



## Summary of Key Bridge Ex-Parte Documents

- **System Architecture & Interface Descriptions**
- **Registration, Authentication & Security**
- **Interference Protection Requirements**

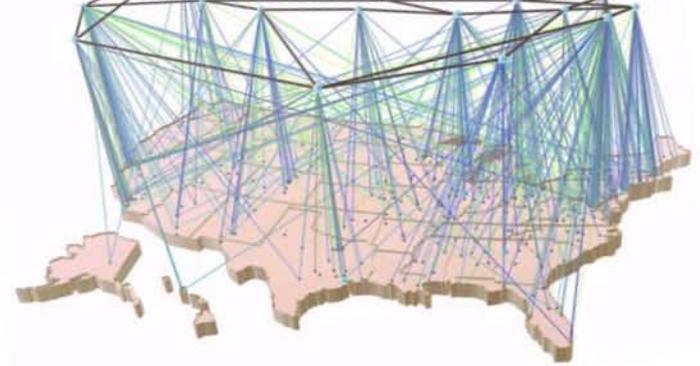


# Executive Summary

- This presentation provides a brief overview of TV bands database documents still under active development with input from many experts and interested parties.
- We are happy to provide updates, additional information or answer any other questions you may have on the topic of unlicensed operation in the TV bands.

# Statement of Principles

## Some things we all agree on

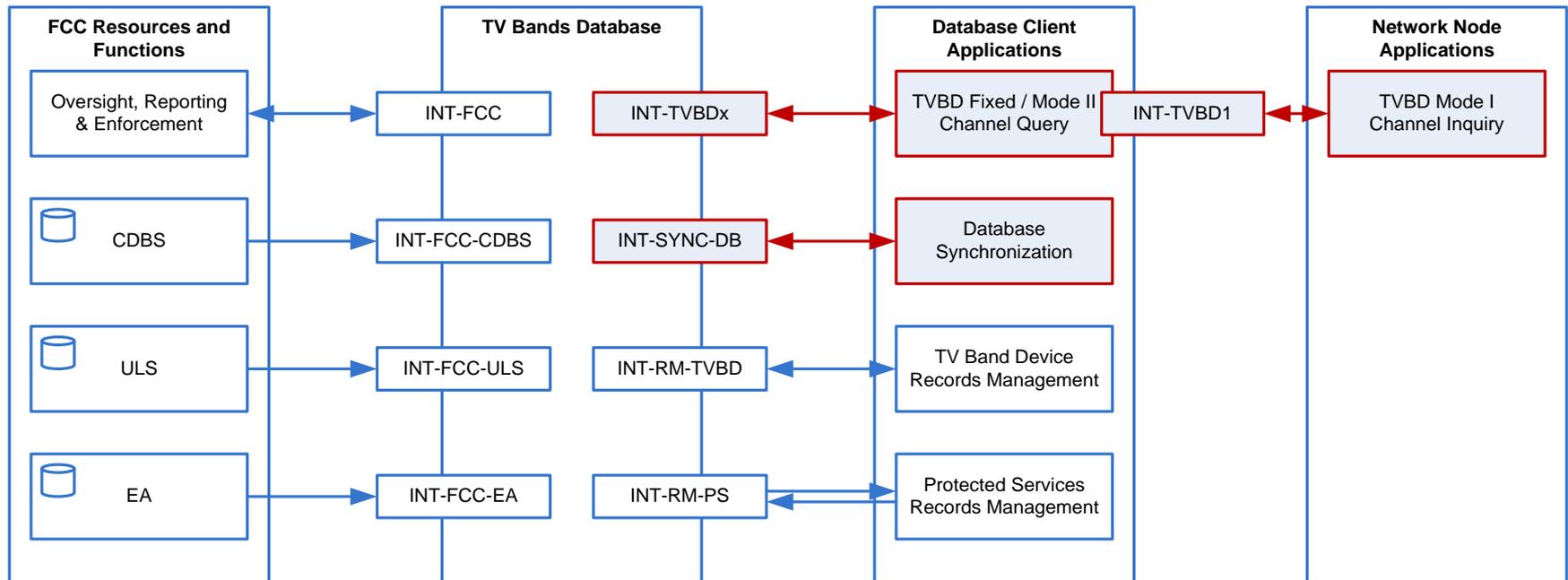


## The TV bands database must:

- Protect incumbent services
- Publish unlicensed spectrum availability
- Maximize consumer convenience and transparency
- Faithfully execute FCC rules and regulations as a neutral party

