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Infocomm Development Authority of Singapore
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Dear Ms Chia,

The Smart Wireless Laboratory of the National Institute of Information and Communications Technology (NICT) would like to submit views and comments on IDA TVWS consultation paper published on 17 June 2013.

Our comments covers part of the questions listed in the consultation paper, including Question 6, 7, 8, 11, 13, 20, 21, 22, 23, 29, 30, and 31.

The particulars of the responsible persons of the comments are:

Director: Dr. Hiroshi Harada

Responsible person: Dr. Chin Sean Sum; Dr. Ming-Tuo Zhou

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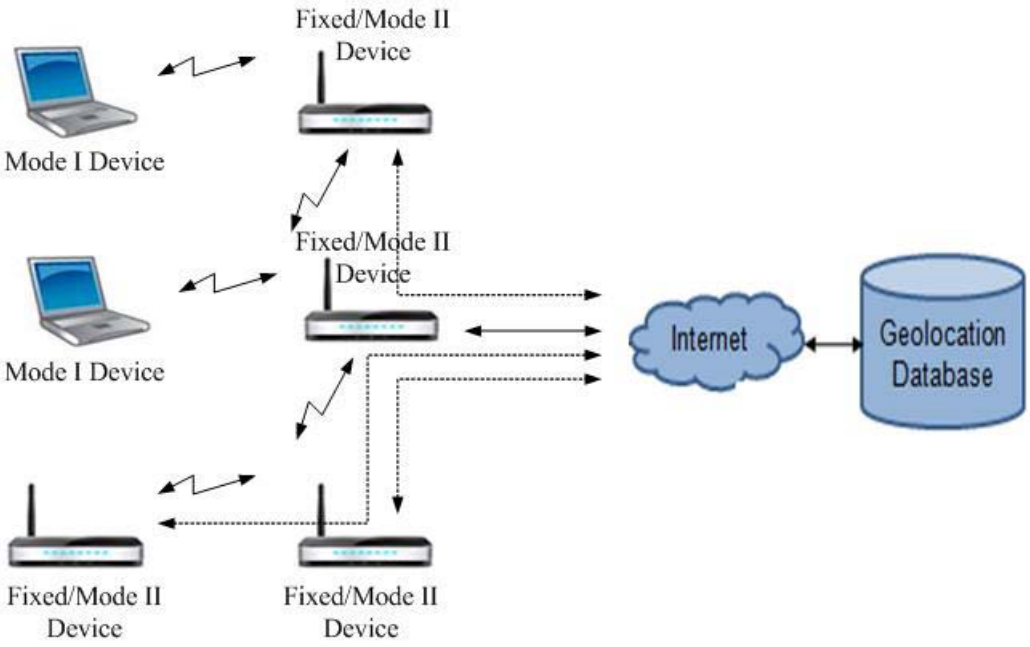
We hope that the comments could help on promoting use of TVWS spectrum in Singapore for more fruitful developments of both society and economics.

Best regards,
Hiroshi Harada, Chin Sean Sum and Ming-Tuo Zhou
NICT

Question #	Comments from NICT
Question 6: IDA invites views on the proposed general requirements for the database query and registration	To set the 'regular interval' is tricky. A flexible way could be like this: instead of requiring WSDs re-query database at regular interval, (1) a database may inform WSDs actively if there are any changes; or (2) when a WSD query a database, the database may inform WSDs about the expiration time of channels. When a channel expired, the WSD query the database again. Doing so allows a flexible 'updating interval'.
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.	50m requirement in (b) is too strict for a mobile WSD as virtually mobile WSD will need to query database all the time because of its mobile nature. We suggest that if the transmitting power of a WSD is less than 100mW, it does not need to query the database again if it moves less than 100m. Geolocation database should set a transmission boundary according to broadcast stations and try to avoid broadcast service area. As long as mobile WSDs are within the transmission boundary, the frequency on request for location update could be lowered.
Question 8: IDA invites views on the output power transmission of WSDs as shown in Table 2.	We think that there should be a mechanism to control transmission power of Mode I devices as if it locates far (e.g., several kilometer) from the Mode II device/Fixed device, it may introduce harmful interference as the maximum transmission power at its location is unknown.
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.	100mW EIRP for WSD is fine. To be more flexible and to improve utilization efficiency of the TVWS spectrum, we suggest that if a Fixed Device limits its transmission power level below 100mW in adjacent channels, it is allowed to transmit in the adjacent channels. With above approach, a Fixed Device may have more spectrum to communicate with WSDs that locate not far from it.

