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August 30, 2013

Ms. Aileen Chia
Deputy Director General (Telecoms and Post)
Infocomm Development Authority of Singapore
10 Pasir Panjang Road
#10-01 Mapletree Business City
Singapore 117438

Re: CONSULTATION PAPER ISSUED BY THE INFO-COMMUNICATIONS DEVELOPMENT AUTHORITY OF SINGAPORE (IDA): PROPOSED REGULATORY FRAMEWORK FOR TV WHITE SPACE OPERATIONS IN THE VHF/UHF BANDS (17 June 2013)

Dear Ms. Chia:

Spectrum Bridge is pleased to offer the following response to the IDA's consultation on PROPOSED REGULATORY FRAMEWORK FOR TV WHITE SPACE OPERATIONS IN THE VHF/UHF BANDS.
As described herein, Spectrum Bridge has significant expertise in spectrum sharing technologies and services, especially in the area of TV White Space. Industry has proven the utility of the TVWS model, as demonstrated by the delivery of functioning solutions for the SWPG and we are ready and able to supply a commercial solution to IDA/Singapore.

While we believe the information we have provided is comprehensive, we welcome the opportunity to address any additional questions or concerns at your convenience.

Best regards,

Peter Stanforth, CTO
Spectrum Bridge, Inc.
peter@spectrumbridge.com

**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.

Spectrum Bridge strongly supports the license-exempt approach. This is consistent with the approach being adopted, or considered, by many other Regulators worldwide. Furthermore, the opportunity to grow the TVWS ecosystem in Singapore, provides additional scale and promotes continued development of devices and solutions which will be a direct benefit to the citizens of Singapore. There is every indication that license-exempt spectrum fosters innovation and complements the business and technology used in licensed applications. Cellular offload using WiFi is a simple example of this mutual benefit. As the demand for license-exempt spectrum use increases, allocating additional license-exempt spectrum will be critical to sustained growth.

**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.

An allocation of some specific (minimum) amount of TVWS for unlicensed use would mitigate concerns. The lack of certainty, as it pertains to TVWS spectrum availability, has been an impediment to faster adoption and use of TVWS in the US. Because the amount of spectrum available, not the specific channels or frequencies of which is critical, Spectrum Bridge asserts that certainty of spectrum access can be managed by policy, via the database even if the specific channels or frequencies are subject to change.

Another issue relates to the deterministic behavior required by certain radio networks and applications. In this case the idea is that certain devices (defined by radio type, owner, application and/or location) would have preference over other devices. This is sometimes described as Priority access or Lightly Licensed access. A Database is an ideal mechanism for implementing this function. Explicitly reserving certain channels for Priority access defeats the purpose of spectrum sharing and reduces the amount of available spectrum for all license-exempt users. The database can be aware of the channels that are designated for restricted service (by policy) and make them available for all devices until such time as a Priority user is identified as requiring access. During times that priority access is required other devices will be denied access to these channels. This mechanism can be implemented by policy (such that Priority devices are identified to the database) or by a process similar to PMSE registration (where the needs are registered in terms of time, location and channel requirements).

**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.

A TVWS database is able to prioritize and reserve access based on any combination of time, location, channel, device type or device owner, in much the same way that PMSE spectrum is

protected today. This allows IDA to add and change policy over time to balance the various needs of licensed and unlicensed users that rely on this band. Managing access as policy(s) that can be modified in a database is much more flexible and future proof than codifying dedicated channel use in the rules.

**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.

Spectrum Bridge fully supports the concept of utilizing idle spectrum until such time as it is repurposed for other use. The use of a database is an effective way of enabling this. Many current TVWS devices could access this spectrum if given permission.

**Question 5:**
IDA invites views on adopting a database approach as the mandated method to access white space spectrum.

A geo-location based database system has been chosen as the primary mechanism of managed access by a number of Regulators and it has been proven effective through almost two years of commercial operation in the US and in other trials and pilot projects around the world. Alternatively, a sensing based approach is a complex option that has not been widely adopted or matured beyond consideration as an alternative. Furthermore, a database is still required to track and implement secondary policy as it applies to protected services beyond television, e.g. PMSE. However Spectrum Bridge strongly supports regulation that allows for sensing to be incorporated into the spectrum sharing systems, as we believe sensing can be used to greatly enhance (but not necessarily replace) the services and usefulness of a geo-location based database management system.