# TV Bands Database

## High Level System Architecture with Interfaces

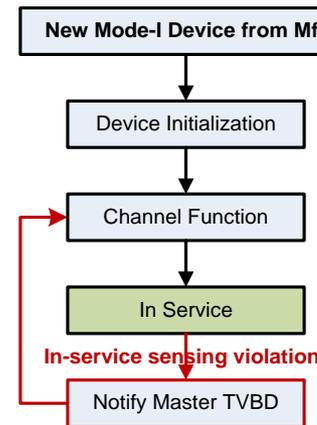
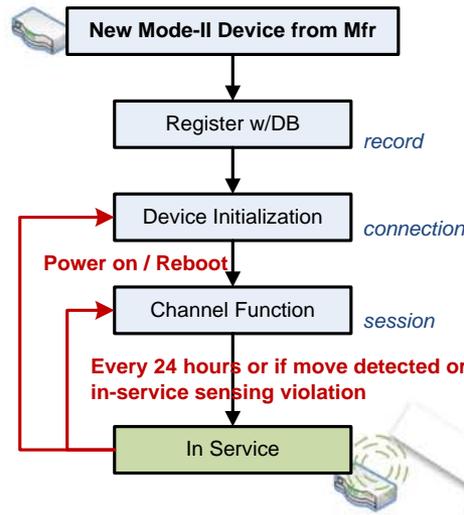
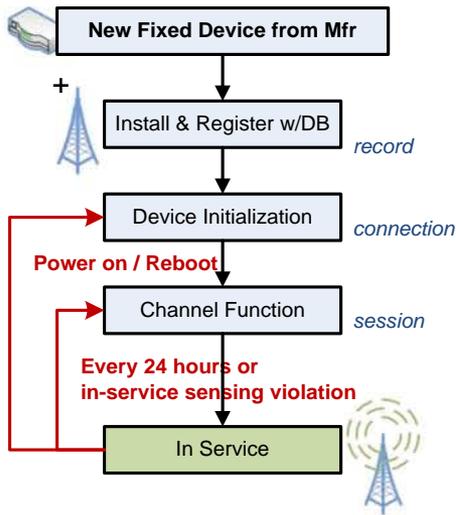


A high-level system block diagram showing the nine interfaces described in the Order and their relationships

- External interfaces are two-way, machine readable communications for authorized devices and persons
- Internal interfaces are not accessed by third parties and only support Database provided services
- Internal, receive only interfaces are for automated machine-to-machine communication and database synchronization

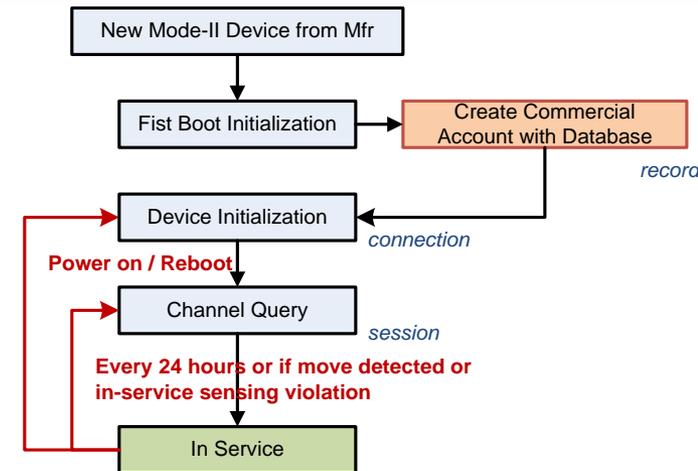
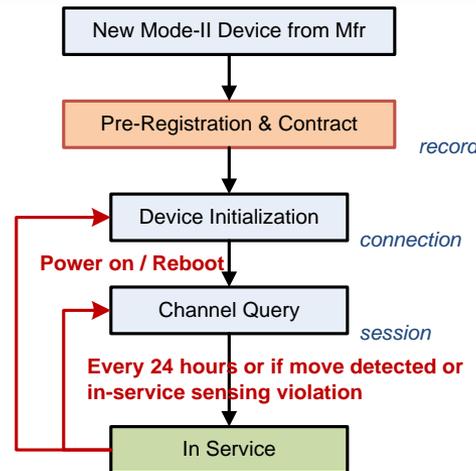
# TV Bands Devices State Diagrams

