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May 18, 2016

VIA ELECTRONIC FILING

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

Re: Ex Parte Notice
Using Spectrum Access Systems in the 4.9 GHz Band
Amendment Part 90 of the Commission's Rules, Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band, Service Rules for the 698-746, 747-762 and 777-792 MHz Bands
WP Docket No. 07-100, PS Docket No. 06-229, WT Docket No. 06-150

Dear Ms. Dortch:

Federated Wireless, Inc. ("Federated Wireless"), a leader in the development and commercialization of revolutionary spectrum sharing technologies, hereby submits for Commission consideration the attached presentation explaining how a dynamic spectrum sharing framework, enabled by a Spectrum Access System ("SAS"), could expand the use of, and improve the efficiency of, the 4.9 GHz band.

In the Citizens Broadband Radio Service ("CBRS"), the Commission adopted an innovative three-tier regulatory framework, administered by a SAS, to enable spectrum sharing among different classes of users while providing interference protection to incumbents in the 3550-3700 MHz band. As demonstrated in the attached presentation, this framework places federal naval radar users and non-federal Fixed Satellite Service ("FSS") users in the highest tier, providing them interference protection from the lower tiers. In the second tier, Priority Access ("PAL") licensees obtain guaranteed spectrum access in their license areas and protection from other PAL operations and users in the third tier. This third tier is made up of General Authorized Access ("GAA") users, who gain access to the spectrum on a licensed-by-rule basis and do not receive interference protection from the higher tiers.

Federated Wireless notes that, as is the case in the CBRS, the 4.9 GHz band currently supports operations by disparate users, including radio astronomy, naval training operations, public safety and critical infrastructure operations. However, the 4.9 GHz band is also underutilized in significant portions of the country and, as such, is a prime candidate for sharing spectrum among between incumbent and newly authorized commercial or private operations.

The attached presentation provides a hypothetical regulatory framework for the 4.9 GHz band, conceptually very similar to the CBRS structure, leveraging SAS technology to enable spectrum sharing. In such a framework, radio astronomy would receive the highest levels of protection, akin to the protection afforded to incumbent FSS operations in the CBRS. Public safety and critical infrastructure users would be licensed in the second tier, providing them guaranteed spectrum access and replacing today's inefficient manual coordination processes with frequency coordination

and interference management through the SAS, in real time. In the third tier, commercial or private operators could utilize the 4.9 GHz band to provide wireless broadband services.

The Wireless Innovation Forum ("WINNF")—a cross-industry stakeholder group made up of wireless operators, equipment manufacturers, incumbent satellite users, and SAS operators—has developed, in close consultation with the Commission and observers including the Department of Defense and the National Telecommunications and Information Administration ("NTIA"), CBRS industry standards. These standards specify processes that are useful for a potential sharing regime in the 4.9 GHz band, including: communications between a SAS and radios; communications among different SASs; and, of particular importance in the 4.9 GHz context, ensuring the security of the shared use ecosystem. Federated Wireless encourages the Commission to take note of the significant standards work that has been done for the CBRS and find ways to utilize those learnings to support sharing in the 4.9 GHz band which will enhance utilization of this valuable spectrum.

Although there are many similarities between the CBRS and the 4.9 GHz band, Federated Wireless also urges the Commission to consider the differences between the bands that may impact the business case for prospective SAS administrators and commercial or private operators at 4.9 GHz. For instance, whereas the CBRS encompasses 150 MHz of spectrum, the 4.9 GHz band is only 50 MHz wide, which may raise bandwidth and band plan concerns for prospective operators. The use of overlapping channels in a Wi-Fi-like band plan could mitigate such concerns. In addition, 3GPP Bands 42 and 43, which include the CBRS spectrum, are internationally harmonized, leading to widespread equipment availability and scale-induced cost efficiencies. The 4.9 GHz band, however, is not internationally harmonized, and thus does not offer similar scale efficiencies on equipment. The broad use of 802.11y technology among 4.9 GHz users may mitigate this concern as well. Finally, to operate in the 4.9 GHz band, a SAS administrator would have to collect subscription fees for its services from users in public safety, critical infrastructure and the general access tier. Such services to public safety users can include detecting the presence of naval training operations and coordinating temporary spectrum repacking, similar to how the SAS works with the Environmental Sensing Capability ("ESC") in the CBRS, and deconflicting overlapping interjurisdictional spectrum uses, similar to how the SAS manages inter-PAL interference in the CBRS. Although public safety and critical infrastructure users may raise concerns about paying such fees, the efficiencies these users will gain from automation of existing, inefficient manual process for frequency coordination will likely more than outweigh any such costs. In addition, as use of the band increases, these efficiencies will increase and further offset the cost of subscribing to a SAS's services.

