing regulatory framework and technical requirements for the 76 – 77 GHz and 79 GHz (77 – 81 GHz) bands are set out in **Annex C** for ease of reference.