**Question 6:**
IDA invites views on the proposed general requirements for the database query and registration.

The database systems deployed by Spectrum Bridge support all the requirements proposed by IDA, including database access and registration functions. Additional or enhanced features can be implemented to accommodate changes in policy.

**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 geo-location database.

Spectrum Bridge concurs with the three situations in which a WSD must query the database, as they are practical and consistent with requirements in other regulatory domains. Furthermore, 50m is a practical limit with respect to the mobility of a portable device, as long as the option exists to acquire channel data for nearby “areas” (50m x50m square cells) a priori, or for a larger area in an effort to increase efficiency and reduce transactional overhead.

**Question 8:**
IDA invites views on the output power transmission of WSDs as shown in Table 2.

Spectrum Bridge believes that the proposed maximum transmit powers are reasonable, as they are consistent with transmit power levels for unlicensed devices in many regulatory domains.

**Question 9:**
IDA invites views on allowing the Fixed Devices to have tunable output power that is capped at a maximum of 4 Watts EIRP.

It is reasonable to expect that devices be encouraged to use the minimum power necessary to avoid unnecessary interference, by regulation even if their maximum power is manually configured. However, a system in which a device may have a tunable maximum power, to facilitate operation at locations where operation at 4W would otherwise not be permitted is an effective means of maximizing access to white space. In this case, the database would provide the maximum permitted transmit power, per channel, in addition to the list of available white space channels.

**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.

Spectrum Bridge agrees that al WSDs should have a unique identifier. This will facilitate device level security/authentication and the ability to uniquely identify and disable certain devices that may be the source of undesirable interference. Standardized identifiers are clearly preferred, but the IETF PAWS protocol is defined in such a way, and the databases implemented such that this is desirable rather than mandatory feature.

**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.

In the relatively small geographic area that is regulated by IDA the use of a simple adjacent channel rule is practical, simple to manage and congruent with other incumbent interference mitigation parameters.

**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.

Spectrum Bridge believes the adjacent channel band edge limit for fixed devices remains as perhaps the biggest impediment to realizing the full potential performance of TVWS. It virtually eliminates all but exceptionally filtered and non-standard waveforms.

The FCC limit is an impediment to WSD development but it has very little evidence or rationale to support it, particularly for fixed devices. The -55 dB limit at the band edge (adjacent channel) emission limits in the US:

See FCC 12-36A1, paragraphs 21-34.

http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-12-36A1.pdf

PMSE and other devices (other than TV) operate in adjacent bands, so this would be a primary driver of the adjacent channel limit (and associated buffer distances). In the US, that this value has been discussed extensively, but a derivation has never been quantitatively published or defended.

Reference FCC 08-260A1, section 3, paragraphs 233-236.

http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-08-260A1.pdf

An interesting [FCC] excerpt from FCC 08-260A2, paragraph 236: "While we believe that the emissions mask is less critical for fixed device that will not operate on adjacent channels, we will require those devices to comply with the same mask as personal/portable devices."

In fact, +23dbm is the maximum power achieved by any certified radio to date, 7 dB less than the +30 dbm (conducted power) limit. In addition, the band-edge requirement also has the effect of reducing the effective bandwidth of the channel.

It should also be noted that there were pre-2008 discussions regarding the original proposal for the -55 dB limit. However very little in terms of quantitative analysis was provided and many of the original assumptions are no longer valid.

**Question 13:**
IDA invites views on defining the OOB emission limits for WSD to WSD operations.

This is not necessary, especially in an unlicensed band. The adjacent channel emissions limits required to protect licensed services are already very protective and more restrictive than emissions requirements applied in other unlicensed bands. The innovation historically applied by industry in unlicensed bands will mitigate potential issues. Furthermore, the most efficient venues for addressing compatibility issues between unlicensed technologies are industry working groups and standards organizations. Any further constraints regarding OOB emissions will impact the utility of unlicensed TVWS.

**Question 14:**
IDA invites views on the proposed approach to manage coexistence between a WSD and the other secondary services within the TVWS channels.