## The Process of Registration, Authentication & Authorization



- State diagrams indicate when devices may establish connections and sessions with the Database, then begin transmitting
- Fixed & Mode-II devices also require a commercial account
- The Mode-I diagram applies to any device operating in client mode

Two possible options for establishing Mode-II commercial accounts: en bulk and retail

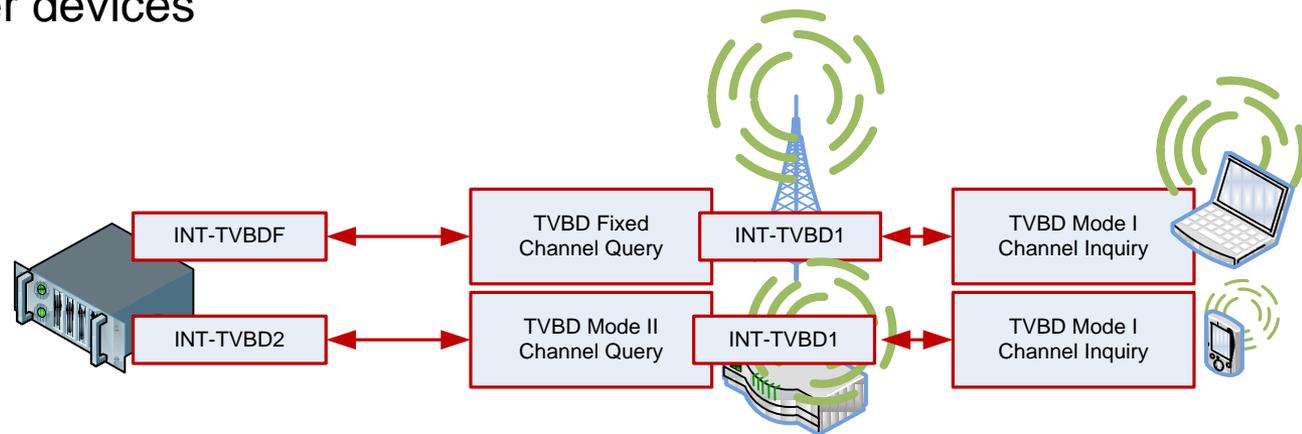


- Any valid Fixed or Mode-II device may be registered with the Database
- All registered devices are authenticated to connect
- All commercial accounts are authorizes to make channel list queries
- Flexible account options will be required to maximize consumer convenience and device adoption

# The TV band device interfaces INT-TVBDx

## Enabling intelligent channel selection and sharing

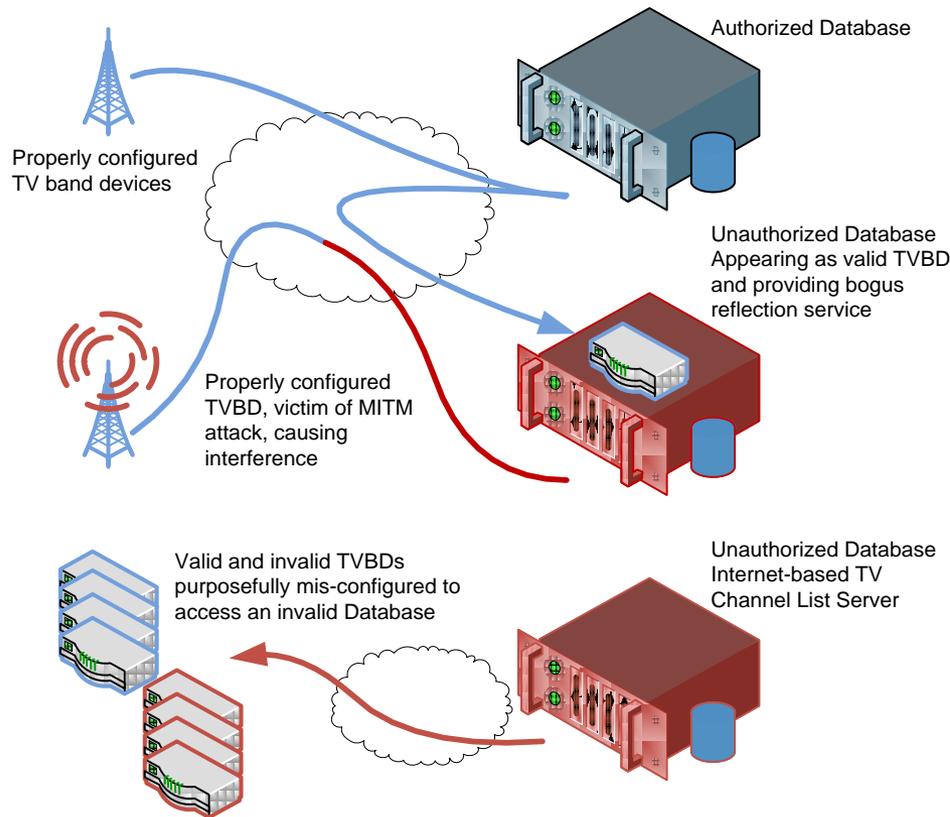
- A Class of functionally similar communications interfaces which enable secure transactions between authorized TV band devices and Database(s)
- Fixed and Mode-II are currently identical and support:
  - Channel query sessions
  - Auditing & enforcement
  - Optional status and information reporting extensions
- Mode-I interface describes requirements placed on Client communication with Master devices





