
**PUBLIC CONSULTATION ON THE PROPOSED REGULATORY
FRAMEWORK FOR TV WHITE SPACE OPERATIONS IN THE
VHF/UHF BANDS**

**Submission by the StarHub Group to the
Info-communications Development Authority of Singapore**

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Statement of Interest

StarHub Ltd is a Facilities Based Operator ("**FBO**") in Singapore, having been awarded a licence to provide public basic telecommunication services ("**PBTS**") by the Telecommunications Authority of Singapore ("**TAS**") (the predecessor to IDA) on 5 May 1998.

Nucleus Connect Pte Ltd, a wholly-owned subsidiary of StarHub Ltd, incorporated on 14 April 2009, is the appointed Operating Company of the Next Generation Nationwide Broadband Network.

StarHub Mobile Pte Ltd is a wholly-owned subsidiary of StarHub Ltd. StarHub Mobile Pte Ltd was issued a licence to provide public cellular mobile telephone services ("**PCMTS**") by the TAS on 5 May 1998. StarHub Ltd launched its commercial PBTS and PCMTS services on 1 April 2000.

StarHub Ltd acquired CyberWay (now StarHub Internet Pte Ltd) for the provision of Public Internet Access Services in Singapore on 21 January 1999.

In July 2002, StarHub Ltd completed a merger with Singapore Cable Vision Limited to form StarHub Cable Vision Ltd. StarHub Cable Vision Ltd holds a FBO licence and offers broadband and cable TV services.

StarHub Online Pte Ltd is a wholly-owned subsidiary of StarHub Ltd. StarHub Online Pte Ltd was issued a licence to provide Public Internet Access Services in Singapore on 22 February 2005.

This submission represents the views of the StarHub group of companies, namely, StarHub Ltd, StarHub Mobile Pte Ltd, StarHub Internet Pte Ltd, StarHub Online Pte Ltd and StarHub Cable Vision Ltd.

1. Introduction

StarHub welcomes the opportunity to provide comments to the Authority's public consultation on proposed regulatory framework for TV White Space ("TVWS") operations in the VHF/UHF bands.

With the increasing use of wireless data applications and services by consumers and businesses, the strong growth in wireless data places a greater emphasis in maximising the efficient use of frequency spectrum. StarHub believes that TVWS technologies allow the industry to maximise the efficient use of spectrum. At the same time, they provide new opportunities for developing and offering new innovative applications and services. The Authority's consultation is an important step towards the development and deployment of TVWS operation in Singapore.

StarHub is a founding member of the Singapore White Space Pilot Group ("SWSPG"). The SWSPG was established in April 2012 with the objective of promoting Singapore as a leading test-bed and innovative zone for conducting pilot projects using TVWS technologies, thereby accelerating the adoption of TVWS technologies locally, regionally and eventually globally. The SWSPG also aims to attract broad members from public and private sectors, local and international industry participants, academic and research institutes and end-user organizations that could benefit from this next generation broadband wireless connectivity.

StarHub's specific comments on the Authority's consultation are set out in the following section.

2. Specific Responses

PART II: LICENSING MECHANISM FOR WHITE SPACE DEVICES

Question 1:

IDA invites views on adopting a licence-exempt approach for WSDs in Singapore, subject to the devices meeting the conditions set by IDA.

StarHub supports the licence-exempt approach for WSDs in Singapore, subject to meeting the conditions set by the Authority. We also propose that the Authority works closely with its counterparts of Singapore's neighbouring countries to further develop the ecosystem of TVWS and deployment of WSDs.

Question 2:

IDA invites views on designating a restricted number of TVWS channels to support the deployment of services that require certainty of spectrum access.

Question 3:

In the event where IDA designates channels to support such services, IDA invites views on the appropriate regulatory approach in designating and managing these TVWS channels and the regulatory framework for the operations of prioritised WSDs.

StarHub will prefer not to designate a restricted number of TVWS channels for deployment of services that require certainty of access to frequency spectrum. This approach will not maximise the efficient use of available frequency spectrum.

We believe that a geolocation database would be able to closely coordinate the use of frequency spectrum by WSDs. With the geolocation database, prioritised WSDs can be treated as a primary user, who will then have priority over all secondary users in accessing the frequency spectrum. The prioritisation can be carried out based on time, location, profile, application and/or device type.

PART III: TV WHITE SPACE SPECTRUM BANDS AND ACCESS MECHANISM

Question 4:

IDA invites views on allowing operation of WSDs in the 694 MHz – 806 MHz band until IDA allocates these frequencies for IMT deployment.