Spectrum Bridge supports methods being developed within industry to promote and manage the coexistence between WSDs and other secondary users at the radio and database level. Both the FCC and Ofcom have proposed a process by which these secondary users are identified and registered by the database and both provide protection criteria. Current FCC rules require a variety of protection criteria which could be supported in Singapore. These range from a point and radius, to polygons and complex shapes (e.g. keyholes).

**Question 15:**
IDA invites views on the proposed propagation model and parameters used to determine the maximum transmission power level of a WSD

The proposed mechanism to support protection of secondary users are reasonable. However, the Hata-urban or -suburban variant is perhaps the most practical and been shown to yield the most realistic results. A free space model is entirely unrealistic as it overprotects, especially in an urban environment with antennas near ground level and within clutter. Alternatively, the LR model is unnecessary complex for this application. There are two ways to implement protection criteria. The first is to rely on the database to calculate the required protection parameters (maximum transmit power as a function of separation distance) using the propagation model. However, because Singapore is a relatively small area and the number and type of secondary users is small, it may be more effective to create a table of protection criteria based on device type and distance. While not as flexible, this will yield consistent results that can be easily replicated and validated in the case that multiple databases are authorized.

**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

The concept of safe harbor channels for license-exempt wireless microphones is interesting, but not entirely useful in practice. Wireless microphones do not typically have the dynamic range to cover the entire UHF band, so it possible that an existing microphone may not be able to access the safe harbor channel. Furthermore, the channels reserved for this use may be far from the most useful (in terms of potential interference). Consequently, unlicensed microphone users may in fact be better served by simply using a channel available for TVWS.

In practice there are a number of channels that are restricted or unavailable to WSDs and these can be identified by location and time and users of license exempt microphones can use this information to determine how to avoid WSDs. (See Figure 1 below)

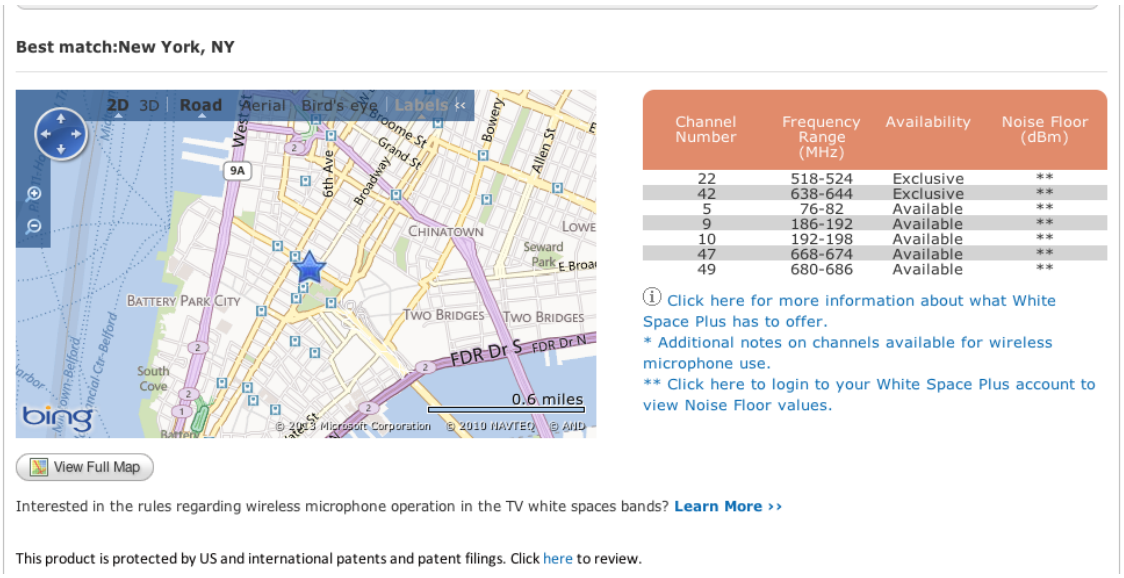



Figure 1

**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.

The Spectrum Bridge prototype database(s) deployed in Singapore include a wireless microphone registration interface similar to the one required by the FCC. This system enables authorized users of wireless microphones to register for protection. The database(s) automatically share and synchronize wireless microphone registration data. Specifically, the system is designed to protect PMSE users that rely on microphone channel use for critical events, in which adequate spectrum may not otherwise be protected or available.

