
CBRS

Broadband Communities 2019 Summit

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CBRS – Citizens Broadband Radio System: Agenda

- CBRS as defined by the FCC
- CBRS as defined by the Industry
- Frequency Band Refresher
- CBRS in the Frequency Spectrum
- Why the Interest



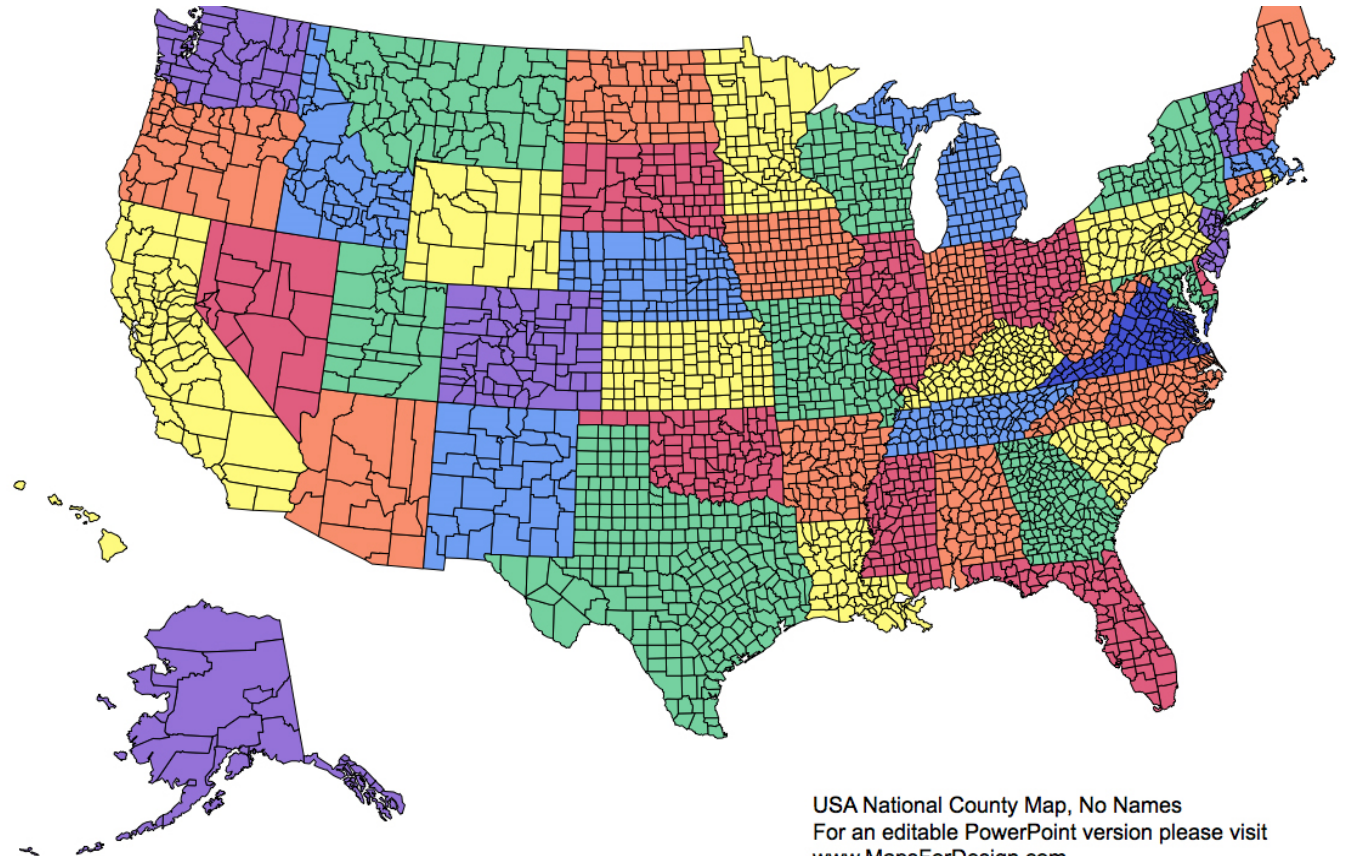
CBRS as defined by the FCC

- Spectrum originally allocated for Military land and ship based radar and Satellite Base Stations
- 20 FCC Rcd 6502 (2005) provided for limited terrestrial use of 3.65 to 3.70 GHz
- FCC 15-47 Docket 12-354 Final NPR Adopted April 15, 2015 Expanded frequency range 3.55 to 3.70 GHz
 - Also known as the 3.5 GHz Order
 - PALS: 3 year Term with one right to renew
 - PAL License Area: 1 Census Tract (73,057 Census Tracts or 500,000 PALs)
- FCC DA 16-946 Docket No. 12-354 Released 8/19/2016 selects the two-pronged approach to protect grandfathered licensed systems until 2020
- FCC 18-149 Docket No. 17-258 Report and Order Released 10/24/2018 Discusses:
 - FCC Recognizes that 3.55 to 3.70 GHz band is being adopted as an international frequency band
 - PAL License Area: County (Approximately 3200 License Areas)
 - 10 Year License with first rights for renewal