Question 13: IDA invites views on defining the OOB emission limits for WSD to WSD operations.	We agree to the idea of not specifying the OOB requirements for WSD to WSD in the regulatory framework. There are different types of technologies and industrial standards with varying specifications on OOB and other RF characteristics. It is thus difficult to specify an OOB requirement that satisfies all parties and it is best to leave this topic to be managed by the industry.
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.	For indoor case, even when GPS is not available, we suggest that as long as WSD can obtain its location position (either by wifi, cellular BS triangulation, etc) and if the database allows it to operate, it can operate normally as outdoor.
Question 21: IDA invites views on allowing the manual input and internal storage of geographic coordinates for indoor Fixed Devices.	//manual input and internal storage geographic coordinates// We agree with the view of IDA regarding manual input and internal storage of geographic coordinates for indoor fixed devices. Additionally, we suggest that such manual input concept could be extended to include Mode II devices as well. The rationale is that similarly to nowadays WiFi, home/office TVWS use case is expected to be widely adopted and aggregate bandwidth to IMS bands in order to provide cheap broadband to the population. We can therefore expect it to become a very popular TVWS application, if not the most popular one in regards to the percentage of population utilizing TVWS services (as compared to the percentage of population utilizing other TVWS application). Offices could take advantage of the “indoors fixed” devices professionally installed. However, we do not think that devices requiring physical fixation are appealing to the home user. In other words, we cannot expect users to screw a “fixed device” to his/her home walls, ceiling or floor due to the obvious inconvenience and aesthetic reasons. Having said so, if manual input is not allowed for mode 2 devices, home TVWS application will need to be either prohibited or we will face the risk of providing TVWS access to devices with low geolocation information accuracy. That is to say, provide TVWS access to those who relied in GPS technology despite the fact they are located indoors. Moreover, to allow manual input and internal storage of geographic coordinates means that the concept ‘in-build geolocation capability’ need to include the situation that a Mode II Device or a Fixed Device allows manual input and

	internal storage of geographic coordinates. //indoor fixed device & mode II device with fixed location & low-power fixed device// And we welcome the idea of an indoor fixed device. In our view, this opens up the gateway supporting a big fraction of application scenarios aligned to our current lifestyle. A good example is the WLAN devices providing broadband wireless internet for users. Furthermore, we even suggest to adopt concept of either 'low-power Fixed Device' or 'Mode II Device with fixed location'. Low-power Fixed Device has same capped maximum transmission power of 100mW. Such 'Low-power Fixed Device' or 'Mode II Device with fixed location' could be Wi-Fi access point, and it allows manual input and internal storage of geographic coordinates.
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.	We agree with the importance of having geolocation correctly input in order to avoid causing interference to incumbents. Additionally, we think that such feat is also possible by any user and not only restricted to professional services. What must be made sure is that previous to or during the installation process the installer provides information such as his/her name and contact address, e.g., home address, telephone number. Such information will allow the person to be contacted and held responsible in case interference to incumbents occurs.
Question 23: IDA invites views on the possible types of TVWS network topologies and use case scenarios.	We suggest IDA to clarify that indirect Internet connection is also included Figure 5 & 6. If indirect Internet is not included in Figure 5 and 6, we suggest IDA allows a Mode II Device to connect to Internet indirectly by way of a Fixed Device or another Mode II Device, same as FCC. Moreover, if indirect Internet connection is not included in Figure 5 and 6, , we suggest that IDA also allows a Fixed Device may connect to Internet indirectly by way of a Fixed Device or anther Mode II Device. Network topology of indirect Internet connection is shown in Figure 1.

	 Figure 1 Indirect Internet connection network Moreover, we see item 54(a) as a suitable deployment scenario for networks such as sensor networks and utility networks, where terminals are stationary sensors and meters. However, requirement on connectivity to the internet for each and every fixed terminal here should be relaxed as these terminals are commonly battery-powered and energy-constraint. We see item 54(b) as a suitable deployment scenario for Internet broadband networks with user terminals such as laptops or smartphones.
Question 29: IDA invites views on the proposed frequency of update for Time A validity and Time B validity.	When a WSD starts operation from certain time when Time A validity is going to expire , it may require a little bit longer time for WSD to obtain a channel or the Time B validity granted may be too short for certain WSD application to be properly used. If Time B Validity expires soon after a WSD updated with its database and some channel status changed, then this change only can be reflected to the WSD after duration of (Time B – Time A). During time (Time B – Time A), the WSD may introduce interfere to TV broadcasting or microphones. One approach may alleviate the above issue – if a database is capable of informing a WSD the channel status actively, then a WSD is not necessary to wait (Time B – Time A) so possible interference to TV broadcasting and microphones can be avoid timely.

	Therefore, we suggest a database has function of informing a WSD the changes of the TVWS channels. Based on the same principle, we also suggest IDA Service List is capable of informing a database the changes of TVWS channels actively for timely processing.
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.	IDA could offer a few choices of Time B validity per WSD's request in the condition that database information is not changed after update.
Question 31: IDA invites views on the benefits and costs of a requirement for WSD to report its operational parameters to the database.	For WSD to report its operational parameters to the database, additional resources at the database-end may be required to process the calculation. We suggest that this reporting may be application specified, which means only certain application that has higher risk of interfering should report its operational parameters. Reporting operational parameters would be helpful for identifying interfering WSDs. However, it also depends on the reporting system itself. If the interfering WSDs work in an ad hoc way, it may be hard to control unless the reporting system is able to identify interfering WSDs in real time. We can expect the high complexity of algorithm to identify the possible interfering WSD.