2018 ACE SCHOOL & RUS SYMPOSIUM
TERMINUS
CONNECTING POINTS OF OPPORTUNITY

Trending Technologies

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White Space Update

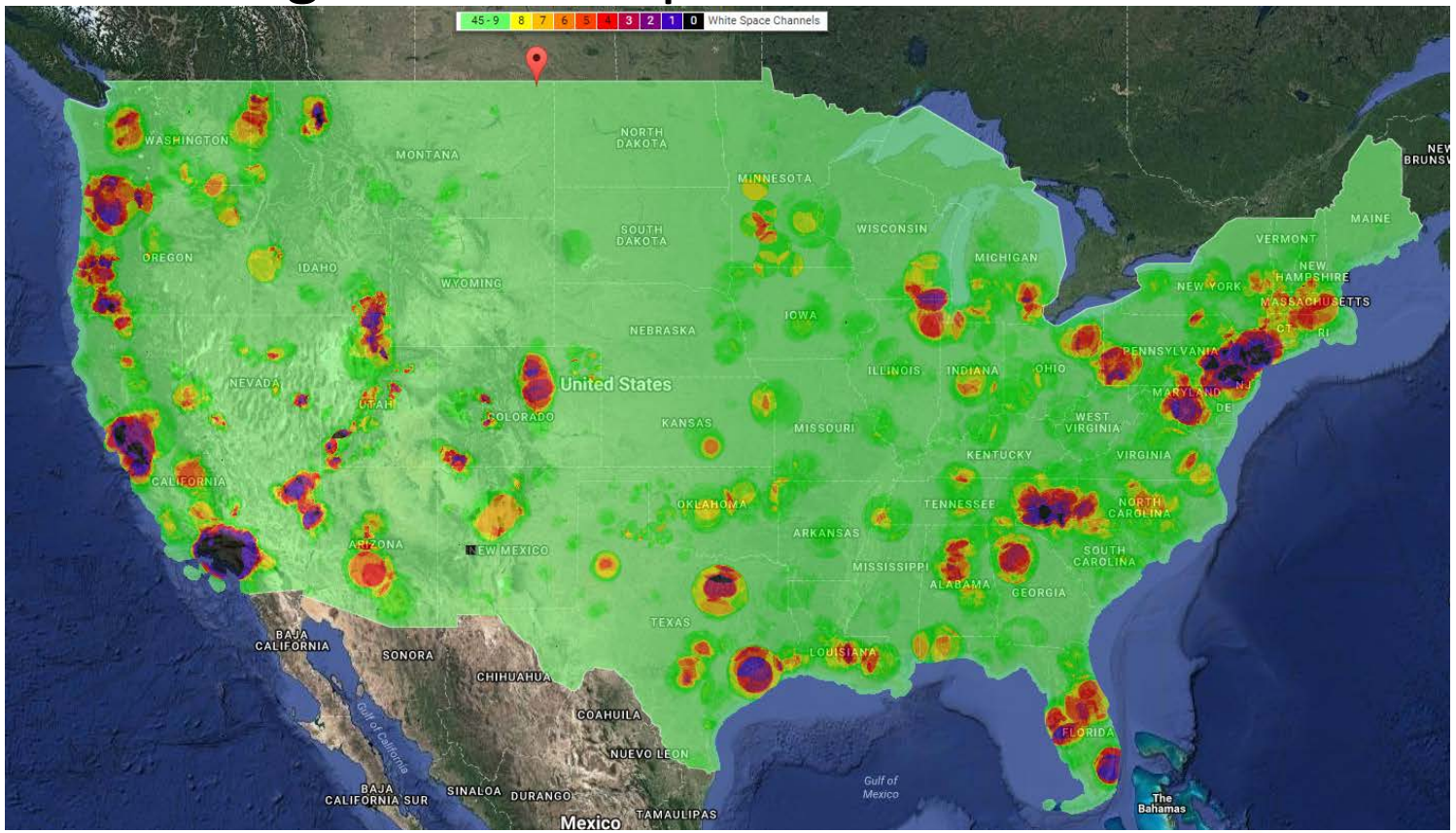
- What is White Space anyway? (From FCC's Allen Yang)
  - In any given TV market area, a number of channels are unassigned to avoid interference
  - Channels may also be assigned for:
    - low power TV & TV translators
    - Channels 14 – 20 for land mobile service in 13 major cities
  - Also can be used for wireless microphones, broadcast auxiliary and offshore telephone service (Gulf of Mexico region only)
  - "White Spaces" are the channels that are "unused" at any given location
- This gives a potentially lucrative spectrum option for Rural Broadband to use