 - Adopted End-of Term Performance Requirements
 - Safe Harbor

CBRS as defined by the FCC

https://www.mapsfordesign.com/site/wp-content/uploads/bj_USNationalCountyR_Free.jpg

- FCC 18-149 Released 10/24/2018
 - Allows partitioning of a county
 - FCC will allow discussion in the bidding process that may allow a single bid across multiple areas
 - Reminds us that there will still be 80 MHz of spectrum within each County that will not require a license



USA National County Map, No Names
For an editable PowerPoint version please visit
www.MapsForDesign.com

CBRS as defined by the Industry

- Championed by the CBRS Alliance
 - Comprised of more than 85 Members



- Service has been branded as OnGo
 - Doesn't sound as techy as CBRS – Just like WiFi became the public ID for the 802.11 series
- The proposed spectrum is considered an international spectrum
 - Wide scale adoption – driving down cost
 - Customer devices will be readily available as early as this year
- Designed for both indoor and outdoor applications



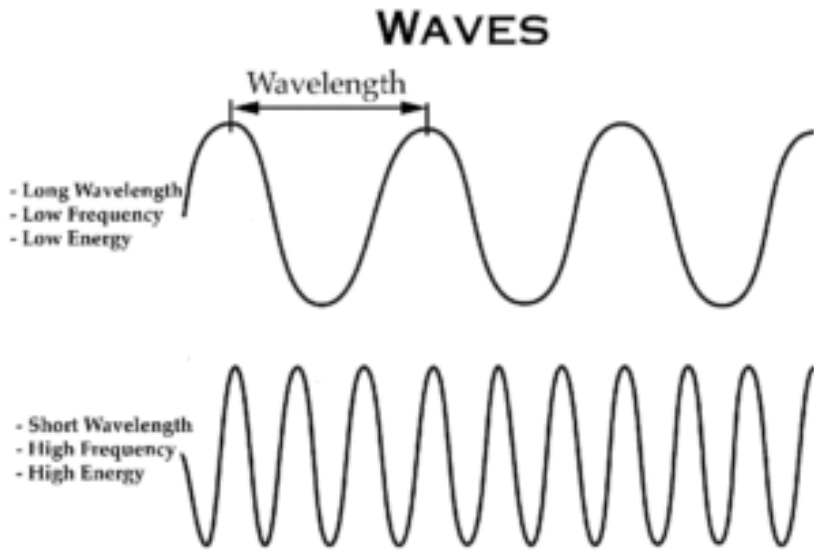
<https://www.cbrsalliance.org/>

Frequency Band Refresher

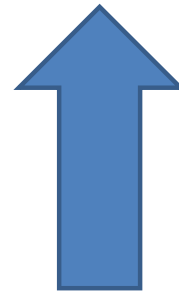
Channel Capacity C is a function of the channel bandwidth and noise

