



Proposal to Administer a TV Bands Database

Summary and Review of The Key Bridge Solution

January 21, 2010



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Key Bridge applauds the Commission's efforts to develop rules that introduce new devices in TV broadcast bands while ensuring that incumbent operators receive meaningful interference protection. Key Bridge supports the FCC's approach of leveraging industry's capacity for innovation. We support the FCC's strategy to foster innovation through competition between multiple Database administrators will ensure that services are widely available and that fee amounts will settle at fair yet commercially sustainable level.

Key Bridge is the only applicant for authorization to administer a TV bands database that incorporates significant contributions and technologies from other companies. This teaming strategy is consistent with how we approach most large system integration opportunities. Comprehensive TV bands administration requires extensive integration of multi-vendor components including networks, storage, computers, databases, application servers and custom software. The Key Bridge teaming strategy brings real-world experience with each of these sub-systems from the industry's most expert and experienced companies. Ours is the only solution that addresses many of the practical aspects of spectrum administration like operations, customer support and protecting sensitive commercial and consumer data.

The group of companies who contributed to the Key Bridge solution is proud of our proposal to administer a database of the unlicensed Television broadcast bands. The many technologies brought together in our solution are tested, proven to work together, and ready for service. The core components, architecture and reference designs we build on presently support millions of network users, trillions of transactions and billions of dollars annually with unmatched safety, security and reliability.

By embracing neutrality, open standards and off-the-shelf technologies, the Key Bridge proposal describes a solution that is scalable, secure and ready for commercial service.

The Key Bridge TV Bands Database Solution



Software and Hardware Products



Implementation, Collocation & Connectivity



Security Products and Implementation



Payments



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The Key Bridge solution brings together industry leading companies with the technology, infrastructure, resources, expertise and personnel needed to develop, deploy and maintain state-of-the-art TV band services.

Sun and Oracle, who together are the largest contributors of open source technology today, provide always-on infrastructure solutions to 100% of the Fortune 100. Their software and hardware products and support services bring unmatched Web technology experience and insight, while the Internet's largest and most reliable service providers contribute a comprehensive implementation, collocation and connectivity portfolio.

Amazon's cloud compute resources enable rapid startup, development and testing. AWS, Equinix and Level 3 bring the foundation necessary to deploy, connect and manage mission-critical, always-on infrastructure. Fortinet, the worldwide leader of network security appliances, enables a comprehensive, turn-key security implementation that is reliable, scalable and standards-compliant.

Flexible and convenient payment options for consumers and businesses are contracted through FirstData, Google Checkout and PayPal, all industry leaders in business-to-business and online retail payments.

Combined with Key Bridge custom software, these company's respective products, technologies and services constitute a TV bands administration solution that is scalable, secure, standards-compliant, and ready for deployment.

The Key Bridge Proposal is 100% Compliant

RFP Response Content Requirements

	Company Overview	Company Overview	Technical Proposal	Proposal	47 CFR Part 15 Subpart H and 15.179	Key Bridge Global	Veriwave	Optima Bridge	Veriwave	Veriwave
1	Describe 5 year Business Plan					Section 8 (p.176)				
2	Affirm Scope of Proposal Function					Section 2.4 (p.13)				
Solution Detail										
3	Demonstrate Technical Expertise					Section 7.1 (p.85)				
4	Describe System Architecture					Section 3 (p.17)				
Communications Detail										
5	Describe TVBD / Database communication					Section 4.4.7 (p.122)				
6	Describe TVBD / Database interoperability					Section 4.4 (p.19)				
7	Detail Database synchronization process					Section 4.4.5 (p.86)				
Security Detail										
8	Describe Database and Information Security					Section 5 (p.99)				
9	Explain Equipment Authorization Process					Section 4.4.1.4 (p.76)				
Consumer Choice										
10	Describe Fee Collection Process					Section 8.3 (p.177)				
						Section 8.4 (p.179)				