Federated Wireless urges the Commission to recognize that application of a SAS-enabled sharing regime to the 4.9 GHz band carries great potential for enhanced utilization of the band. The Commission should consider the substantial similarities between the CBRS and the 4.9 GHz band, the efficiencies to be gained in building on the significant work already completed by the Commission and the WINNF in the CBRS, and the unique attributes of the 4.9 GHz band that must be addressed to ensure its market viability. Federated Wireless stands ready to assist the Commission with this consideration, and looks forward to continuing to partner with the Commission in bringing the myriad benefits of dynamic spectrum sharing technology to bear in the U.S. wireless marketplace.

Respectfully submitted,

/s/

Kurt Schaubach
Chief Technology Officer
Federated Wireless, Inc.

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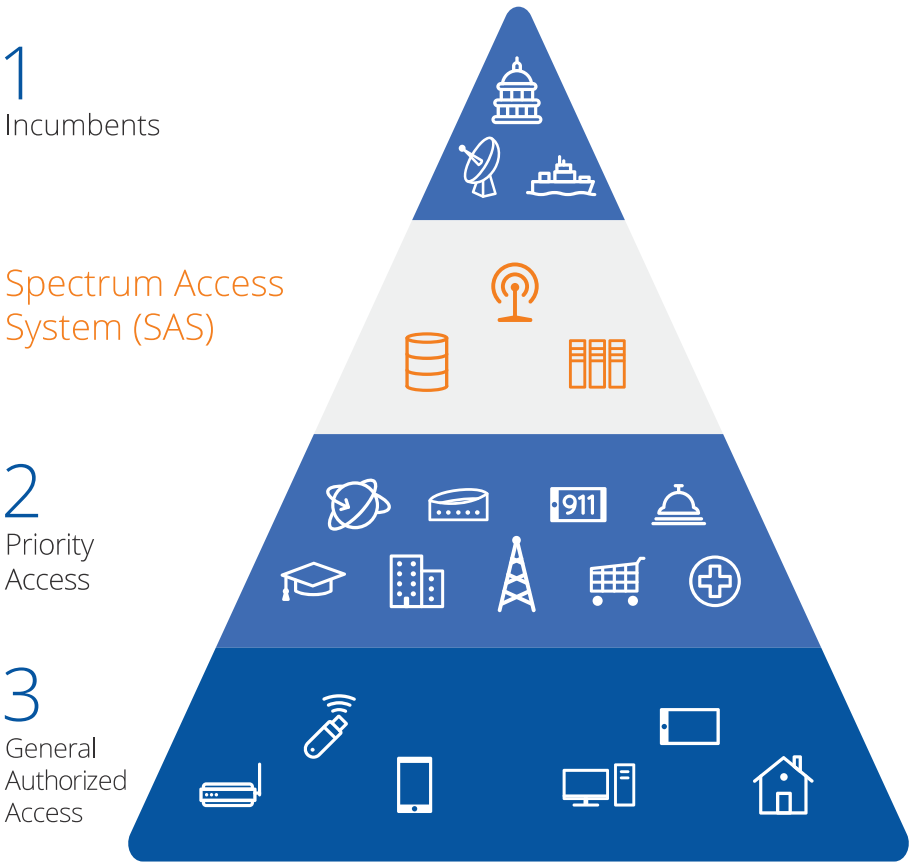
Federated Wireless is a leader in the emerging market for Shared Spectrum

Our platform provides coordinated shared spectrum resources to Enterprise Customers, Network Operators, and Service Providers

3.5 GHz CBRS Spectrum Sharing Framework



- 150 MHz of shared spectrum
- Low power, small cell applications
- Spectrum Access System (SAS) provides spectrum management
- **Incumbents** – Naval radars that use band infrequently
- **Priority Access** – finite term license for interference protection
- **General Authorized Access** – no license required, unprotected use
- At least 80 MHz of spectrum always available for GAA use

