

January 24, 2013

VIA ELECTRONIC FILING

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th St SW
Washington, DC 20554

Re: ET Docket No. 04-186 Unlicensed Operation in TV Broadcast Bands

Submission for the Record

Dear Ms. Dortch:

Since October 2012 Key Bridge has been engaged with representatives of the Office of Engineering and Technology as they conduct an evaluation of our system for White Space administration.

In this document we wish to memorialize the current status of review and, we hope, to provide additional context, supplementary explanations and references to on-line resources that we hope will help the Commission complete its review and proceed expeditiously with the public trial of our White Space System.

Introduction to the Key Bridge White Space System

The Key Bridge White Space System consists of four web portals, each configured to support the other with different core functions. These are:

- Account

The Key Bridge Account Management System provides a single centralized resource for user credential management. This is the starting point for all users to register their user name and password when creating a new Portal account. The Account Management System also supports secure password change and reset plus enables users to review an audit trail of their account history.

The Account Portal is located at: <https://account.keybridgeglobal.com>

- API

The Key Bridge API, Tools & Developer Resources Portal provides third-party applications with programmatic access to many of the features, functionality and calculating engines within the Key Bridge White Space system via secure web services. The API Portal provides a catch-all of useful features and developer resources including extensive documentation, a demonstration showcase, a data browser for various raw source databases such as CDBS, ULS, etc., and links to download our open source software reference client and daily White Space database export.

The API Portal is located at: <https://api.keybridgeglobal.com>

- Peering

The Key Bridge Peering Portal provides on-line resources, utilities and automated web services to support database synchronization and peering between Key Bridge and other authorized White Space administrators. The Peering engine supports the open *Wireless Service Information Format Distribution and Exchange* specification and will be extended as required to support the

proprietary WSDBA implementations for bilateral peering.

The Peering portal is located at: <https://peering.keybridgeglobal.com>

- White Space

The Key Bridge White Space Portal is a publicly available version of the Key Bridge Community Portal operated and maintained by Key Bridge for public use. This on-line resource provides tools and utilities to help the public review and register protected wireless services operating within the United States, register unlicensed White Space devices operating as fixed infrastructure and at high-power, and learn more about spectrum occupancy and database-mediated spectrum sharing.

The White Space portal is located at: <https://whitespace.keybridgeglobal.com>

Database Review

Key Bridge has established and maintained daily mirrored copies of many FCC databases including CDBS, ULS, IBFS, COALS and EAS since 2008 and 2009. We have been extracting White Space-compliant records from these FCC databases since mid-2009 and our database extraction routines are regularly updated to reflect changes in guidance and updated information in and about the FCC databases and tables.

We currently extract, inspect and process over 16,000 records daily from various FCC and Industry Canada database to build and maintain the core set of protected entity records in our White Space database.

The Key Bridge White Space Database Export includes a completely documented logical data model to simplify third party data import and analysis.
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- Data Export

Every day Key Bridge provides an updated bulk data export of our White Space database for download. This is publicly available at no charge from the 'Data Export' page on the our API portal (sign in required) at:

<https://api.keybridgeglobal.com/api/download/data.xhtml>

- Data Browser

Users may also search, query and browse records our White Space Database on-line via our White Space Portal Data Browser application. The Data Browser enables simple and fast online search, review and exploration of very large databases. This is publicly available at no charge from the 'Explore' section of our White Space portal at:

<https://whitespace.keybridgeglobal.com/content/explore/database/index.xhtml>

Status of Database Review

Database evaluation so far has primarily been a matching of call signs found in our and other system's data export files. When discounting for invalid or non-transmitting records the Key Bridge database call signs better match the Spectrum Bridge and Telcordia databases than they do each other.

However, neither Spectrum Bridge nor Telcordia identify the source data record in their exported data records, and so it is not possible to confirm with certainty that our databases exactly match. However the strong correlation and overlap of call signs is a positive indicator that the same source records are being referenced.

Key Bridge identifies the source data record to simplify end-to-end validation of our database build strategy.