DA 09-2479

47 CFR Part 15 Subpart H Administrator Requirements

	Company Overview	Company Overview	Technical Proposal	Proposal	47 CFR Part 15 Subpart H and 15.179	Key Bridge Global	Veriwave	Optima Bridge	Veriwave	Veriwave
47 CFR 15 Subpart H Requirements to Administer a TV Bands Database										
1	Collect incumbent data from the FCC every 24 hours					Section 4.4.1				
2	Validate and identify protected entry records					4.4.1.2				
3	Convert all location data to HAD83 where necessary					4.4.1.3				
4	Enable protected entry registration					4.4.2				
5	Accommodate cable head ends, BAS head ends, LP-AUT microphones					4.4.2.1.2.3				
6	Enable the registration of Fixed TV band devices					4.4.4				
7	Enable verification, correction or removal of records					4.4.3				
8	Synchronize records with other authorized administrators					4.4.5				
9	Calculate protected services contours					4.4.6				
10	Calculate available channels					4.4.7				
11	Enable the FCC to enforce against any make or model of TV band device					4.4.1.6				
12	Identify and authenticate the certification and enforcement status of TVBDs					4.4.1.4				
13	Calculate, construct and communicate a standards-compliant channel list message					4.4.7.1				
14	Provide channel list instructions for TV band devices					4.4.7.2				
15	Accept channel list requests via the Internet from any TV band device					4.4.7				
16	Protect the TV bands administration system					5.12.4				
17	Protect the TV bands information services and data					5.4.1.6.6				
18	Protect end-user devices					5.13				

Subpart H - Television Band Devices

The Key Bridge proposal is a comprehensive, end-to-end solution that completely satisfies all of the FCC's technical requirements, is flexible enough to accommodate future changes or modifications to those requirements, and is 100% compliant with the FCC's TV Bands RFP instructions.

In Title 47, Part 15, Subpart H – *Television Band Devices* of the Code of Federal Regulations, the FCC specifies the requirements that a TV bands database must meet.

DA 09-2479 enumerates the topics that must be addressed in each proposal from entities seeking designation to administer a TV bands database.

Important Aspects of the Key Bridge Approach

▪ Neutral

Incorporates requirements and suggestions of over 20 organizations and companies with open-standards technology and protocols

Only Key Bridge has an open commercial policy development process and TV Bands governance solution in place

▪ Transparent

Only Key Bridge provides a complete system blueprint with published algorithms, specified products and an implementation and management plan.

Our system has extensive transaction logging and supports third party audits to verify incumbent protection and non-discriminatory access.

▪ Collaborative

Worked with 20 organization and companies to develop a system that supports their business requirements, assures protection of sensitive commercial data and protects consumer privacy

Partnered with industry experts and top tier companies to bring industry best practices, products and technologies that deliver a viable solution, ready today

Key Bridge agrees with the FCC that that TV band services are delivered on a non-discriminatory basis and that TV band resources must be governed by a set of neutral commercial policies to everyone's benefit. To ensure a stable, robust and fair marketplace for unlicensed TV band networks, systems and consumer electronics, spectrum administrators must demonstrate three important characteristics. These are:

Neutral

The Key Bridge Team is not aligned to any particular interest group and our solution is a neutral television band database administrator. Key Bridge commercial policy is:

- To implement the letter and spirit of Commission rules
- To provide robust incumbent protection from interference, and
- To publish available spectrum for unlicensed operation on a nondiscriminatory basis

The Radio Frequency Spectrum Database (RFSDB) provides an open forum for establishing neutral TV bands policy. RFSDB policies will guide and direct Key Bridge's commercial implementation wherever there is ambiguity in the Rules and provides a formal governing body to resolve potential conflicts between competing interests.

Transparent

While most submitted proposals are little more than elaborate promissory notes, the Key Bridge document provides a complete blueprint to build and operate a TV bands database system. Key Bridge has already developed a working system and is working with hardware manufacturers to develop a standard channel transaction specification and with incumbents to verify geographic protection algorithms. To ensure interoperability, Key Bridge will open-source the software stack post-award.