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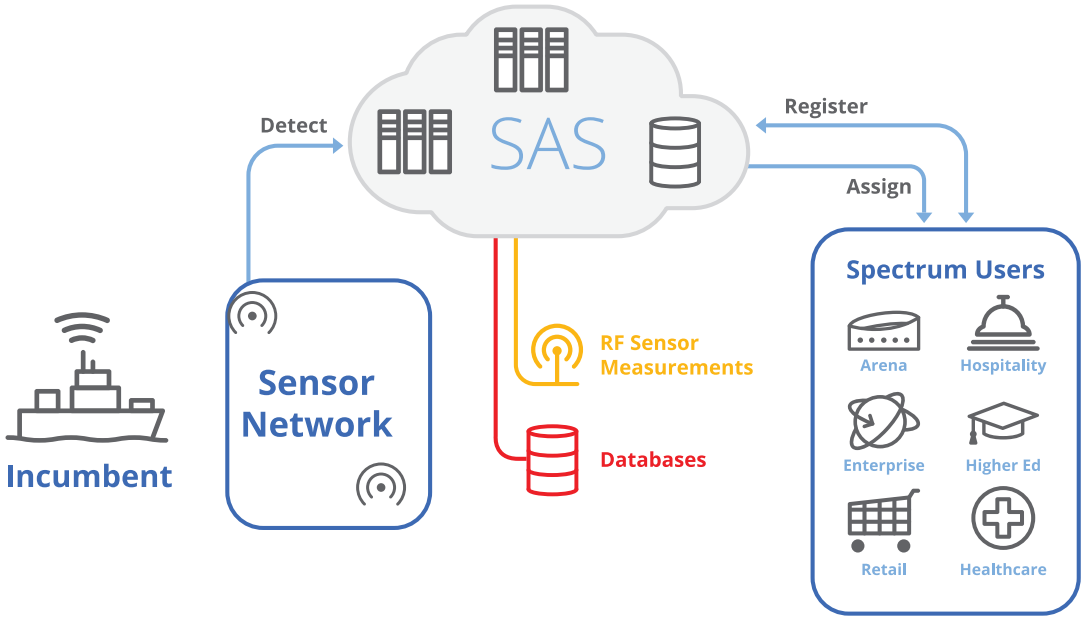
Cloud-based Spectrum Access Systems

Transforming spectrum access and management



- Cloud-based for scale, extensibility, and efficiency
- Predicts RF propagation in real time
- Provides interference protection based on aggregate effects
- Employs sensing for closed loop management

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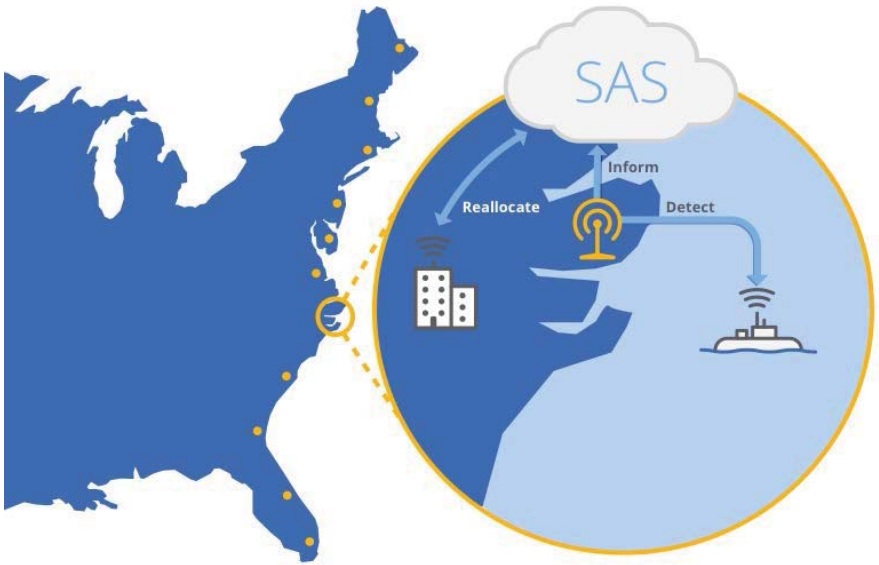
Environmental Sensing Capability