StarHub supports the Authority's proposal in allowing the operation of WSDs in the 694MHz - 806 MHz band until these frequencies are allocated for IMT deployment. We believe that this should not pose any significant problem and can be easily managed by the geolocation database. We suggest that the Authority allocates these frequencies for IMT deployment early, so that any necessary transition required arising from WSDs operating in these frequencies can be carried out without causing delay or problems to the IMT deployment.

We also suggest that the Authority reviews the availability of spectrum on a regular basis to identify any untapped source of spectrum that could be used by WSDs.

Question 5:

IDA invites views on adopting a database approach as the mandated method to access white space spectrum.

StarHub agrees with the Authority that a database approach can be adopted as the mandated method to access TVWS. Based on time and location information, the geolocation database will help to manage the use of frequencies efficiently without comprising the quality of the services. Notwithstanding this, the Authority should also explore other options, such as radio spectrum sensing, as there may be circumstances where the use of the geolocation database is not feasible.

Question 6:

IDA invites views on the proposed general requirements for the database query and registration.

StarHub does not have concerns with the proposed general requirements for database query and registration. To facilitate a quick deployment of the geolocation database, the Authority could consider implementing a database with simple query and registration features in the initial stage (e.g., querying the white space channel availability, the duration and location which the WSD can operate). At a later stage, the Authority could introduce more sophisticated features (such as the transmission power control of WSDs, priority assignment according to the WSD usage profile, and frequency assignment according to the WSD device type, etc).

Question 7:

IDA invites views on the three situations in which a WSD must query the database. In particular, IDA invites views on defining 50m as the maximum distance that WSDs are allowed to move from its original location, without contacting the geolocation database.

StarHub is agreeable to the 3 situations set out by the Authority in which a WSD must query the database.

However, we are of the view that the requirement for a WSD to query the database and request up-to-date information when the WSD has moved more than 50 meters from its original location is likely to be overly-stringent. We propose adopting a requirement of 100 meters from the WSD's original location. This should not pose significant risk to interference and would reduce the overhead requirements on WSDs. The Authority could review this requirement in future when necessary.

PART IV: COEXISTENCE CRITERIA AND OTHER PARAMETERS FOR WHITE SPACE DEVICES

Question 8:

IDA invites views on the output power transmission of WSDs as shown in Table 2.

StarHub views that the maximum power levels set out in Table 2 for Fixed Device, Mode I Device and Mode II Device are acceptable. However, we seek the Authority's confirmation that Fixed Devices without the ability to query the database shall be allowed to transmit power up to 4Watts EIRP.

We also propose that the Authority allows a higher output power (more than 4Watts EIRP) for certain applications where the risk of interference is low (for example, point-to-point backhaul transmission and narrow beamwidth antenna).

Question 9:

IDA invites views on allowing the Fixed Devices to have tuneable output power that is capped at a maximum of 4Watts EIRP.

StarHub agrees with the Authority's proposal on allowing Fixed Devices to have tuneable output power. By allowing such capability, this will reduce interference caused to other WSDs, thereby encouraging more efficient use of available spectrum. In addition, we believe that portable devices should be given the option to support the tuneable output power.

Question 10:

IDA invites views on the requirement of a Unique WSD Identifier and for this identifier to be based on standards developed by recognised standards organisations.

StarHub agrees with the Authority's requirement to have a unique WSD identifier and the identifier should be based on standards developed by recognised standards organisation. With these features standardised, this will drive down the costs of WSDs, increase adoption, and facilitate inter-operability with cross-border geolocation databases.

Question 11:

IDA invites views on the proposed maximum transmission level of 100mW EIRP for WSDs operating in channels adjacent to a local broadcast channel.

StarHub agrees with the proposed maximum transmission level of 100mW EIRP for WSDs operating in channels adjacent to a local broadcast channel. The interference to broadcast services should reduce further when local broadcast services switch to digitisation transmission in future.

We also suggest that this transmission level should not be limited to portable devices only. Fixed devices which limit their transmission level to 100mW EIRP should also be allowed.

Question 12:

IDA invites views on the proposed OOB emission limit of -56.8dBm, which will be imposed on WSDs operating in channels that are directly adjacent to a local broadcast service.

StarHub has no concerns with the proposed OOB emission limit of -56.8dBm.

Question 13:

IDA invites views on defining the OOB emission limits for WSD to WSD operations.

StarHub agrees that it is not necessary to define the OOB emission limits for adjacent WSD to WSD operations. We believe that the OOB emissions from WSDs are unlikely to cause significant interference to each other, and suggest allowing the industry to determine the best approach to address this matter.

Question 14:

IDA invites views on the proposed approach to manage coexistence between a WSD and the other secondary services within the TVWS channels.