Collaborative

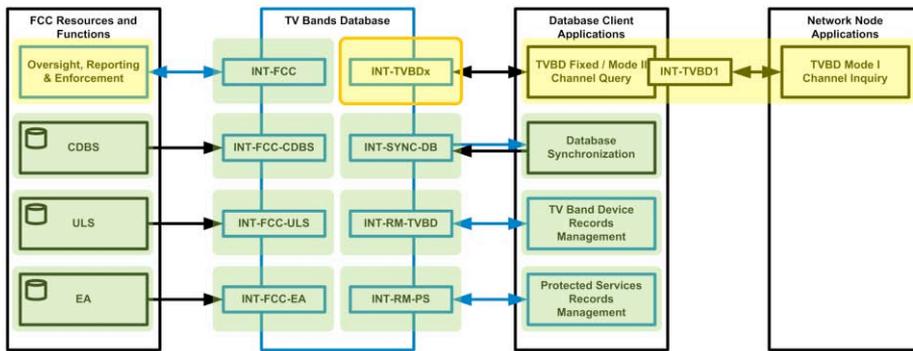
The Key Bridge TV bands solution has a comprehensive security strategy that includes technologies from Sun, Oracle and Fortinet to protect and sanitize sensitive information prior to transmission. Key Bridge has worked with over 20 organizations and companies to develop information security and handling to protect commercially sensitive data and consumer privacy.

The TV Bands Database Functional Design

At its most basic:



The full ecosystem:

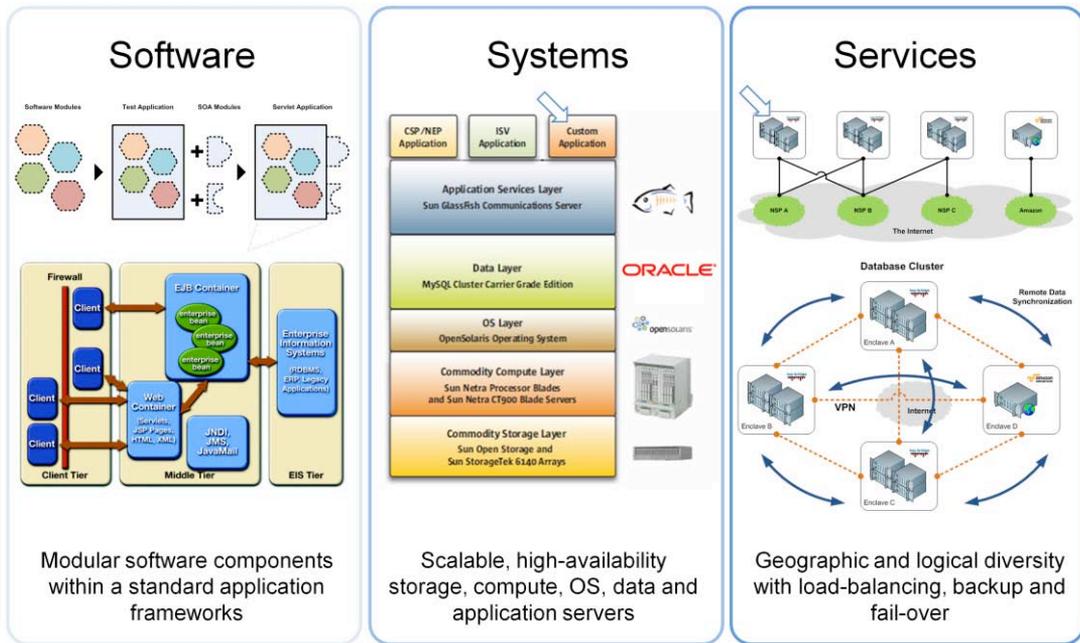


Title 47, Part 15, Subpart H – *Television Band Devices* of the Code of Federal Regulations describes in general the minimum set of functions a TV bands database administrator must provide and describes several data transactions it must support between the TV bands database (“Database”) and various external systems. These services include channel lists for unlicensed TV band devices (“TVBD”), registration of protected entities and the verification their services records plus the support of FCC auditing and enforcement activities.

The most basic description of the TV bands database’s intended function is a channel list server that imports and processes raw data from a number of sources, including the FCC, to calculate channel lists and respond to external inquiries. Many additional features and functions are necessary in a real-world system. The simplest schematic of a complete database ecosystem, which incorporates all of the necessary components and communications interfaces required for an end-to-end TV bands database solution, includes the FCC, a TV Bands administrator, various client and management applications plus end users and consumers.