Dedicated, purpose-built listening devices to accurately and rapidly detect federal incumbent transmissions in 3550 – 3650 MHz



- Sensors situated along coastline for unobstructed view of ocean
- Multiple sensors contribute to detection event to assure accurate detection and high availability
- Average 30 – 40 km spacing
- Trusted-boot, anti-tamper, secure design

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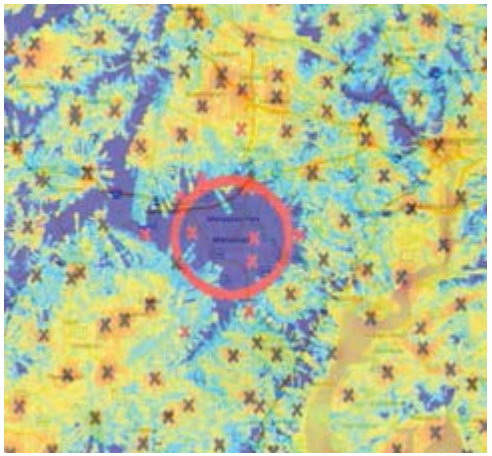
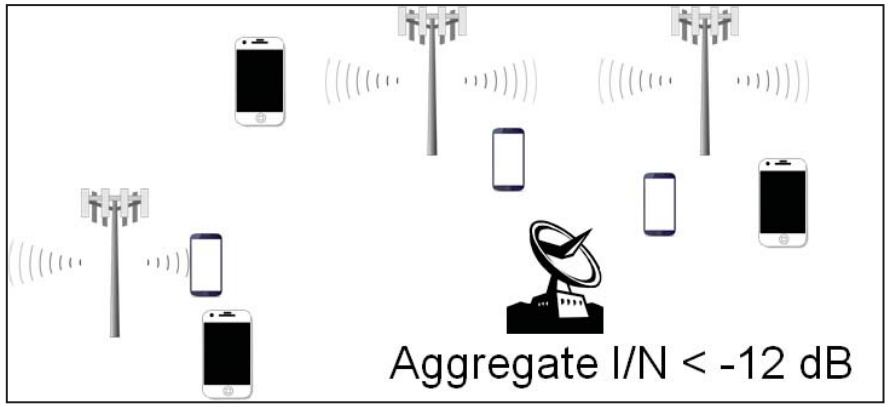
Non-Federal Incumbent Protections

- Fixed Satellite Service and Grandfathered Wireless Broadband Service Operators register sites and configuration information with FCC
- SAS assigns frequencies and maximum power levels to CBSDs protect these sites based on aggregate interference protections
- Interference predicted via CBSD registration data, detailed propagation modeling, and statistical aggregate interference calculations
- Interference Reports provide fail-safe mechanism

Lower 48 Distribution of CBRS FSS Sites

Example Modeling





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Wireless Innovation Forum (WINNF)

Registered Standards Development Organization dedicated to: "Advocating for Spectrum Innovation, and Advancing Radio Technologies Supporting Essential or Critical Communications Worldwide"

Spectrum Sharing Committee

- Common industry & government standards body for the development and advancement of spectrum sharing technologies
- Main activities:
  - Detailing common industry & government functionality and architecture for SAS, sensors, and devices
  - Interoperability requirements and protocol definition
  - Common framework for testing and integration of components of spectrum sharing technologies
  - Requirements, processes, and methods for protection of incumbent users
  - Operational procedures definition for spectrum assignment and management
- Developing robust security, authentication measures, and interference reporting measures
  - Communication protocols between ecosystem elements
  - Methods to assure devices remain under authoritative control of the SAS
  - Device geolocation and signal measurement reporting to provide accurate depiction of radio environment
  - Procedures to escalate and resolve interference