Concerns about Further Comparison

Our concerns about the Telcordia system mirror those expressed earlier about the Spectrum Bridge system.¹ However, while we do not expect that our System's channel list results will differ from those provided by Spectrum Bridge or Telcordia, except perhaps that neither provides a publicly available channel calculator that incorporates the required separation distances from 15.712(a)(2)², we fear that it will be impossible for us and for the Commission to identify and resolve the source of any discovered discrepancy between our systems with a reasonable amount of effort and in a reasonable amount of time. We believe that it would not be fair to hold Key Bridge responsible for the resolution of any such discrepancy, if discovered, given the lack of detail provided in the Spectrum Bridge and Telcordia database exports, the extreme difficulty to use their graphical contour browser (one requiring a proprietary web browser extension which we do not support), the inability to reference individual call signs from their on-line systems, and the absence of any public API for software-based analysis.

We believe that our White Space System more than satisfies all of the requirements identified in the Rules and supplemental guidance, and that our System should be reviewed by the Commission and the public on its own merits.

A Example

Spectrum Bridge and Telcordia provide only one entry in their data export file for Land Mobile stations, whereas Key Bridge provides one entry per transmitting station. Neither Spectrum Bridge nor Telcordia provide a publicly available mechanism to inspect individual stations or call signs. It is not possible to verify that their underlying protection of multi-station Land Mobile services matches ours.

As an example, WGH876 is a Land Mobile system that requires a dedicated White Space contour. Our data export file includes 137 locations for this call sign, whereas Spectrum Bridge and Telcordia both identify only one.

This one call sign, and our inability to objectively verify whether a given record is correctly represented in the Telcordia or Spectrum Bridge databases, is a contributing factor to the concerns described above.

1 See Comments of Key Bridge Global LLC Regarding Public Testing of Spectrum Bridge Inc.'s TV Bands Database System, Submitted 11/29/2011

2 As amended in the Third Memorandum Opinion and Order, Adopted April 5, 2012.

Details of our protection for WGH876 are shown below and may be viewed on the White Space Portal at:

<https://whitespace.keybridgeglobal.com/content/explore/database/wsif/detail.xhtml?uuid=ebffca00-ce9a-4e30-bdfa-2c9ac6b615b7>