In 2009 Key Bridge assembled a solution team to design, develop and deploy a prototype TV band database. In July 2009 Key Bridge previewed its first prototype. Additional testing and feedback led to the launch in October 2009 of our first operational, FCC Rules and open standards-compliant TV band channel-list Web services on the Amazon Elastic Compute Cloud, a virtual computing environment that provides resizable compute capacity via the Internet. Since October, Key Bridge has collaborated with a limited number of end users to test the system. We continue to add convenience features, increase Web service and Web portal performance, and implement security. Most components are now operational on the Amazon EC2 cloud compute platform and ready for testing by the TV bands community. This system is very flexible and ideally suited for interoperability testing, device certification and feature enhancements during the early stages of TV band technology development.

Three Tiers of the Key Bridge Architecture



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Software Architecture:

The Key Bridge TV bands solution implements industry best practice for the development and operation of database applications. We employ a modular software development strategy and implement the Java Platform, Enterprise Edition (Java EE) reference architecture. Application development, testing, integration and operation follow the Java EE recommended practice. Modular software components are the building blocks for service orientation throughout software engineering. Examples include Web Services and Service-Oriented Architecture (SOA) - whereby a software component is converted into a service and made available to other computer modules via standard service definitions.

Software components run inside the Glassfish application server, which provides the additional resources and capabilities needed to deliver scalable, highly available, standards compliant Web services.

System Architecture:

Key Bridge builds upon a suite of standards-based, open, extensible software and hardware reference designs provided by Sun Microsystems. This unified and comprehensive system delivers secure, robust and scalable TV bands database services in a flexible SOA environment based on open standards and communications protocols.

Service Architecture:

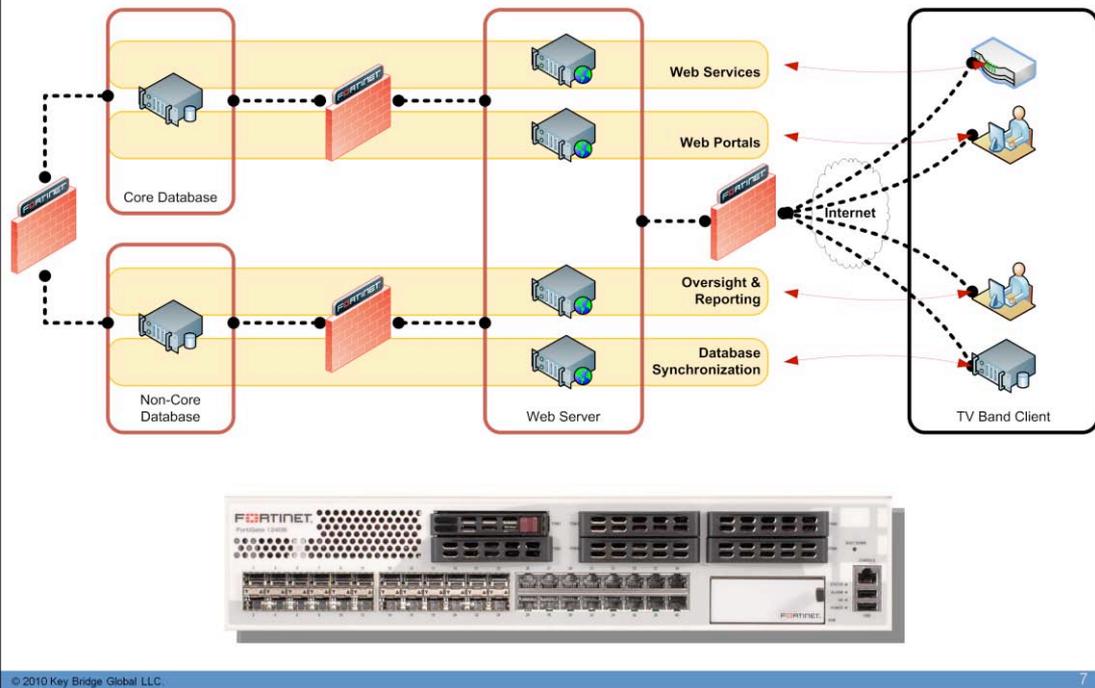
The Database system's modular design builds from an autonomous database system node ("Node"). Each Node is a self-contained hardware-software solution that provides the complete portfolio of TV band functions and services.