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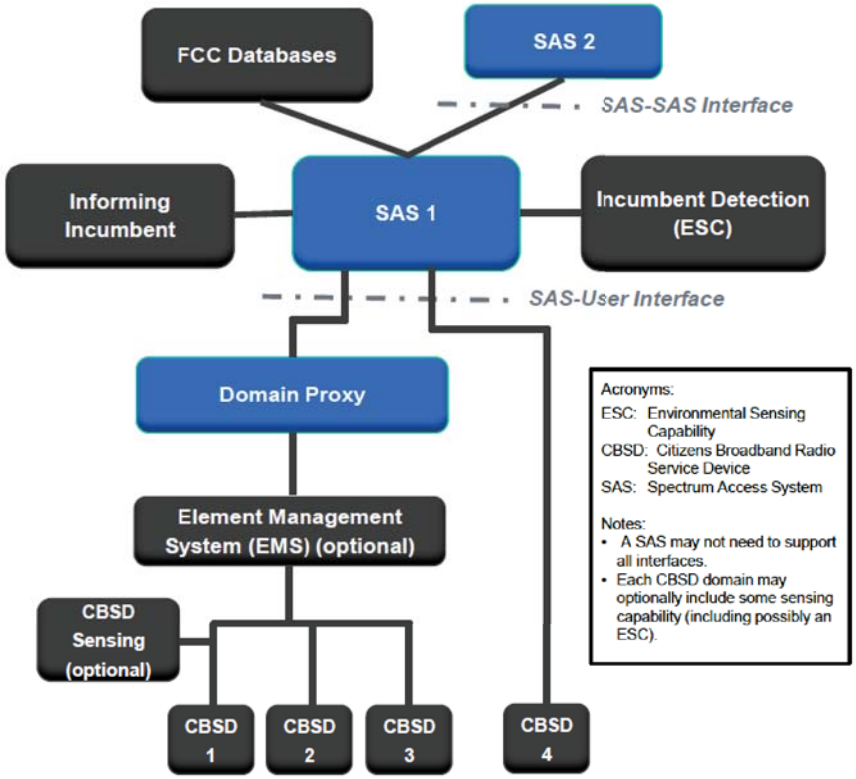
WINNF SAS Functional Architecture



- SAS, CBSD, and ESC as defined in Part 96.
- Element Management System (EMS): Consists of systems and applications for managing network elements.
- Domain Proxy (DP): a managing intermediary that performs bidirectional information processing and routing.
- Through use of DP and EMS, the SAS can readily interface to legacy network equipment

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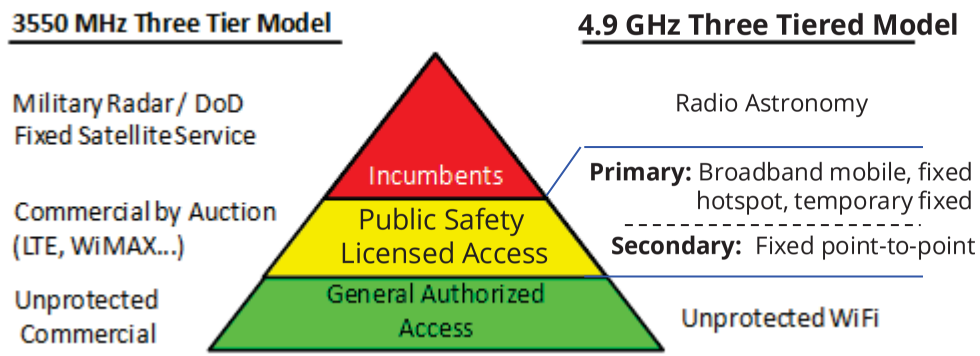
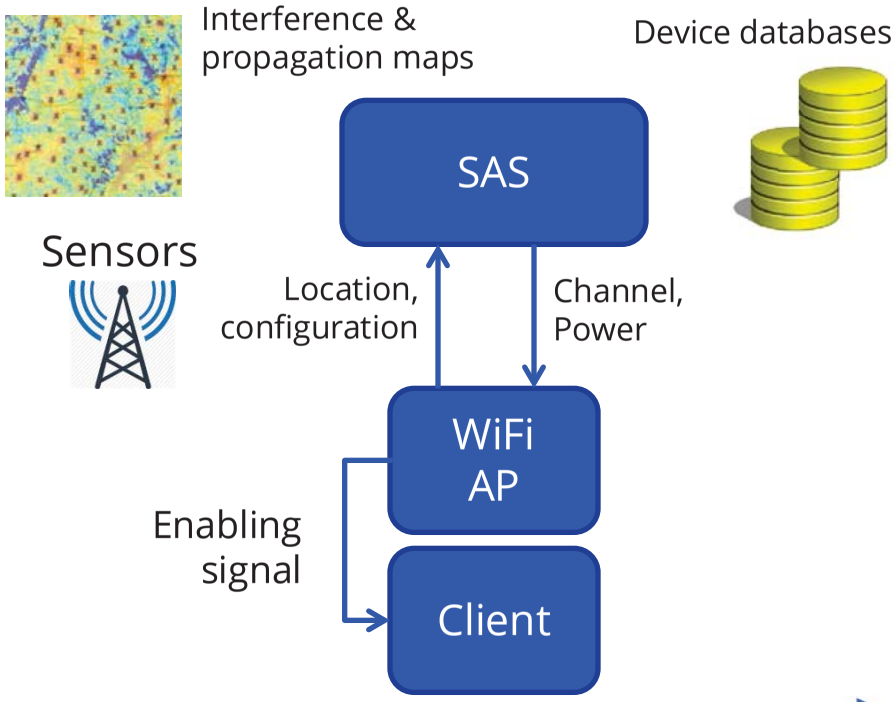
Three Tier Sharing in 4.9 GHz