**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.

A demarcation zone as proposed, is a simple and expedient method of protecting neighboring TV operations in other domains. It should be noted that the prototype databases also include information about TV station operations in Malaysia and Indonesia, and can manage the necessary protections in a way similar to the process employed by the FCC (See Figure 2 below). Spectrum Bridge believes that this information is accurate and can be monitored by Regulators provided it remains publicly accessible. It should also be noted that through the flexibility of the database, protection criteria can be updated or modified as required.

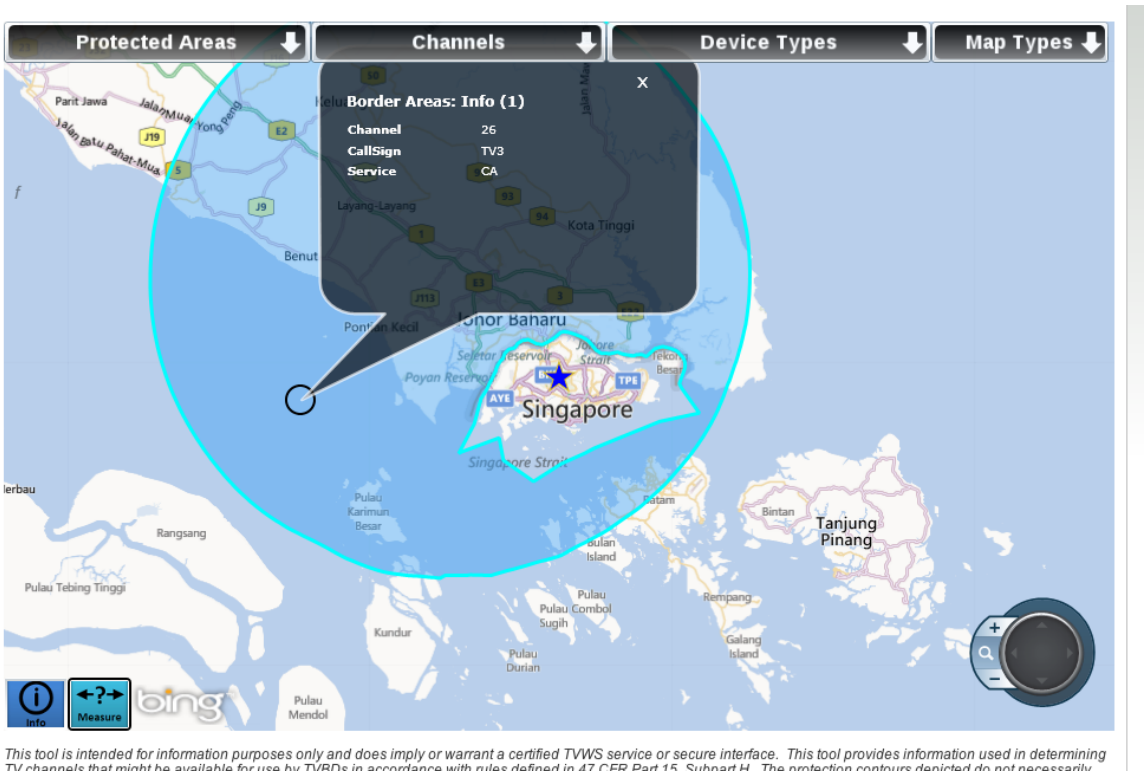



Figure 2

**Question 19:**
IDA invites views on the aggregate interference effect of WSD and whether any adjustment in terms of technical requirement is needed.

The impact of aggregate interference is a hypothetical concept that relies on unrealistic operational scenarios and has never been identified as an issue in commercial or trial deployments to date. Based on practical experience, Spectrum Bridge suggests that no further action be taken. If this type of scenario eventually manifests itself, the problem can be addressed via a database solution. This presents a strong argument in favor of deploying policy based spectrum management databases to manage spectrum access. As previously mentioned, a geo-location database is capable of adjusting the maximum transmit power allocated at a given location, channel, time, or device type, to reduce the impact of aggregate interference in situations where dense numbers of WSDs are deployed.

