LEVEREGE

LTE in 3.5GHz or CBRS Shared Spectrum Explained

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Introduction

The CBRS Alliance is looking more and more powerful every day. The group, which advo- cates for LTE services in the 3.5 GHz Citizens Broadband Radio Service (CBRS) spectrum, now boasts all four major US cellular carriers (AT&T, Verizon, T-Mobile, and Sprint), cable giants Comcast and Charter, as well as Google, Intel, Nokia, and Qualcomm. It's easy to see why the cellular carriers would be interested in more available spectrum, but what is driving Google and other cable companies' interests in the band? This post will examine what CBRS spectrum is, why it is an attractive deployment option for cellular and non-wireless operators alike, and how this affects IoT business strategy moving forward.

What is CBRS?

In 2015, FCC authorized the use of the 3.5 GHz band (3550 MHz to 3700 MHz) for shared wireless access, opening up previously protected spectrum used by the US Navy and other DoD members. While the radio interface is the same as LTE in the licensed spectrum or in the unlicensed 5 GHz band, the difference with CBRS lies in spectrum assignment. To use CBRS spectrum, one must individually request and be assigned a band by a Spectrum Allocation Server (SAS) programmatically. The SAS calculates RF density and channel availability using terrain and radio propagation data before authorizing the request. Also, when the use of the spectrum is no longer required, the channel is freed up for use by other requesters.

FCC Rules Part 96 further defines three levels of priority access in descending order for assigning the use of the CBRS spectrum:

1. Incumbents: Existing users (e.g. US Naval Radar, DoD personnel) get permanent priority as well as site-specific protection for registered sites.
1. Priority Access Licenses (PAL): Organizations can pay a fee to request up to four PALs in a limited geographic area for three years. Only the lower 100 MHz of the CBRS band will be auctioned off; with restrictions of a maximum of seven concurrent 10 MHz PALs
2. General Authorized Access (GAA): The rest of the spectrum will be open to GAA use and coexistence issues will be determined by SAS providers for spectrum allocation.

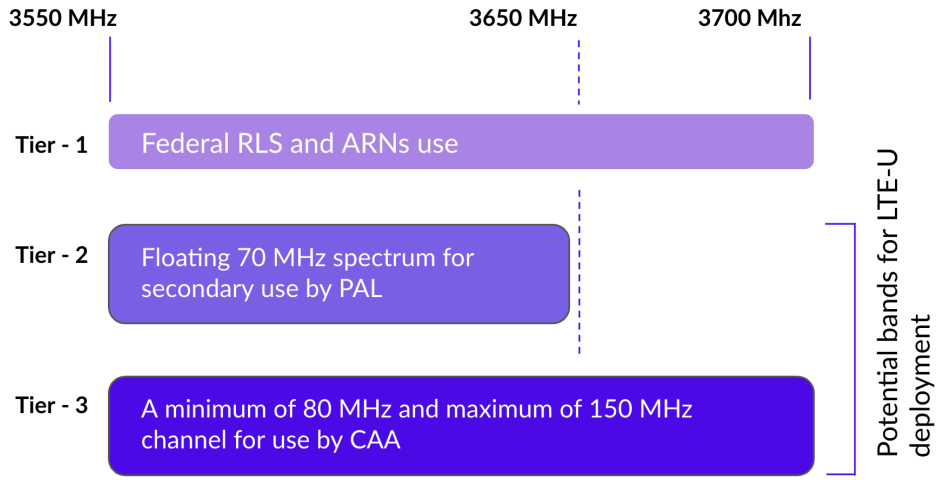

Figure 1, CBRS Spectrum Tiers

Image Credit: Imtiaz Parves at al

It's also important to note that the cost of PALs will be proportional to the population density of the geographic location. This enables rural network operators to protect their license at a lower cost. Even for big carriers, given the plethora of available tracts (74,134) with up to 7 PALs in each, FCC expects that low license costs will help alleviate overloaded spectrum issues in dense, urban environments.

Advantages of CBRS

CBRS significantly lowers the barrier to entry for non-traditional wireless carriers. The limited propagation characteristics of the 3.5GHz spectrum

Trials are already happening in both the industrial IoT and smart home fronts. GE Digital in San Ramon ran a private LTE trial using CBRS spectrum with Qualcomm and Nokia for its Predix platform. PALs fit the need for local connectivity in remote or temporary locations for industrial complexes such as mines, power plants, oil platforms, factories, and warehouses. Private and localized LTE deployments merge the quality of service of LTE and the low cost of unlicensed spectrum.

Alex Glaser of Harbor Research sees CBRS at work in home settings as well. He notes Comcast's acquisition of iControl Networks to potentially move smart home devices to run on CBRS networks. LTE's superiority in quality, performance, and security bodes well for cable providers like Comcast to transition WiFi routers into CBRS-compatible gateways, perhaps through a partnership with with Huawei.