- Allow WiFi access as non-interfering Third Tier
- Apply 3.5 GHz-like protections
  - Automatically detect and mitigate mis-configured devices
    - Need device measurements
  - Basic location and info verification
  - Simplified audit trail
- Operating Framework
  - WiFi devices register their location, credentials, and configuration with SAS
    - Public safety equipment in ULS
  - Based on basic channel availability and predictions of interference, SAS tells WiFi available channels and maximum power
  - WiFi tells SAS what it actually uses
  - WiFi spectrum updates regularly for ULS and CEC changes
  - WiFi AP / Client enabling can be based on 802.11y





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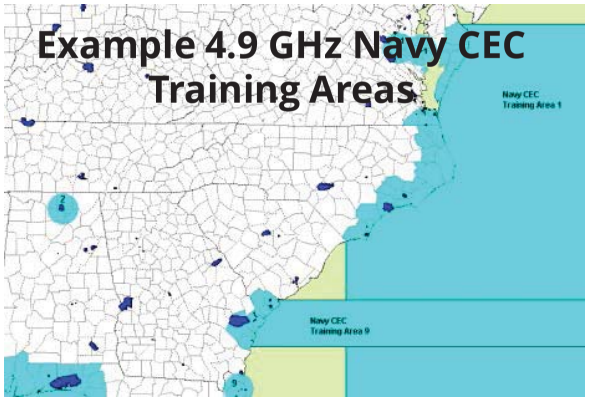
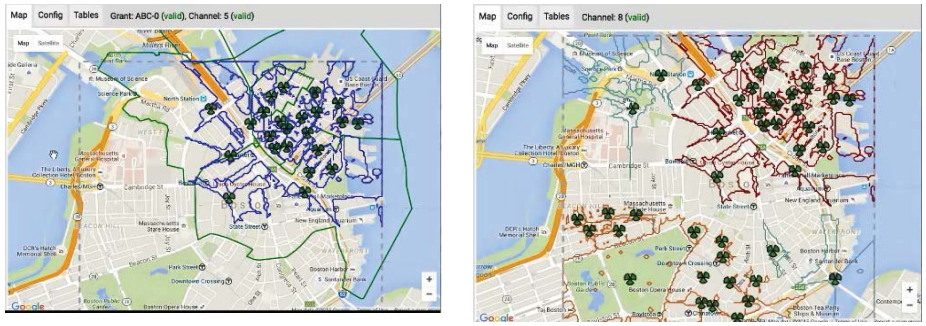
Additional 4.9 GHz Applications

- Coordinate use around Navy CEC Training Areas
  - Significant overlap with 3.5 GHz areas
  - Extend 3.5 ESC for automatic detection of training
  - Coordinate 4.9 GHz spectrum contingency plans in affected areas based on actual CEC usage
- Manage Licensed / Public Safety Registration
  - Geographical licenses similar to PAL
  - Authorize deployments in seconds
  - Immediately catch basic errors
  - Incumbent protection, border coordination
- Automatically de-conflict spectrum usage in overlapping geographic license / jurisdictional areas





3.5 PAL Spectrum De-confliction

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