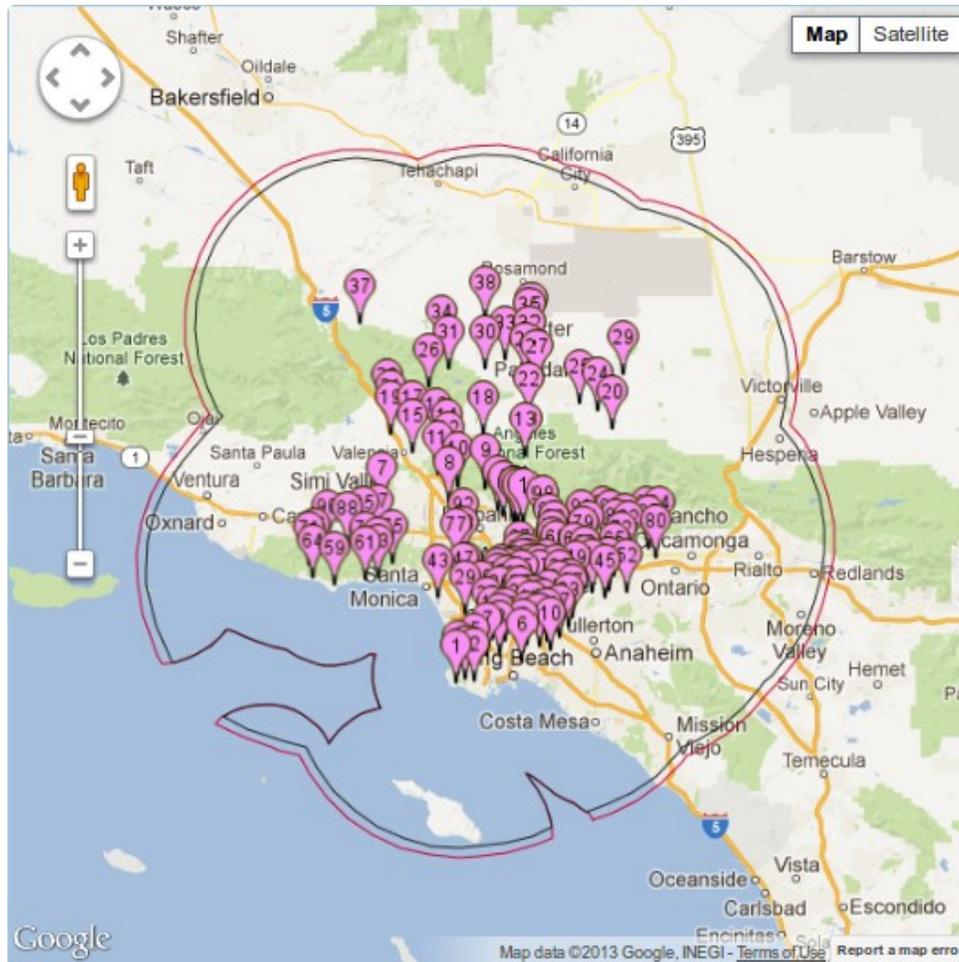


Illustration 1: Protected contour around WGH876 showing 137 site locations, co-channel (red) and adjacent channel (grey) contours and cutouts from the international maritime border.

Registration Work Flows

The Key Bridge White Space Portal includes a number of automated, interactive on-line forms to register licensed and authorized wireless services to receive interference protection from unlicensed White Space devices. This includes:

Registration forms are streamlined and data driven. Most all reference information and option choices are automatically calculated and offered when you need them.

- MVPD Sites as required under section 15.715(c)
- Temporary BAS facilities as required under section 15.714(c)
- Sites / Venues where Part 74 licensed and unlicensed wireless microphones are used on a regular basis as required under section 15.715(d)

The registration overview page on the White Space Portal provides a direct link and further explanation for each forms functionality. This page may be viewed at (sign in required):

<https://whitespace.keybridgeglobal.com/secure/register/>

- Enabling Call Signs

All registration activity on the White Space Portal requires a call sign or call sign equivalent, and call signs must be enabled in a user's account prior to use in a registration form.

Call signs must be enabled to an account and all transactions are logged. This discourages unauthorized or fraudulent use.

FCC-issued call signs and call sign equivalents may be identified and enabled using the 'License Authorization' utility under the 'Account' menu item (sign in required).

- MVPD Receivers

This on-line form enables users to register Multichannel Video Programming Distributor (MVPD) Receive Sites (e.g. Cable Head Ends, Satellite Earth Stations and Up Link Facilities) to receive interference protection from unlicensed White Space devices.

For MVPD Station registration we have simplified the users data entry requirement as much as possible. The user need only identify their receive location, after which our system will automatically calculate and present a list of possible stations that may be received at that location without a waiver. The user then only needs to select their call sign of interest and verify the receive channel.

Key Bridge automatically builds all MVPD stations granted waivers in FCC DA 12-845

The form is available on the White Space portal under the 'MVPD Receivers' item in the 'Register' menu (sign in required).

Per FCC Guidance, users may also use this form to register point-to-point TV translator relay stations that re-transmit signals received off-the-air.

- Temporary Broadcast Auxiliary Service links (STL, TSL, RPU, ENG)

Similar to the MVPD work flow described above, users may use this form to identify, configure and register Temporary Broadcast Auxiliary Services to receive interference protection from unlicensed White Space devices.

The form is available on the White Space portal under the 'Temp. BAS Links' item in the 'Register' menu (sign in required).

- Wireless Microphone Events and Venues: LP-AUX Licensed

This on-line form enables users to register an event and venue where licensed wireless microphones operating under a Part 74 or Part 73 license and call sign are used. Once registered the event or venue location will receive interference protection from unlicensed White Space devices.

The form is available on the White Space portal under the 'LP-AUX Licensed' item in the 'Register' menu (sign in required).

- Wireless Microphone Events and Venues: LP-AUX Unlicensed

This on-line form enables users to register an event and venue where licensed wireless microphones operating under Part 15 and having received a call sign equivalent authorization from the FCC. Once registered the event or venue location will receive interference protection from unlicensed White Space devices.

The form is available on the White Space portal under the 'LP-AUX Unlicensed' item in the 'Register' menu (sign in required).

- White Space Devices: Access Points

Key Bridge requires that all unlicensed White Space devices (WSD) are enabled on our System prior to communicating with our System. This quick and easy process is necessary to ensure compliance with White Space Rules and provides information necessary to establish a trust relationship between the Key Bridge White Space System and the WSD for automated authentication, authorization and encrypted machine-to-machine data exchange.