# Unlicensed TV Bands Operation

## Operational Risks and Concerns for Spectrum Sharing



### Largest concern is interference

Principle risk for the long-term success of unlicensed TV bands operation is purposeful interference caused by unauthorized Databases or mis-configured TVBDs, either maliciously, by accident, or as victims of abuse

This is most often realized as variations of two general threat scenarios:

### Unauthorized Database

TVBDs must only connect to a valid Database

### Unauthorized Devices

Devices that circumvent the Database will likely cause interference

# Security Technologies & Procedures

## Recommendations to Suppress Operational Risk

- **First Authentication then Authorization**

Authentication allows for secure two-way communications between networked systems

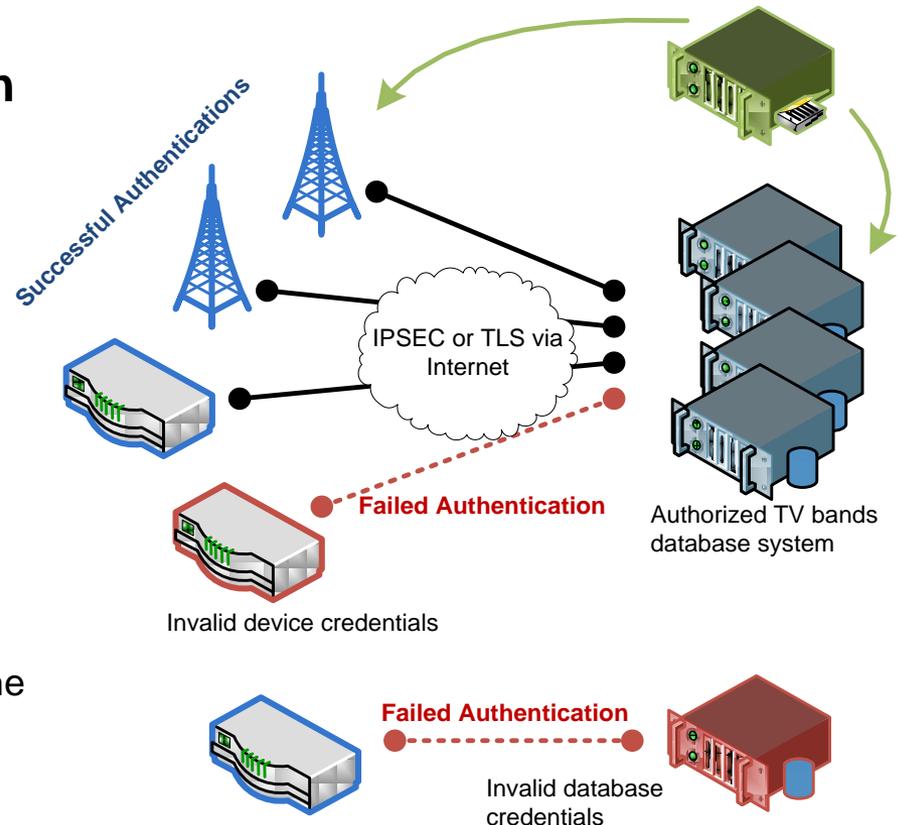
Authorization provides for access to information services which the end user is entitled

- **Mutual authentication**

Independent verification of each party's identity helps to assure the Database and TVBDs that their transaction and information can be trusted