$$C = B \cdot \log_2(1 + S/N) \text{ bits/sec}$$

Shannon-Hartley Theorem



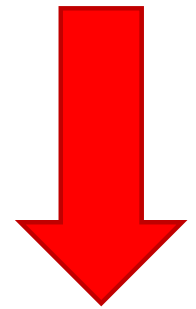
Frequency Throughput



Potential



Distance & LOS

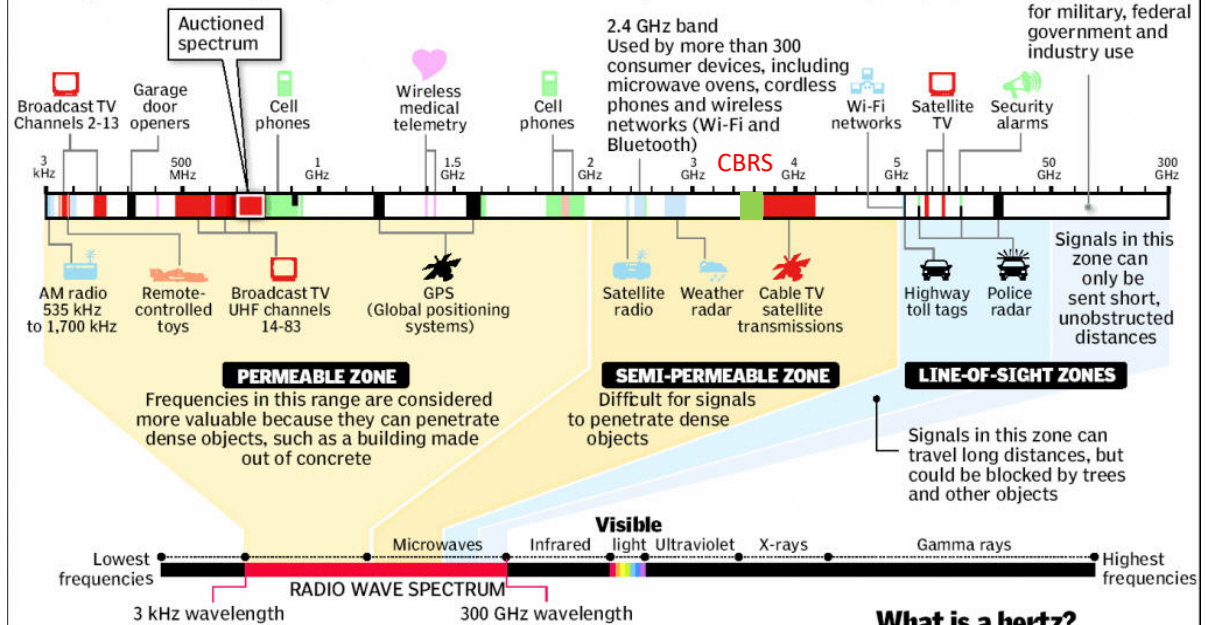


CBRS in the Frequency Spectrum

- Sits between WiFi 2.4 GHz and 5.0 GHz
- Better Propagation than WiFi 5 GHz
- Slightly higher powers than WiFi
- Uncluttered spectrum

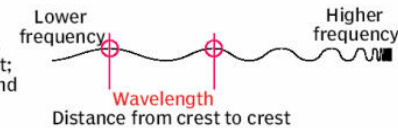
Inside the radio wave spectrum

Almost every wireless technology - from cell phones to garage door openers - uses radio waves to communicate. Some services, such as TV and radio broadcasts, have exclusive use of their frequency within a geographic area. But many devices share frequencies, which can cause interference. Examples of radio waves used by everyday devices are reserved for military, federal government and industry use



The electromagnetic spectrum

Radio waves occupy part of the electromagnetic spectrum, a range of electric and magnetic waves of different lengths that travel at the speed of light; other parts of the spectrum include visible light and x-rays; the shortest wavelengths have the highest frequency, measured in hertz



What is a hertz?