StarHub has no concern with the Authority's proposed approach to manage the coexistence between a WSD and other secondary services. We believe that this issue can be managed using both the radio sensing and the geolocation database. The secondary services can be registered with the geolocation database (the latter will coordinate the usage of the TVWS channels between the WSD and the secondary services).

Question 15:

IDA invites views on the proposed propagation model and parameters used to determine the maximum transmission power level of a WSD.

StarHub supports the use of the Hata Okumura Path Loss model given: (a) its suitability to the Singapore urban environment; and (b) the fact that it has already been widely-accepted and used by various institutions. We believe that the use of a high resolution geographical map with detailed landscape characteristics and parameters will help to determine the maximum transmission power level which a WSD can operate in a given situation, thereby maximise the efficient use of available spectrum.

Question 16:

IDA invites views on its proposal for the protection of licence-exempt and licensed wireless microphones. IDA also invites views and comments on the optimal number of safe harbour channels required to ensure that licence-exempt wireless microphones can continue to be used once WSDs are deployed.

StarHub does not think that designating safe harbour channels for wireless microphone operation would be a practical approach. This is because wireless microphones use a wide range of frequencies, and it will be difficult to ensure that these microphones would only operate within the safe harbour channels.

Question 17:

IDA invites views on the need to develop a registration process for users of licence-exempt wireless microphones that require additional channels beyond the safe harbour channels.

StarHub suggests that all users of licence-exempt wireless microphones register with the geolocation database, and provide information on location, timing and number of microphones used. This information would allow the database to coordinate the frequencies used by them and other services.

Question 18:

IDA invites views on whether the proposed demarcation zone approach is sufficient in terms of managing cross border interference issue and if there are any other factors IDA should consider.

StarHub recognises that the proposed demarcation zone approach is the simplest implementation option. However, in order to maximise the efficient use of frequency spectrum, we propose that the locations of TV broadcast towers and receivers situated in the neighbouring countries be included in the geolocation database. In the long run, to facilitate cross-border usage of WSDs, the Singapore's geolocation database could interwork with the geolocation databases of neighbouring countries.

The Authority has also proposed a limit of -120dBm for signals propagated by WSDs to the northern borders of Singapore. We view that this requirement is overly stringent and suggest the Authority to relax this requirement.

Question 19:

IDA invites views on the aggregate interference effect of WSD and whether any adjustment in terms of technical requirement is needed.

StarHub does not have any concerns with the Authority's conclusion. However, due to the Singapore's dense urban environment, we suggest that studies could be conducted in future when the number WSDs in operation has increased.

Question 20:

IDA invites views on using GPS as the method to determine location accuracy, and on whether 50m is a sufficient location accuracy requirement for the operation of WSDs.

StarHub suggests that the Authority only specify the location accuracy, and leaves the location-based technology to be determined by the industry. This approach will allow more location-based technology solutions to be deployed, provided that they fulfil the location accuracy requirement.

The Authority has also suggested a 50m location accuracy requirement. While we do not have any concerns with this approach, the Authority might want to consider relaxing this requirement to 100m location accuracy, as a typical TVWS network is likely to have a larger coverage area.

Question 21:

IDA invites views on allowing the manual input and internal storage of geographic coordinates for indoor Fixed Devices.

Question 22:

IDA invites views on the requirement of an approval process for the installer of indoor Fixed Devices and the necessary conditions for approval.

StarHub has no concerns with the proposed approach to facilitate the indoor operation of WSDs. Alternatively, the Authority could explore the feasibility of using IP address as geographic coordinates for indoor operation of WSDs.

PART V: TV WHITE SPACE NETWORKS

Question 23:

IDA invites views on the possible types of TVWS network topologies and use case scenarios.

StarHub agrees with the Authority that the TVWS regulatory framework should adopt an application-neutral and service-neutral approach. Though the Authority has set out the possible types of TVWS networks topologies, it is important that the regulatory framework will not restrict other possible network topologies in future.

We understand that the usage scenarios for WSDs at present are likely to be:

- a. Point-to-point communication, which could be used to provide backhaul transmission solution;
- b. Point-to-multi-point communication, which could be used for rural wireless broadband applications, machine-to-machine applications, small cells wireless backhaul; and
- c. Mini or small scale broadcast communication, such as broadcasting message updates to digital signage.

PART VI: MANAGEMENT OF GEOLOCATION DATABASE

Question 24:

IDA invites views on the payment of fees for the use of database services.