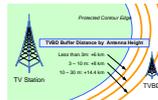
- **Encrypted sessions**

Protected communications between TVBDs and the Database reduce the risks of message interception or hijack across the public Internet



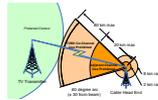
# Summary of Protected Services

Broadcast TV



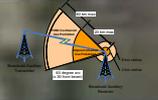
Calculated contour

TV Translators & Cable Head Ends



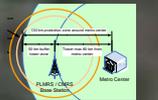
80 km Slice + 8 km Circle

Broadcast Auxiliary



80 km Slice + 8 km Circle

PLMRS / CMRS



134 km Circle [+ 50 km circle]

Wireless Microphones



1 km Circle(s)

Border Areas



32, 40 or 60 km from Border

Offshore Radiotelephone



Defined areas

Radio Astronomy



2.4 km Circle

# Calculating TV Services Protected Contours

## An important, non-trivial process

- The Database must calculate the correct radial distance for a specified Field Strength according to that station's type (Full service, class, A, etc.) and transmitting channel
- Calculations must correct for antenna height above average terrain and radiation profile
- Every station within potential interference range of an inquiring TVBD must be checked
- This must all be done in near real-time

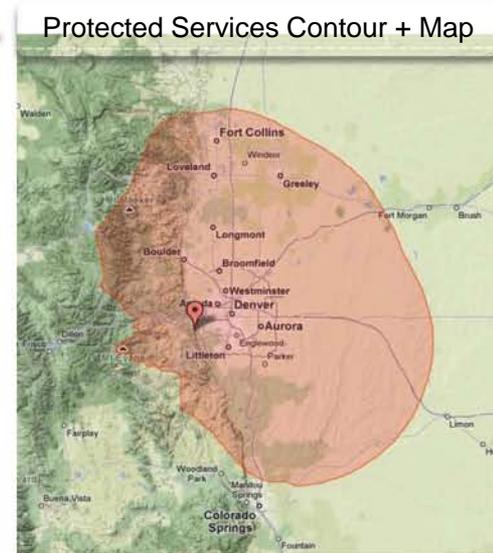
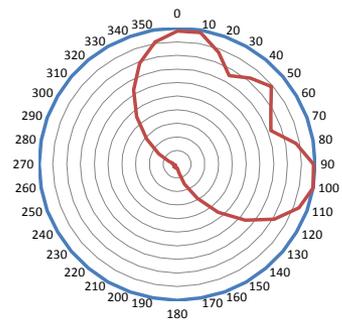
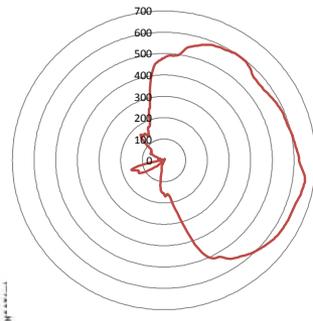
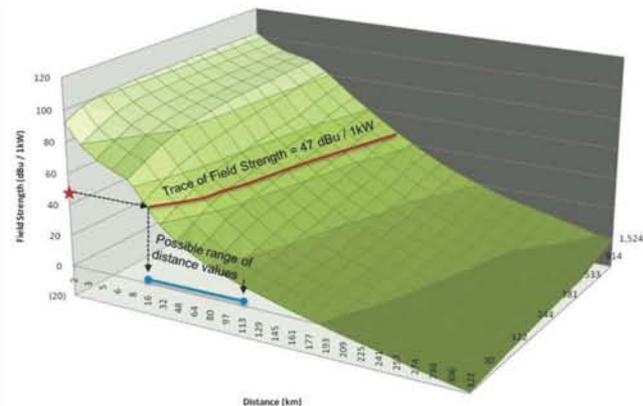
Protected contour		
Channel	Contour (dBU)	Propagation curve
Low VHF (2-6)	47	F(50,50)
High VHF (7-13)	56	F(50,50)
UHF (14-69)	64	F(50,50)
Low VHF (2-6)	28	F(50,90)
High VHF (7-13)	36	F(50,90)
UHF (14-51)	41	F(50,90)