We provide a user-selectable list of all certified WSD FCC ID numbers. Users need only provide a device serial number.

To begin operation a WSD must still receive a valid channel list from the Key Bridge White Space System. After it is enabled (and configured if required) all further communication between the WSD and Key Bridge White Space System should be automatic and not require user intervention.

We envision and hope that devices will be enabled en-bulk by their manufacturer. The process is automated, anonymous, simple and free of charge. However, consumers may also easily enable a device directly on our Portal by entering the device FCC ID and Serial number.

The form is available on the White Space portal under the 'Enable Devices' item in the 'Register' menu (no sign in required).

- White Space Devices: Fixed Infrastructure

In addition to being enabled, Fixed (permanently installed, high-power) unlicensed White Space Devices must also register their installation configuration prior to receiving White Space Frequency lists for operation. This simple extra step is required to ensure Rules compliant operation by the Key Bridge Portal and, to the extent possible, by the WSD.

We understand the Commission desires a system where a WSD informs the Database of its entire configuration each time it contacts the Database, and that a human should not separately contact the database to enter this information. The *White Space Device Messaging* document, part of the *Wireless Service Information Format* specification, includes this capability and the Key Bridge White Space System supports zero-touch enablement of Fixed, high-power WSDs that implement the *White Space Device Messaging* specification. However, professional installers of devices that do not support this specification must manually register each device installation.

The form is available on the White Space portal under the 'Register Networks' item in the 'Register' menu (no sign in required).

Register Low Power Auxiliary Stations (Licensed)

Authorizing Information

The authorizing Part 74 (Low power auxiliary station) or Part 73 (Broadcast station) call sign issued to you by the FCC.

Call Sign or Equivalent [Ⓜ]
Select One

Not showing?
 Enable your call sign

Registration Information

Provide a clear name and concise description to help you identify this registration later.

Name [Ⓜ]

Description [Ⓜ]

You may also add any number of annotated notes to this registration as label/value pairs.

Annotations [Ⓜ]

Label [Ⓜ] Value [Ⓜ] +

Operating Schedule

Identify event the start and end dates here. Also indicate if the event will repeat by configuring its recurrence. (e.g. every day at Noon)

Start [Ⓜ] 01/24/2013 00:00 End [Ⓜ] 01/31/2013 23:59

Set as full time [Ⓜ] Recurrence

Timezone [Ⓜ] America/New_York ? Schedule help

Operating Location

Use this utility to positively identify and describe your geographic operating location. Available input options are:

1. Select [Address] tab to search on a physical address.
2. Select [Coordinate] tab to enter your geographic coordinates and geodetic datum.
3. Select [Geometry] tab to input an extended or complex geographic area.

LP-AUX Location Input Selector [Ⓜ]

Address Coordinate Geometry

Address [Ⓜ]
1600 Tysons Blvd., Suite 1100, Mclean, VA

Illustration 2: Input forms include clear instructions, automated data processing and input validation.

Unlicensed Channel Availability

White Space channel availability is calculated according to the geographic separation between an inquiring unlicensed White Space Device (WSD) and licensed or protected wireless service areas. For operation within the United States a television channel is considered available for unlicensed White Space operation if the inquiring device (plus any separation buffer) is not within a protected wireless service area. WSDs require a supplemental separation buffer whose distance depends upon the WSD type (e.g. FIXED versus MODE-II Access Points), installation location and antenna configuration.

A White Space channel availability calculation requires many input variables which are drawn from a WSDs current operating status and location. This does not pose a problem for automated machine-to-machine communication but can make it difficult for users to browse, evaluate and survey White Space channel availability or to study what-if scenarios. Key Bridge supports two modes of access to our channel calculation engine: Automated Access for Devices and software clients, and Browser-based Access for on-line inspection and evaluation.

- Automated Access

Devices and software clients may access the API White Space web service for programmatic access to the White Space database, to conduct location-aware spectrum search and analysis, and for other interactions with the Key Bridge White Space System. Through the Web Services API a programmer can develop third party applications that incorporate advanced White Space analysis capabilities, location-based spectrum occupancy, and more.