Brief White Space History

- 2002- The FCC establishes their first inquiry
- 2004 – First NPRM is issued for utilizing this spectrum
- 2006 – First Report and Order released
- 2008 – Second Report and Order released
- 2009 – Transition from analog to digital TV broadcasting
- 2011 – First Database administrator approved
- 2012 – Third Report and Order released
- 2014 – 2018 ??????????????????

White Space Spectrum

- From Google's White Space Database



White Space – How to Use

- Fixed base stations must have the ability to access a database and provide geolocation information
- This base station will then get the available channels from the database prior to going active
- The base station will then register with the database and also must regularly recheck with the database on a set schedule
- The main database operators currently are Google and Spectrum Bridge

White Space Limitations

- Why didn't this take off in the US?
  - Lack of a technology standard
    - IEEE 802.11af became common base for a few vendors
    - Limited to no interoperability available
  - Limited Vendor Options
  - Limited channel size - 6 MHz/TV Channel
    - May not be consecutively available for grouping
  - Limited broadband speeds – 72 Mbps Max from base station, with on 24 Mbps available to an individual subscriber
    - Often much lower than that due to RF performance
  - Coverage Radius is fairly limited due to height and power restrictions to protect the TV channels (Less than six miles with outdoor installations)

CBRS – 3.5 GHz

- Citizens Broadband Radio Service – (CBRS)
  - CBRS is an attempt by the FCC to open up spectrum that is used internationally for fixed wireless services here in the US
  - The concept is that there is a large pool of vendors already making high grade equipment for this band and therefore can lead to cost efficient rural broadband deployments
  - The 3.550-3.7 GHz band is currently used by the Military, Satellite Providers, and Rural Incumbents
  - Propose a lightly licensed to unlicensed framework to encourage innovation and competition

CBRS History

- Use of this band first proposed by the NTIA 2010 Fast Track Report.
- 2012 – FCC announces Notice of Proposed Rulemaking to establish rules and procedures in the 3.5 GHz band
- 2014 – FCC announces a further NPRM
- 2015 – FCC releases the Report and Order and Second Further Notice of Proposed Rulemaking – Link below
  - https://www.fcc.gov/document/fcc-releases-rules-innovative-spectrum-sharing-35-ghz-band
- 2016 – CBRS Alliance is formed
- 2018 – Final rules are still being discussed

CBRS Alliance

- “The Alliance believes that LTE-based solutions in the CBRS band, utilizing shared spectrum, can enable both in-building and outdoor coverage and capacity expansion at massive scale. In order to maximize CBRS’s full potential, the **CBRS Alliance** aims to enable a robust ecosystem towards making LTE-based CBRS solutions available” – From cbrsalliance.org
- Hoping to copy the Wi-Fi success story

CBRS Band Plan/License

- The band is broken up into 15 10 MHz channels from 3.550 GHZ to 3.7 GHz for a total of 150 MHz
- Three types of licenses will be assigned
  - Incumbent – Grandfathered Fixed Satellite Stations/Existing Operators in the 3.650GHz to 3.7GHz license bands
  - PAL – Priority Access Licenses
  - GAA - General Access Licenses
- A spectrum database system similar to that used for TV White Spaces will be used to assign spectrum for each operator