Field Strength Curves

Radial HAAT

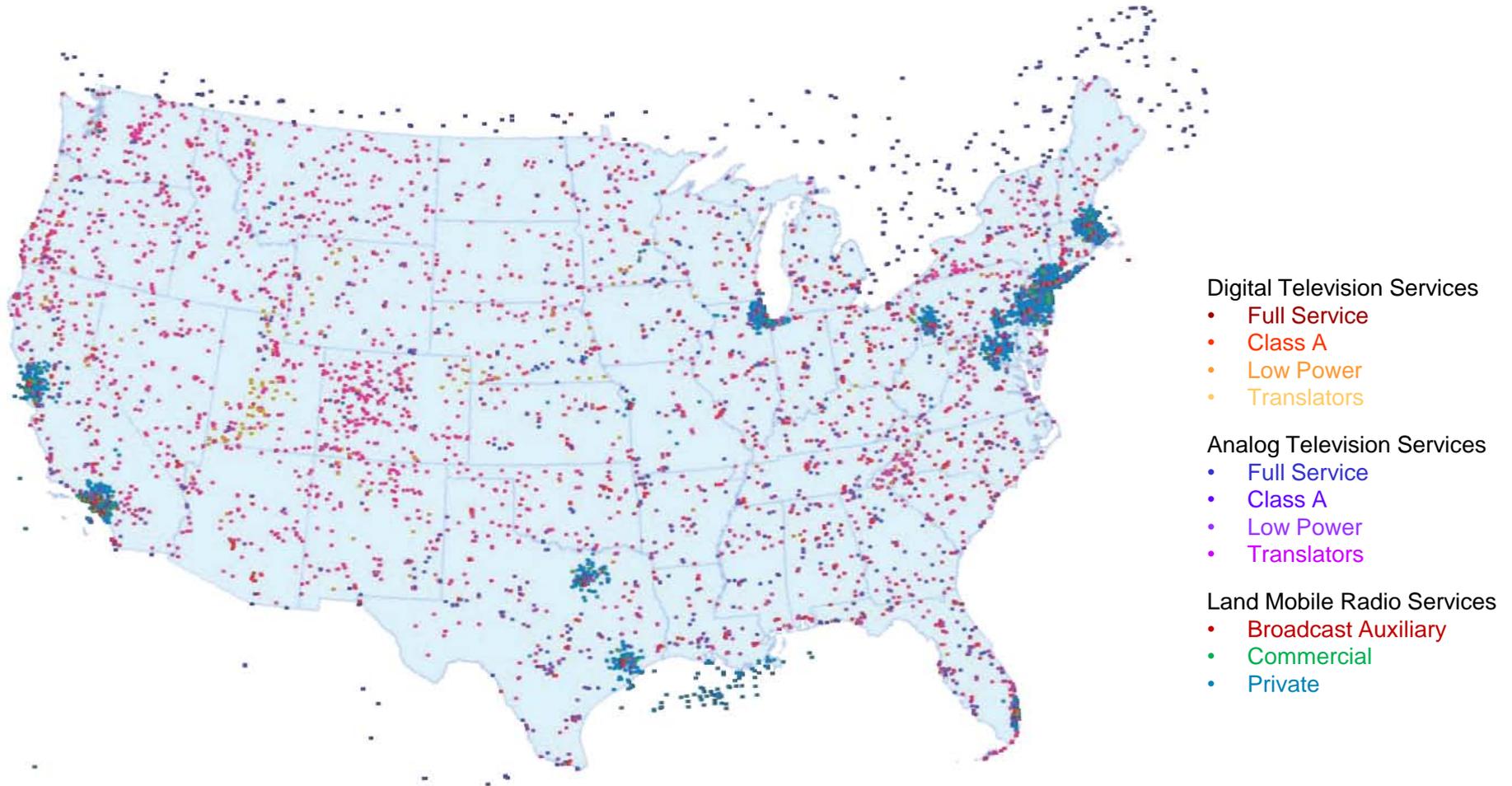
Antenna Profile

Protected Services Contour + Map



# Accurate Location of Incumbent Transmitters

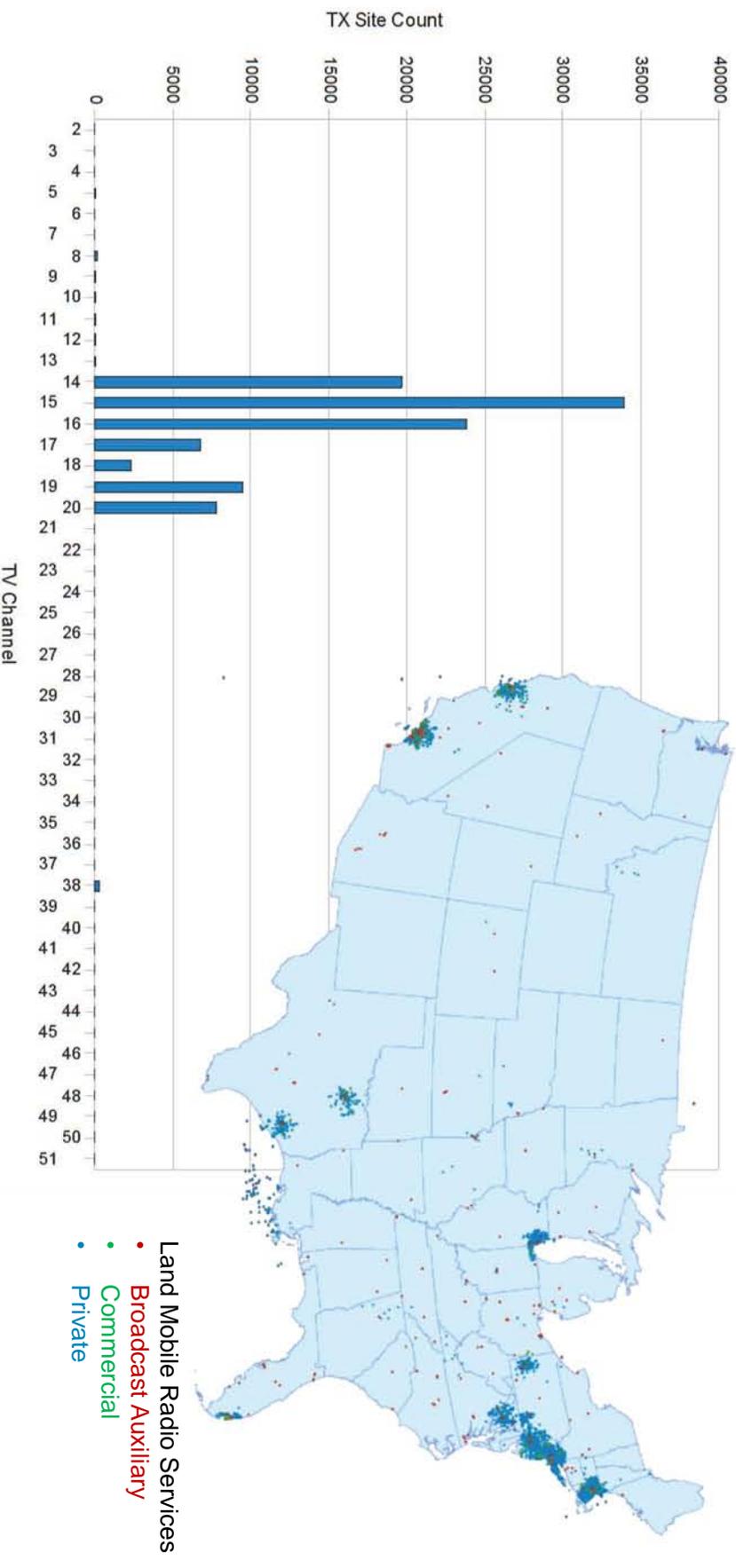
## The Database lets TVBDs check their local listings



Key Bridge has processed, optimized and merged TV bands records from various FCC databases. The data is synchronized with the FCC every 24 hours with a rich auditing record.

# Protecting Non Television TV Band Services

## Channel Occupancy of BAS, PLMRS/GMRS, etc.



To reliably protect services and to publish accurate channel lists the Database must also track occupied spectrum. A summary analysis of non-Television protected services channel occupancy across the US shows concentrations by geography and spectrum.

# Promoting Interference Avoidance

## Helping to Solve Problems Before they Surface

- Verification of protected contours
- Near-real-time reporting of TV band activities in region

TV Broadcaster

key bridge

key bridge

Wireless ISP

- More comprehensive channel occupancy information where available

As a neutral third party the Database can serve as an important resource for incumbents to quickly isolate potential interference issues and for new service providers to deliver stable, robust unlicensed wireless broadband services

# key bridge



Key Bridge Global LLC  
1600 Tysons Blvd., Suite 450  
McLean, VA 22102

Tel: 703 414 3500  
Fax: 703 414 3051

Jesse Caulfield  
[jesse.caulfield@keyBridgeGlobal.com](mailto:jesse.caulfield@keyBridgeGlobal.com)