**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.

50m accuracy is reasonable and practical requirement for location accuracy. The IETF PAWS protocol supports a location accuracy/confidence factor and based on suitable and appropriate validation, the database could make use of more or less accurate location to access to white space. It should be noted that technologies, other than GPS, are capable of providing greater than 50m accuracy under certain conditions.

**Question 21:**
IDA invites views on allowing the manual input and internal storage of geographic coordinates for indoor Fixed Devices.

Manual input of coordinates is a practical alternative for an otherwise challenging dilemma. However, manual input should only be permitted by "professional installers", which can be monitored via the registration process and publically available registration data.

**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.

Installation of indoor fixed devices (without auto-location capability) should be performed by a professional installer, to prevent mischief. The notion of approval of professional installers is valid and perhaps require participation in an appropriate training course. This provides checks and balances afforded by the registration system and publicly available data. Some database solutions can also be enabled/required to track the installations and ensure that they are compliant with the rules.

**Question 23:**
IDA invites views on the possible types of TVWS network topologies and use case scenarios.

It has been our experience that a wide range of network topologies and use cases have been utilized for white space applications and it is likely that there will be more in the future.
To date we have witnessed:

- Point to Point solutions in which white space is used to provide backhaul to isolated locations.
- Point to Mulipoint applications servicing intelligent agriculture, industrial telemetry, smart city, rural broadband, and enterprise applications.
- Broadcast solutions for digital signage and content distribution applications.

All of these applications have used the concepts of shared spectrum, managed by a database.

**Question 24:**
IDA invites views on the payment of fees for the use of database services.

Spectrum Bridge believes the database solution should provide protection to incumbents and existing users with no fees. However, the database can be used to offer value added (fee based) services to incumbent users, on an entirely voluntary basis.

Service provided to TVBDs is generally covered by a business relationship between the device manufacturer and the database provider. The fees associated with on-going support for TVBDs is negotiated between the manufacturer and the database provider. There are a number of possible business models and fees related to the levels of service the manufacturer requires, as well as the volume/number of devices the database will serve. These business models have

been proven in the US commercial market and it expected that similar business models will exist in other regulatory domains, including Singapore. Database providers are also offering value added services to the device manufacturers and networks operators that extend beyond the basic regulatory requirements.

**Question 25:**
IDA invites views on both approaches in managing the database (i.e. industry-managed or government-managed database).

The majority of regulators have chosen to support an environment where multiple industry supported databases exist. This model is currently working in the US, in which there are currently three certified databases with three additional database providers in the certification process. Industry supports this framework for two reasons. First, the competitive environment ensures competitive pricing and efficient service. Second, not all applications and services require the same set of services. Therefore, in the case of multiple databases, various business models can be supported. Examples include basic service versus highly reliable and managed service, or mobile devices versus fixed services, or commercial versus residential services. Each necessitates different cost models. It should also be noted that white space technology and regulation are still evolving. Therefore, industry is better equipped to respond through a healthy, diverse and evolving market place.
A question that must be addressed by IDA (within the context of questions 25, 26 27) is what happens if a specific database operator ceases operations? We recommend that this be addressed in the certification process. There is no one "right" answer but satisfying IDA that an appropriate contingency plan is in place becomes a criteria for certification. With the broad interest from multiple parties it is unlikely that all databases would cease to exist, and as standards such as IETF PAWS, come into effect, the ability for a radio vendor to update the firmware to communicate with an alternate database is fairly straightforward.

**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

Spectrum Bridge has developed an extensible platform that supports all varieties of TV White Space spectrum management. This solution supports commercial service in the US today. It also provides the basis of the solution we are developing for Ofcom, Industry Canada, and the solution deployed for IDA. Our current Singapore solution will require minor adjustments and enhancements to comply with final IDA requirements, but this is entirely self funded.
Spectrum Bridge is interested in supporting a commercial TVWS database solution in Singapore. We may choose to do this directly or through a partnership with an existing Singapore based entity. We have no requirement for funding or cost recovery from IDA.

The solution will support WSD manufacturers as described previously and it is unlikely that there will be any fees required for basic operation from TVWS users. We do anticipate providing optional, value added services to manufacturers and end users.