Role of SAS & Neutral Hosts

Another interesting aspect of CBRS is the role of SAS and neutral hosts. Interests from all four major cellular carriers in the 3.5GHz spectrum is notable, but Preston Marshall, the engineering director for Alphabet Access at Google, sees the neutral host concept as the killer application. Multiple private networks can be managed by neutral hosts that will aggregate the traffic and relay it to major networks. This provides a robust in-building LTE ervice to users via a common backhaul and management not tied to a single network provider.

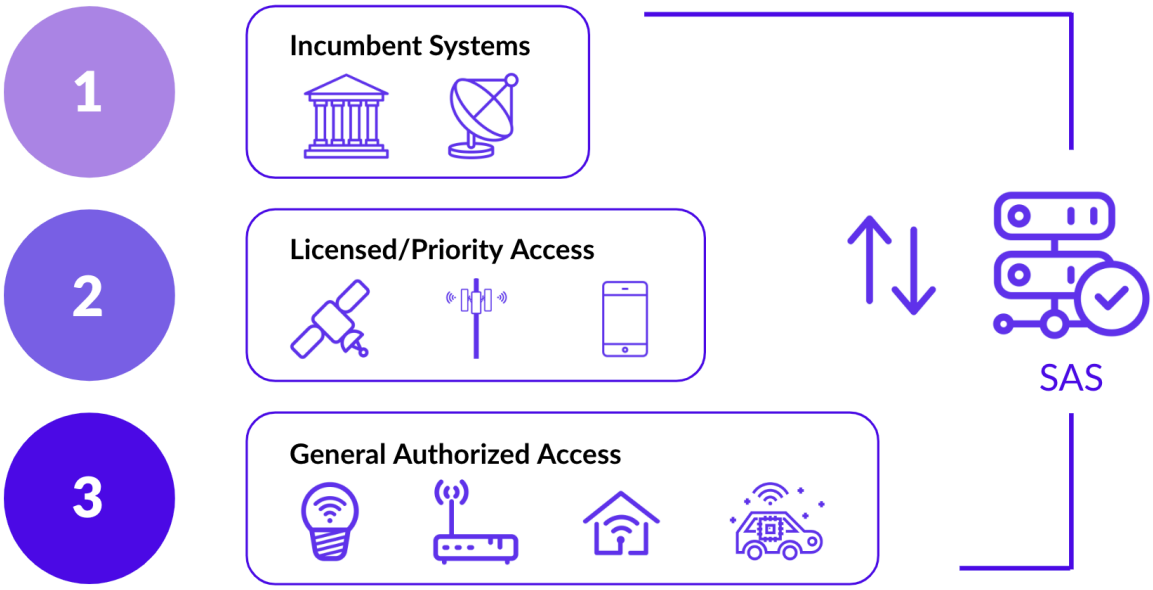

Figure 2, Role of SAS and Neutral Hosts for CBRS Tiers

Image Credit: Comsearch

This decentralized spectrum model redefines spectrum ownership and invites smaller players to deploy private networks. In practice, network owners essentially deploy a CBRS spectrum similar to WiFi. They simply buy FCC-certified gear, register the equip- ment, and select a SAS vendor to connect to the network. Given this scenario, the role of the SAS vendor cannot be understated, which is why Google, along with Federated Wire- less, Spectrum Bridge, Amdocs, and Comsearch, are all interested in the 3.5 GHz spectrum.

IoT Strategy

Aside from industrial IoT players and general network operators looking for more available channels, the SAS model for CBRS invites more players to participate in the eventual deployment of 5G technology. Low license fees and neutral hosts allow non-traditional cellular carriers to build private networks independent of exclusively licensed frequencies or heavily congested unlicensed spectrum in the 5GHz band.

In February, Qualcomm announced that its Snapdragon X20 modem will support the CBRS spectrum. This follows announcements from SpiderCloud demonstrating interoperability with Federated Wireless SAS, Ruckus Wireless's unveiling its version of CBRS called OpenG , and Nokia announcing CBRS support for their indoor and outdoor cells. The table below depicts how CBRS compares with the more traditional unlicensed and licensed spectrum models and highlights some of its inherent advantages. If your IoT strategy revolves around residential/smart home, enterprise or industrial IoT, urban, or rural private networks, it's time to consider CBRS as a serious deployment option.

Spectrum Type:	Licensed	Unlicensed	CBRS
License Rights	Exclusive	Non-Exclusive	"Use it or Share it"
License Area	Large, contiguous metro areas (MSAs)	N/A	Calculated in real-time based on exact location (50m H, 3m V) and comprehensive RF propagation models
License Cost	$Billions in auctions	Free	Free with monthly fee or SAS. Option for additional local protection (PAL) for a fee at auction.
Enforcement	Legal/Regulatory	Power limits, LBT	Central coordination service (SAS)
Technologies	GSM, CDMA, LTE	Wifi, BT, MulteFire	LTE
Deployed by	MNOs	Anyone	Enterprises, MSOs, MNIOs, or MSPs

Table 1, Spectrum Differences of Licensed, Unlicensed, and CBRS

Table Credit: Ruckus Room