WSDs and Software clients can easily get location-based White Space information using our API and Web Services.

All API web services use the *Wireless Service Information Format (WSIF)* specification. An open-source reference software client and WSIF data model implementation is also available for download from the API Portal at:

Key Bridge provides an open sourced web client and reference data model software.

<https://api.keybridgeglobal.com/download/index.xhtml>

The White Space Spectrum Occupancy & Availability web service includes the following public services that are freely available for non-commercial use:

- Find Available

This method supports unlicensed White Space Devices. It takes as its input a WSIF WhitespaceQuery object describing the query client device, location and operating parameters. It returns a validated WSIF WhitespaceResponse object containing a list of available channels calculated for the FCC-certified device and location identified in the WhitespaceQuery. More information is available on the API Portal at:

<https://api.keybridgeglobal.com/documentation/whitespace/find.xhtml>

- Find Reserved

This method supports wireless microphones. It takes as its input a geographic location and returns a validated WhitespaceResponse object containing the two reserved channels for wireless microphones above and below channel UHF37 at the indicated

geographic coordinate. More information is available on the API Portal at:

<https://api.keybridgeglobal.com/documentation/whitespace/reservedGet.xhtml>

This document section demonstrates satisfactory implementation of the following requirements:

- maintain required communications with WSDs

However at this time we do not request evaluation of our System with any particular WSD.

- Browser-based Access

We have created two on-line resources to simplify evaluation of our White Space channel availability calculator. These are: the Spectrum Explorer application and a Channel Calculator demonstration.

- Spectrum Explorer

The Spectrum Explorer application provides an excellent generalized spectrum occupancy overview with a simple and easy to use mapping system and direct cross-linking to the underlying wireless services. The Spectrum Explorer is designed to enable Consumer inspection and survey of White Space availability and does not provide details for all the various Fixed device type configuration options.



The Spectrum Explorer is available on the White Space portal at:

<https://whitespace.keybridgeglobal.com/content/explore/spectrum/index.xhtml>

- Channel Calculator Application

The White Space Channel Calculator application provides a detailed list of every possible channel availability option at a given location. This resource does not provide linking to the underlying services but does enable a comprehensive view of how channel availability varies at a given location for Fixed devices based upon their antenna installation.

CH	FIXED										MODE II		LPAUX
	<3	3-10	10-30	30-50	50-75	75-100	100-250	250-200	200-250	100	40		
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
5	X	X	X	X	X	X	X	X	X	X	✓	X	
6	X	X	X	X	X	X	X	X	X	✓	✓	✓	
7	X	X	X	X	X	X	X	X	X	✓	✓	✓	
8	X	X	X	X	X	X	X	X	X	✓	✓	✓	
9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10	✓	✓	✓	✓	✓	✓	X	X	X	✓	✓	✓	
11	✓	✓	✓	✓	✓	✓	X	X	X	✓	✓	✓	
12	X	X	X	X	X	X	X	X	X	✓	✓	✓	
13	X	X	X	X	X	X	X	X	X	✓	✓	✓	
14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
15	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
16	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
17	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
18	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
19	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
20	✓	✓	✓	X	X	X	X	X	X	✓	✓	✓	
21	✓	✓	✓	X	X	X	X	X	X	✓	✓	✓	
22	✓	✓	✓	X	X	X	X	X	X	✓	✓	✓	

The White Space channel calculator demonstration is available on the API portal at (sign in required):

<https://api.keybridgeglobal.com/demo/whitespace/index.xhtml>

This document section demonstrates satisfactory implementation of the following requirements:

- provide channel lists appropriate for the device class and location
- manage schedules for WSDs as required by low-power auxiliary device registrations
- specify power reduction for personal / portable WSDs that do not meet 1st adjacent spacing

Unlicensed White Space Device Authentication and Authorization

WSDs are identified by their device id (FCC ID in the United States) and manufacturer serial number.

As explained before, Key Bridge requires that all devices wishing to communicate with our White Space System must be enabled first, and that high-power 'Fixed' devices must also register their operating location and antenna installation configuration. There is no charge for enabling devices nor for registering 'Fixed' devices.