In the US, ten companies expressed interest and qualified as provisional database providers. Several more have submitted requests to participate in the Ofcom pilot project and three database providers are substantially involved in the current Singapore trial so there is clear industry support for providing database services.

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

The assumption on which these comments are based, is the relationship between IDA and the database provider is such that the database provider acts as an agent or service provider to IDA. It is important to maintain the proper regulatory authority, i.e. the database provider is not an enforcer, but executing IDA policy in accordance with IDA requirements. Beyond situations in which the database may be operating in error, all issues (licensing and conflict resolution) remain as IDA responsibilities. The database will provide service to WSDs through a direct business relationship with a device manufacturer or network operator. Only WSDs covered by one of these relationships will be served by the database. Note that in the US, some WSD manufacturers have relationships with more than one database provider. One question IDA should consider is "how WSDs serviced by a database will continue to be serviced, should the database provider no longer be in a position, or desire, to operate". IDA should also define a process for validating and authorizing databases, as well as a method to deal with operational issues, up to and including removal of a database authorization. Similar conditions are in place for databases operating under FCC authority. Ofcom has proposed similar conditions for their pilot project.

**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 proposed approach for accessing authorized database administrators is consistent with the methods being adopted by Ofcom. No known technical issues or concerns.

The proposed approach for WSD to Database communications is supported by the IETF PAWS draft standard. No known technical issues or concerns.

**Question 29:**
IDA invites views on the proposed frequency of update for Time A validity and Time B validity.

The frequency required for a database update of information for protected entity information is directly related to the frequency of update of the channel availability of the WSD. For example, it is not logical to update the regulatory information every 15 minutes, if a WSD channel

requests are required once every 24 hours. However, the database can be configured with any query interval that is appropriate (e.g. 6 hours). In the US, changes in PMSE registration data are propagated and made available within 15 minutes. Whereas the database is only required to query the TV station data once per day. The current database supports an IETF PAWS construct that permits variation of the "Time Validity B" from 0-24 hours, with the US default being 24 hours.

**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.

Given the flexibility of the current database implementation, [dynamic] adjustments to these time parameters would be transparent to operations.

**Question 31:**
IDA invites views on the benefits and costs of a requirement for WSD to report its operational parameters to the database.

Obtaining information on channel selection or use is valuable. If this information can be provided without undue burden, it should be captured. However, there are two implications when considering this capability. The first is the "cost" of tracking the channel use by devices. The cost of capturing and maintaining this information is minimal, especially if the channel selection is fairly static and recorded over a period of weeks. However if the device is required to re-report every time it hops from one channel to another, during the day the burden or storage and transport overhead could be quite high. Perhaps the requirement could be clarified to specify the period in which data is stored and if multiple channels could be stored of channel hopping is employed.

**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

Other regulatory agencies have not mandated a requirement for low power devices to register with the database. However this could be useful and is entirely feasible. A database is able to track channel queries as a function of time, location and device identity. It is commonplace to require high power fixed devices to register with the database, including the information identified by IDA. Current database solutions are capable of capturing and storing this information. It is also reasonable for IDA to require the database to retain this information for the purposes of resolving issues related to potential interference with incumbents. It does require IDA to determine how this information is to be treated. In the US, FCC rules require that the registration data be shared between databases and made publicly available. IDA may adopt similar requirements or choose alternate methods based on privacy or security considerations.

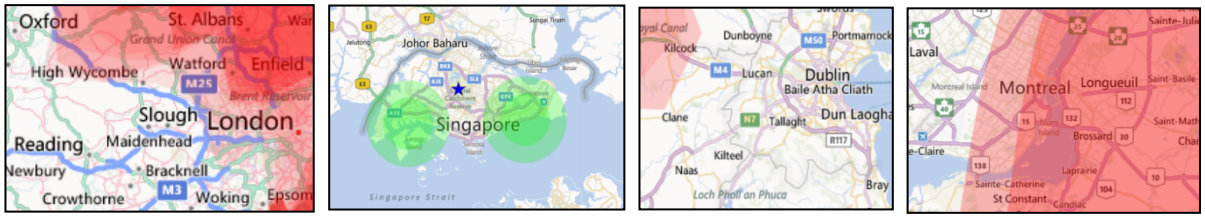
## About Spectrum Bridge

Spectrum Bridge, Inc. (SBI) was founded in 2007 by a seasoned team of wireless entrepreneurs and technologists on the premise that wireless market dynamics would change the way spectrum is allocated and managed today. As a result, we have created technology that improves spectrum utilization and availability.