The complete TV bands database service is delivered from four (or more) nodes, each supporting the others with load balancing, traffic management, backup and fail-over redundancy across physical and logically diverse installations.

The Key Bridge TV bands solution provides:

- **Event-driven architecture**
TV band services are inherently asynchronous and event-driven. The system must efficiently respond to inquiries and events. We use the Glassfish application server as a foundation for creating event-driven, message-based solutions.
- **Low latency services**
Response times must be fast and consistent, especially as services gain acceptance and demand volumes grow. Response times generally depend on subsystem processing times, and often by the speed of I/O operations and network connections. Optimized database and hardware systems like MySQL and Oracle Clusters minimize asynchronous operation and network latencies.
- **High availability infrastructure**
TV bands infrastructure must withstand hardware or software failures without resulting in a loss in service. Redundant server instances and cluster nodes allow software and hardware upgrades to occur without downtime, enhancing availability and dynamic scaling with high throughput and optimal scalability.
- **Zero downtime management**
Application monitoring produces immediate detection of software or hardware failure, rerouting to other instances within the cluster node. System components can be taken offline for maintenance, expanded or upgraded, and brought back online without affecting service availability. An integrated backup and disaster recovery strategy also replicates data and services across geographically distributed nodes

A Comprehensive, Scalable Security Strategy



The Key Bridge solution with Fortinet technology enforces a positive security model. Fortinet, a leading provider of network security appliances and the leading provider of unified threat management (UTM) solutions worldwide, provides a ready product portfolio to support the TV bands database.

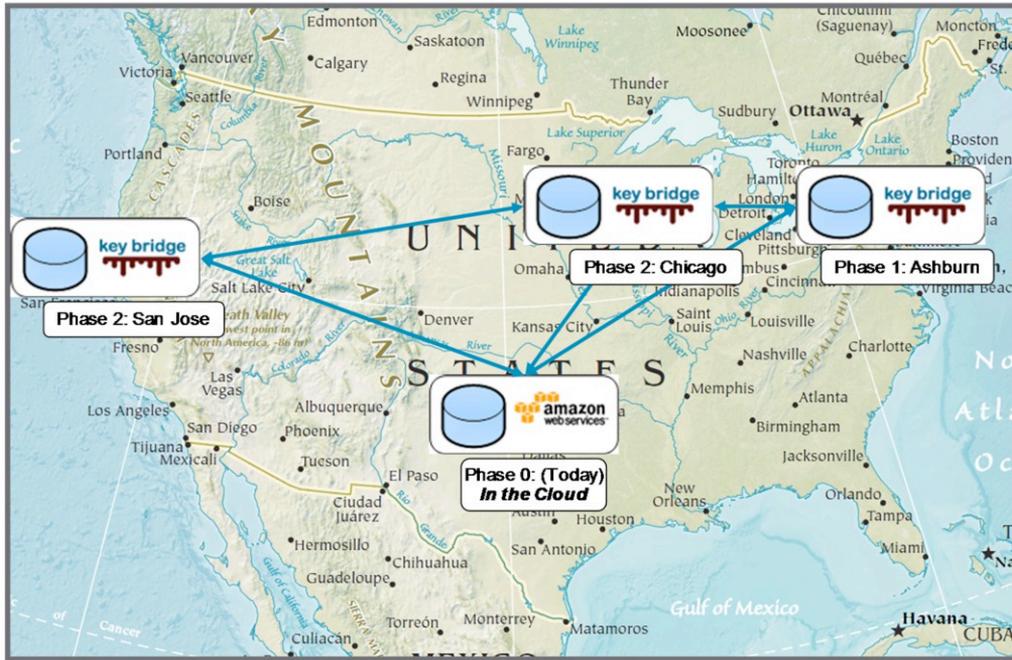
Fortinet's solutions integrate multiple levels of security protection, including firewall, virtual private networking, antivirus, intrusion prevention, Web filtering, antispam and wide area network (WAN) acceleration. Through its products and subscription services, Fortinet provides integrated protection against dynamic security threats.