StarHub agrees with the Authority's assessment that resources will be required to develop and continually maintain the database. Therefore, it is reasonable for the cost of database management to be recovered from the TVWS users. This will ensure that the database can operate on self-sustainable business model, providing greater level of certainty to businesses and consumers. We suggest that the Authority should leave it to the industry to determine the best charging regime.

Question 25:

IDA invites views on both approaches in managing the database (i.e. industry-managed or government-managed database).

StarHub acknowledges that both the industry-managed and government-managed database models have their own advantages and disadvantages. StarHub's assessment is that an industry-managed database will be more appropriate, as such a model could encourage further innovation, development and deployment of services, thereby growing the TVWS ecosystem. However, given the small size of Singapore, it is not clear whether our local environment could support multiple databases.

Question 26:

To better gauge the level of interest from the industry, IDA invites companies that are interested in developing and managing the database for Singapore to register its interest with us and share the following details:

- i) Funding for database development and management (i.e. self-funded, cost recovery, etc)**

- ii) Business models considered when providing database services
- iii) Possible fees involved for TVWS users

StarHub proposes to develop the industry-managed geolocation database with the help of the Authority. First, the Authority may consider co-funding the development of the database. Second, the Authority could work closely with the industry in establishing the appropriate governance and operating model of database. To ensure that the database can sustain its own business operation in the long term, we envisage that some form of usage fees should be levied by the database operator on TVWS users. For example, manufacturers and users of WSDs could pay a connection fee to query the database. The database operator could also offer ancillary services, such as installation of indoor WSD devices and establishing geographic coordinates.

Question 27:
IDA invites views on the proposed preliminary conditions for the operation and administration of the databases

To safeguard the interests of TVWS operation in Singapore, StarHub agrees that these preliminary conditions are necessary. However, the relevant laws and regulations must not be overly burdensome, which could stifle the development and deployment of TVWS services. For an industry-managed database(s), it is important that the database operator(s) possesses the necessary expertise and financial standing. It may also be necessary to put in place business continuity safeguards to ensure continuity in operation of the geolocation database(s).

Question 28:
IDA invites views on the proposed approach and communications protocols between the following:
i) WSD and IDA website containing the list of authorised database administrators
ii) WSD and the database

The Authority may consider the following communication protocols:

- a. To adopt HTTPS44 or VPN for secure communication between the WSD and Authority's website to access the list of authorised databases; and
- b. To adopt IETF PAWS standards for secure communication between the WSD and the database.

Question 29:

IDA invites views on the proposed frequency of update for Time A validity and Time B validity.

Question 30:

IDA invites views on requiring the adjustment of the value for Time A validity and Time B validity, and for this to be within the range of 6 to 24 hours.

StarHub has no concerns with the proposed frequency of update for Time A validity and Time B validity. We are also agreeable to have the requirement of dynamic adjustment of the value for Time A validity and Time B validity to be within the range of 6 to 24 hours.

Question 31:

IDA invites views on the benefits and costs of a requirement for WSD to report its operational parameters to the database.

Given the small urban environment for Singapore, StarHub agrees that it is necessary for a WSD to report its operational parameters to the database. However, we are very aware of the increased resources and costs on the operation of WSD. Therefore, it is important to strike a right balance to determine the frequency of reporting such that the resources and costs will not be overly cumbersome and yet allow sufficient information to be gathered by the geolocation database to better manage the interference and operation of WSDs.

Question 32:

IDA invites views on the benefits of including within the TVWS regulations a requirement for WSD to register its contact parameters to the database.

StarHub supports the requirement for WSD to register its contact parameters in the database. This will help the database operator to manage and troubleshoot interference issues expediently and effectively.

3. Conclusion

StarHub welcomes the opportunity to provide comments to the Authority's public consultation on proposed regulatory framework for TVWS operations in the VHF/UHF bands.

Consumers and businesses are increasingly relying on wireless data applications and services. This is also accompanied by on-going innovation and development of application, services and devices that use wireless data. The strong growth in wireless data clearly places a greater emphasis in maximising the efficient use of frequency spectrum. StarHub believes that TVWS technologies allow the industry to maximise the efficient use of spectrum. At the same time, they provide new opportunities for developing and offering new innovative applications and services in Singapore.

The Authority's consultation is an important step towards the development and deployment of new innovative applications and services using the TVWS space technologies. StarHub supports the general approach put forward by the Authority for TVWS operation in Singapore. We suggest that the Authority works further with the industry in establishing the necessary standards and implementation details for TVWS operation.

StarHub is grateful for the opportunity to comment on this matter. In the event that submissions from other parties raise new issues or is likely to affect responses given by StarHub under this submission, we would appreciate the opportunity to comment further on the matter.

StarHub Ltd

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