Only Part 15H device IDs that have been certified by the FCC with the following equipment class codes may be enabled on the Key Bridge system:

WG1	White Space Device with Geo-location- Mode 1
WG2	White Space Device with Geo-location- Mode 2
WGF	White Space Device with Geo-location- Fixed
WS1	White Space Device with Sensing-Mode 1
WS2	White Space Device with Sensing-Mode 2
WSF	White Space Device with Sensing-Fixed

The device ID is verified with the FCC's Equipment Authorization System.

Sensing mode devices are included because, while none currently exist, it is anticipated that such devices may wish or need to supplement their sensing capability with occasional queries to a White Space database.

When a WSD requests White Space channel availability from the Key Bridge White Space System the device must present its device ID and serial number plus a number of other operating parameters. Device ID / serial number pairs that do not match any already enables pairs are rejected as not valid.

This document section demonstrates satisfactory implementation of the following requirements:

At this time we do not request evaluation of our System with any particular WSD.

- register, initialize or validate devices as required by the device class by checking with EAS

Key Bridge provides an EAS Data Browser implementation for those seeking more information about device grants, specifications and equipment classes. The EAS Data Browser is available on the API portal at (sign in required):

<https://api.keybridgeglobal.com/database/eas//index.xhtml>

Operational Requirements

Key Bridge has already demonstrated or can demonstrate upon demand satisfactory implementation of all of the following requirements:

- Verify, correct and/or remove inaccurate data as required under Section 15.715(i)
Our database records management system enables us to rapidly update, modify, rebuild or delete any wireless service record upon demand. We have demonstrated this repeatedly over the past several months.
- Upon request by the Commission, provide no channels when queried by a specific WSD or model of WSD
Our device management system enables us to rapidly and easily identify any enabled White Space device on our system by its device ID / serial number pair and to update that WSD's enabled status.
- Upon request by the Commission, provide no channels to all WSDs within a geographic area defined by a set of four geographic coordinates defining a polygon.
This is already demonstrated in the White Space Channel Calculator application, where co-channel and adjacent channel buffers are drawn around the inquiring location coordinates to illustrate how channel availability varies by WSD antenna height above average terrain.
Our White Space channel calculator can easily incorporate most any form of inclusive or exclusive filters the Commission may require to specify: we are not limited to a four-point polygon.
- Make information in its database available for inspection by the public.
A daily extract of our White Space database is publicly available from the Download menu of our API Portal.

Security Requirements

Key Bridge has already demonstrated or can demonstrate upon demand satisfactory implementation of all of the following requirements:

- Security protocols to protect communication between the database and devices
Key Bridge has submitted documentation to the Commission which describes how human and machine clients implement authentication, authorization, and secure communication with the Key Bridge White Space System.
- Detect and reject duplicate devices that query from different locations within a short period of time.
Fixed, high-power WSD locations are validated against their registered location. Any requests indicating a new location are rejected. For personal / portal WSDs: The System records and compares the last query location with the current query location. Queries occurring too close in time or too far apart in geography are flagged.
- Operational reliability, system and database integrity, power outages, back up.
Key Bridge has submitted documentation to the Commission which describes our general

operating strategy, system design, outage recovery plan, and records retention procedures.

Inter-Administrator Peering

Key Bridge maintains a dedicated Peering portal to enable and support inter-administrator database synchronization. The Key Bridge Peering engine currently supports the open *Wireless Service Information Format Distribution and Exchange* specification. The System will be extended as required to support proprietary WSDBA implementations for bilateral peering.

Summary and Conclusion

We believe that any further evaluation of our System by the Commission should be based exclusively on its compliance with the Rules and supplementary guidance, and we believe that such an evaluation must conclude that our White Space System more than satisfies all of the requirements identified in the Rules; especially the provisions concerning a TV Bands database in 15.713 and 15.715.

We hope that information contained in this document and supplemental attachments will help to simplify the FCC's internal review of our System and expedite the initiation of a public trial so that we may bring these technologies and services to market and continue to build and expand a prosperous White Space ecosystem.

Sincerely,

/s/

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<http://keybridgeGlobal.com>

Thursday, January 24, 2013

Attachments:

- WS-DATACOMPARE Key Bridge Summary
- Key Bridge Database Browser
- Key Bridge Spectrum Explorer
- Key Bridge White Space Channel Calculator