A Security Domain is an group of computer applications that are functionally distinct. Different security domains are protected behind firewalls and may only communicate with other domains via designated methods. This is called Functional isolation. Logical segmentation creates security communities across system components without regard to their physical location. It allows a flexible, layered security approach with tailored security profiles. Logical segmentation helps to pinpoint and prevent attacks at a very fine level, providing a robust method to prevent "pivot" attacks, where one compromised service is exploited to attack others.

Our solution has tremendous flexibility and accommodates data security at the physical and logical networking layers, in between security enclaves, and the application components of system applications. The TV bands database system employs functional isolation and logical segmentation to prevent unauthorized access, protect sensitive data and limit the potential effect of a system breach, attack or failure.

- Functional isolation protects system enclaves
- Logical isolation protects system applications
- TLS certificate-based mutual authentication protects Web portals
 - Support for Pre-shared keys, Hardware security device (HSD) and Username / Password methods provide maximum flexibility while preserving mandatory security requirements
- WS Security protects Web service messaging
 - Authentication, Integrity and Confidentiality protect the database system and consumer electronic devices from tamper, attack and mis-direction.

A Three-Phased Implementation Plan



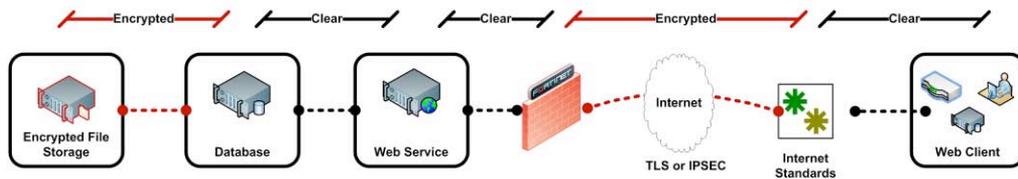
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Implementation begins with a virtual installation, the lowest cost installation, adds up to three physical nodes, and then splits those nodes as necessary to accommodate growth and scale. Implementation is described in three phases: zero, one and two, with each having its own schedule, scale and scope of capabilities.

- Phase 0 is defined by development, test and interoperability. It includes a Node on Amazon’s cloud-compute platform and a limited Node installation in Ashburn, VA. The cloud-compute environment it is functionally identical to a physical installation except for hardware-accelerated performance.
- Phase 1 implementation is triggered when the first TV band devices receiving FCC certification. Its timing will assure that full-scale TV band services are online when the first certified devices become commercially available. In Phase 1, a full Node is installed at the Equinix facility in Ashburn, VA. Phase I will incorporate all of the technology development from Phase 0 and bring significant performance improvements from hardware acceleration of security, encryption and database clustering.
- Phase 2 implementation begins when the Phase 1 systems reach an average 50% of sustained compute resource utilization. Calculating protected service contours at high volume and high speed requires significant computer processor capacity. Choosing 50% utilization matches resource deployment with market demand and provides enough time to ensure sufficient capacity is always available. Phase 2 sees the remaining two physical nodes at Equinix facilities in San Jose, CA and Chicago, IL installed and commissioned

Development, Interoperability & Certification



Interoperability with the TV Bands database is assured when devices and clients use open Internet standards

Function	Standard
Transport Security and Authentication	RFC-5246 & 2716 (TLS) or RFC 2401 (IPSEC)
Asynchronous Messaging	JSR 914 (Java Message Service)
Message authentication, integrity and confidentiality	JSR 101 (JAX-RPC) and JSR 196 (WS-Security)
Data encoding and decoding	NMEA 0183
Real-time Database synchronization	MySQL Peering
Management, registration and oversight	HTTPS capable web browser

Java Community Process or JCP, is a formalized process that allows interested parties to get involved in the definition of future versions and features of the Java platform. Java Specification Requests (JSRs) are the formal documents that describe proposed specifications and technologies for adding to the Java platform. JSRs are the Java analogue to IETF Request for Comment (RFC) documents.