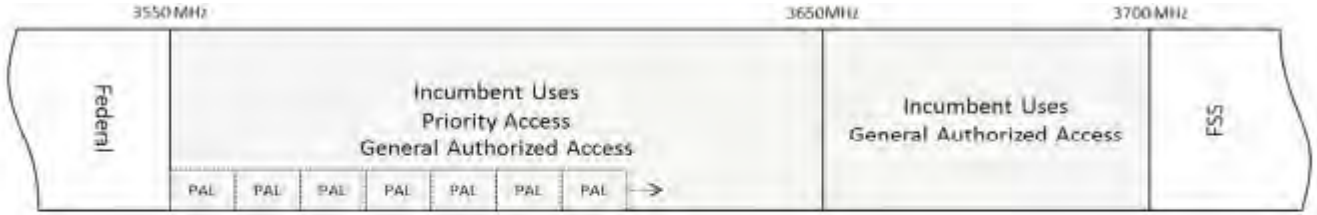


Figure 1: Potential Bandplan

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Sample Band Plan

- From the FCC 2nd Report and Order

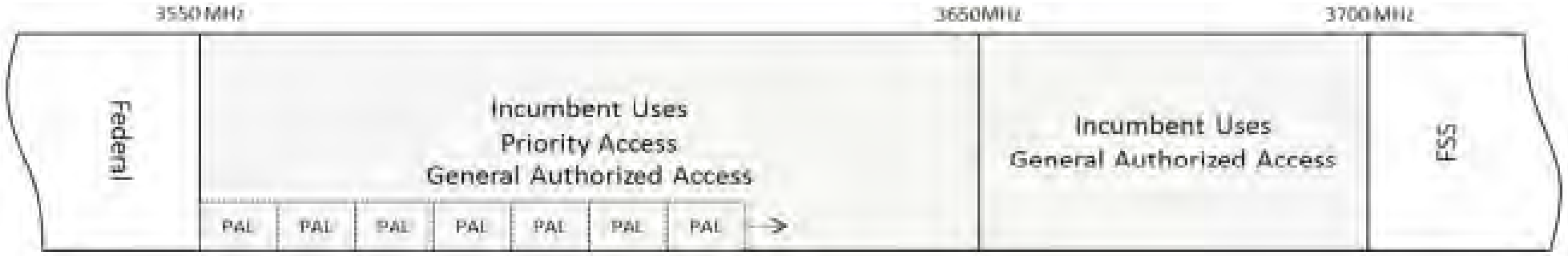

Figure 1: Potential Bandplan

CBRS Band Plan/License

- PAL
  - A max of 7 licensees will be auctioned off on a census track basis
  - A single provider allowed to have a maximum of four licenses per track
  - License Term:
    - Three years, non renewable
    - Option to purchase two additional, three year terms at auction
  - The actual license frequencies will be assigned after the auction is completed
- GAA
  - Will have access to the rest of the spectrum in each block
  - Again will be coordinated and assigned by the spectrum database

CBRS Technology

- It is expected that the equipment used in this band will be a variation of LTE-TDD
  - Most popular fixed access wireless system in the world
  - Offers 4x4 and 8x8 MIMO capabilities
  - True broadband of 100 Mbps to a subscriber is possible
  - LOS range of over 10 Miles may be possible pending final rules
- With a large number of vendors already making this equipment, time to market and the initial cost points should be lower than any other telecom grade wireless access equipment

CBRS Limitations

- Still need the final rules to be presented
  - Possible change of PAL licenses to more traditional CMA, MSA regions
- 3.5 GHz is not the best for Rural nLOS applications
- GAA licenses have no expectations for interference protection from PAL or incumbent users
- Basically a small cell deployment, backhaul and power considerations needed to significantly more locations than expected with traditional micro cell deployment

Thanks!