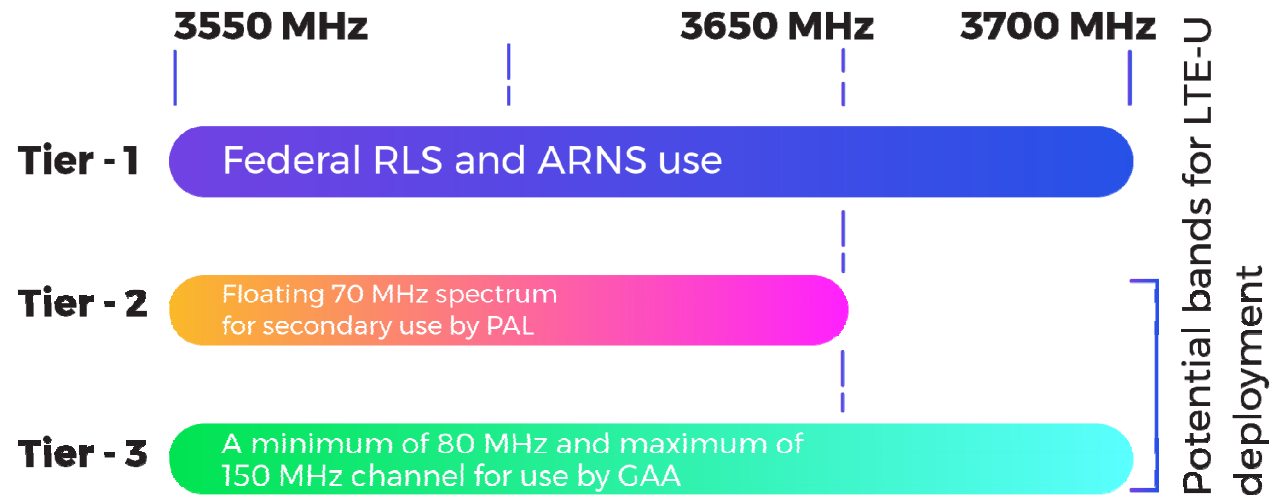
One hertz is one cycle per second. For radio waves, a cycle is the distance from wave crest to crest
 1 kilohertz (kHz) = 1,000 hertz
 1 megahertz (MHz) = 1 million hertz
 1 gigahertz (GHz) = 1 billion hertz

Source: New America Foundation, MCT, Howstuffworks.com
 Graphic: Nathaniel Levine, Sacramento Bee

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CBRS – Citizens Broadband Radio System

- LTE Based
- 3.55-3.70 GHz = 150MHz
- Spectrum Allocation Service (SAS) will dictate spectrum usage for all
- 3 levels of access FCC 15-47
 - Tier 1 Incumbent – Military, Government, protected by Priority Access License (PAL)
 - Tier 2 Priority (PAL) – Up to seven 10MHz Channels auction to highest bidder per census tract (limit 4 blocks/License)
 - Tier 3 General Authorized Access (GAA) – At least 80 M Hz No license required, some regulation



Hwang, Y (2017, June 9) What is CBRS? Retrieved from www.leverage.com

CBRS – Citizens Broadband Radio System

- Category A Base Station: Low power indoor system 24 dBm and a maximum EIRP of 30 dBm in 10 megahertz
- Category B Base Station: High power outdoor unit
 - Non-rural Areas: 24 dBm and a maximum EIRP of 40 dBm in 10 megahertz
 - Rural Areas: 30dBm per 10 MHz and EIRP to 47 dBm EIRP per 10 MHz
 - Safe Harbor:
 - County Population \leq 135k: Need to cover 50% of population or 4 Point-to-Point Links operational
 - County Population $>$ 135k: Need to cover 50% of the population or have a number of Point-to-Point links calculated by the following equation: $\text{Round}(\text{Population}/33,500,0)$
- Spectrum Access Server (SAS)
 - Detects Incumbent systems and automatically moves everyone else to another frequency
 - Trial Systems operational
 - Estimates the service will cost several dollars per month per end point

Questions??

Thank you!
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