Section 6.1 of our proposal describes device testing and database certification. Key Bridge provides a development sandbox for development and testing, and application programmer interfaces and prescribed tests for self certification. The Key Bridge developer sandbox is a defined, published and interoperable resource for TV band client applications. The development sandbox provides a fully functional instance of the channel list query responder for TV band device software development and testing.

Key Bridge also provides a series of procedural tests that developers may use to self-certify the interoperability of their applications and devices with the Key Bridge TV bands database. Tests describe input data, output response, transaction flow and required application actions. These resources will be available to support the Commission's own TV band device testing and certification efforts.

System Operations & Customer Support



Schedule	Support Function
8:00 to 18:00 Mon - Fri	Telephone and email support for all Web portals and Web services
24 x 7 x 365	Emergency telephone and email support for select Web portals and services like account management and channel lists
24 x 7 x 365	Operations support of all TV Bands system infrastructure, connectivity and availability



Customer service and technical support staff are collocated with the AWS Meteorological Services group, an organizations that currently provides round-the-clock support for operations and customer service.

Throughout implementation, Key Bridge and AWS will develop administrative procedures and technical guidelines to support the TV band user community's evolving requirements. We will provide telephone and email support for customers and business partners covering interoperability, software troubleshooting and support, account management, information reporting and general operation.

Summary



- The Key Bridge solution is supported by number 1 companies in their respective fields.



- Only Key Bridge provides a comprehensive, end-to-end plan for development, testing, integration, deployment, security and long-term operation of a TV bands database



- Our commitment to neutrality, transparency, and open governance produce a TV bands database that all parties can trust



Thank you

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The Key Bridge Proposal is 100% Compliant with DA 09-2479

	Comsearch	Frequency Finder	Google	KB Enterprises and LS Telecom	Key Bridge Global	Neustar	Spectrum Bridge	Telcordia Technologies	WSab
Company Overview									
1					Section 8 (p176)				
2					Section 2.4 (p13)				
Solution Detail									
3					Section 7.1 (p165)				
4					Section 3 (p17)				
Communications Detail									
5					Section 4.4.7 (p122) Section 5.4.1 (p153)				
6					Section 6 (p159)				
7					Section 4.4.5 (p96)				
Security Detail									
8					Section 5 (p99)				
9					Section 4.4.1.4 (p.79)				
Consumer Choice									
10					Section 8.3 (p.177) Section 8.4 (p.179)				

TV Band Proposal Requirements

The Office of Engineering and Technology (OET) invites entities that are interested in being designated TV band database manager(s) to file proposals with the Commission by January 4, 2010.

Proposals must

1. Address how the basic components of a TV band database(s) will be satisfied
 1. i.e., a data repository
 2. a data registration process
 3. a query process—and
2. Address whether the proponent seeks to provide all or only some of these functions and
3. Affirm that the database service will comply with all of the applicable rules

Proposals must include the following information:

1. Demonstrate sufficient technical expertise to administer a TV band database
2. Demonstrate a viable business plan to operate for five-year term
3. Describe the fee collection process from registrations or queries
4. Describe in detail the scope of the database functions that it intends to perform, such as
 - a) managing a data repository,
 - b) performing calculations to determine available channels, and/or
 - c) registering fixed unlicensed devices
 - d) registering licensed services not listed in the Commission's databases, or
 - e) *how it will have functions performed in a secure and reliable manner by another entity*
5. Describe data synchronization between multiple databases
 - a) how quickly this synchronization of data will be accomplished
6. Provide diagrams showing the architecture of the database system and a
 - a) Describe how each function operates and
 - b) Describe how each function interacts with the other functions
7. *If the entity will not be performing all database functions, it must*
 - a) *provide information on the entities operating other functions and*
 - b) *the business relationship between itself and these other entities.*
 - c) *In particular, it must address how the Commission can ensure that all of the requirements for TV band database administrators in Section 15.715 are satisfied when database functions are divided among multiple entities, including a*
 - i. *description of how data will be transferred among these various related entities and other databases if multiple databases are authorized and*
 - ii. *the expected schedule of such data transfers (i.e., real-time, once an hour, etc.).*
8. Describe the methods (e.g., interfaces, protocols) used by TV band devices to communicate with the database and
9. Describe the procedures to use to verify that a device can properly communicate with the database
10. Describe the security methods to ensure that unauthorized parties
 - a) cannot access the database
 - b) cannot alter the database or
 - c) cannot otherwise corrupt the operation of the database system
 - d) cannot interrupt the database system from performing its intended functions
11. Describe whether and how security methods will verify that Mode 1 personal/portable devices have received equipment authorization