Our mission is to virtualize spectrum with cloud-based software solutions that dynamically allocate and manage spectrum for next generation wireless networks. As a recognized thought leader in spectrum management globally, the company has employed a continuous innovation process of developing technology that has produced seminal Intellectual Property for dynamically managing spectrum.

Until now, spectrum allocation has been archaic, expensive and inefficiently managed. Our solutions are unlocking the value of spectrum by enabling high-speed and low-cost bandwidth across wireless networks and applications with our unique, patented spectrum management technology. Service providers and network operators will now be able to access and allocate both exclusive and shared spectrum through the Spectrum Bridge Authorized Shared Access (ASA) platform that promotes cooperation and sharing of spectrum between all types of wireless users.

A critical component of Spectrum Bridge's ASA platform is a TV White Space database, certified by the FCC as the first TV White Spaces database in 2011. This was the first time the FCC has adopted a database solution to automate the allocation and management of wireless frequencies. As a leader in this industry, our current product development efforts are focused on extending this technology and developing products to facilitate the next generation of cognitive wireless systems. These systems enable co-existence and real-time, priority-based, allocation of licensed spectrum. Spectrum Bridge has also developed prototype TVWS database solutions for Ofcom (UK), Ireland, Industry Canada and IDA Singapore to aid regulatory bodies in exploring the effects of various policy decisions on usability.




Authorized Shared Access (ASA) is Spectrum Bridge's unique and patented spectrum management solution, which enables methods of dynamic spectrum allocation. ASA extends the *Managed Spectrum Access* technology model by allowing network operators and end users to manage spectrum availability and fulfill spectrum needs in specific terms: frequency, geography, time, intended use, cost and quality of service. ASA also provides the means to provision and allocate licensed spectrum. In order to cope with this level of complexity in real-time, a matching engine has been developed to execute the spectrum allocation process according to provisioned constraints. Network operators may provision an array of spectrum

management policies such as interference parameters, transmit power, consumption limits, co-existence thresholds and allocation methodologies. This centrally managed implementation eliminates the need for complex and costly subscriber radios, increases spectral efficiency and provides network operators with a comprehensive real-time view of network performance.

The company has developed graphical information system (GIS) tools, databases, search agents, mobile applications and other proprietary software solutions that allow spectrum holders to better manage and monetize spectrum. We have extensive experience in virtually all spectrum bands including: VHF and UHF TV bands, Broadband PCS, 1/7/2.1 GHz AWS, 700 MHz, 2.3GHz WCS, 900 MHz, UHF/VHF, 220 MHz Maritime, NB & IVDS, 2.5 GHz (EBS & BRS), 800 MHz, and 24/39 GHz microwave spectrum.

Our recognition as the leader in spectrum management and spectrum valuations has positioned Spectrum Bridge as a primary resource for regulatory agencies both domestic and abroad. We have advised regulators in rulemaking processes, policy changes and future wireless initiatives as a result of a close working relationship with the FCC, both at the staff and Commissioner level. Spectrum Bridge also regularly advises other government entities and regulatory bodies globally, including Ofcom, Industry Canada and Singapore IDA on spectrum issues.

Our online spectrum exchange represents numerous types of commercially licensed spectrum, which allows the company to acquire the most up to date market pricing for all types of spectrum. Frequent visitors and users of the system include major carriers, broadcasters, transportation authorities, energy and utility companies, major system integrators, local and state government agencies plus many more.

Spectrum Bridge has also provided detailed valuations and spectrum consulting services for a host of clients including financial institutions, legal firms, private enterprises, and individual spectrum license holders. SBI's customers use our expertise and data to formulate license selling and leasing strategies, gain access to spectrum, create Requests for Proposals, determine auction strategies, and design leasing models to accurately forecast financial returns on their spectrum.