The Key Bridge Solution Meets 100% of Requirements in 47 CFR 15, Subpart H

47 CFR 15 Subpart H Requirements to Administer a TV Bands Database

- Collect incumbent data from the FCC every 24 hours
- Validate and identify protected entity records
- Convert all location data to NAD83 where necessary
- Enable protected entity registration
- Accommodate cable head ends, BAS fixed links, LP-AUX microphones
- Enable the registration of Fixed TV band devices
- Enable verification, correction or removal of records
- Synchronize records with other authorized administrators
- Calculate protected services contours
- Calculate available channels
- Enable the FCC to enforce against any make or model of TV band device
- Identify and authenticate the certification and enforcement status of TVBDs
- Calculate, construct and communicate a standards-compliant channel list message
- Provide channel list transactions for TV band devices
- Accept channel list inquiries via the Internet from any TV band device
- Protect the TV bands administration system
- Protect the TV bands information services and data
- Protect end-user devices

	Comsearch	Frequency Finder	Google	KB Enterprises and LS Telecom	Key Bridge Global	Neustar	Spectrum Bridge	Telcordia Technologies	WSdb
				Section 4.4.1.1					
				4.4.1.2					
				4.4.1.3					
				4.4.2					
				4.4.2.1,2,3					
				4.4.4					
				4.4.3					
				4.4.5					
				4.4.6					
				4.4.7					
				4.4.1.5					
				4.4.1.4					
				4.4.7.1					
				4.4.7.2					
				4.4.7					
				5.1.2,4					
				5.4.1, 5.5					
				5.1.3					

TV Band Database Functional Requirements

Title 47: Telecommunication

PART 15—RADIO FREQUENCY DEVICES

Subpart H—Television Band Devices

§ 15.713 TV bands database.

(a) Purpose. The TV bands database serves the following functions:

- 1) To determine and provide to a TVBD, upon request, the available TV channels at the TVBD's location. Available channels are determined based on the interference protection requirements in §15.712.
- 2) To register the identification information and location of fixed TVBDs.
- 3) To register protected locations and channels as specified in paragraph (b)(2) of this section, that are not otherwise recorded in Commission licensing databases.

§ 15.715 TV bands database administrator.

The Commission will designate one or more entities to administer a TV bands database.

Each database administrator shall:

- a) Maintain a database that contains the information described in §15.713.
- b) Establish a process for acquiring and storing in the database necessary and appropriate information from the Commission's databases and synchronizing the database with the current Commission databases at least once a week to include newly licensed facilities or any changes to licensed facilities.
- c) Establish a process for registering fixed TVBDs and registering and including in the database facilities entitled to protection but not contained in a Commission database, including cable head ends and TV translator receiver sites.
- d) Establish a process for registering facilities where part 74 low power auxiliary devices are used on a regular basis.
- e) Provide lists of available channels to fixed and personal/portable TVBDs that submit to it the information required under §15.713(f) based on their geographic location.
- f) Make its services available to all unlicensed TV band device users on a non-discriminatory basis.
- g) Provide service for a five-year term. This term can be renewed at the Commission's discretion.
- h) Respond in a timely manner to verify, correct and/or remove, as appropriate, data in the event that the Commission or a party brings claim of inaccuracies in the database to its attention.
- i) Transfer its database along with the IP addresses and URLs used to access the database and list of registered Fixed TVBDs, to another designated entity in the event it does not continue as the database administrator at the end of its term. It may charge a reasonable price for such conveyance.
- j) The database must have functionality such that upon request from the Commission it can indicate that no channels are available when queried by a specific TVBD or model of TVBDs.
- k) If more than one database is developed, the database administrators shall cooperate to develop a standardized process for providing on a daily basis or more often, as appropriate, the data collected for the facilities listed in §15.713(b)(2) to all other TV bands databases to ensure consistency in the records of protected facilities.