GSMA

The Impact of Spectrum Set-Asides on 5G

United States of America

High economic cost resulting from tiered access to shared spectrum



Key lessons

What: Enabling dynamic spectrum sharing in the 3500 MHz band

Why: Protection of incumbent user whilst giving flexible access to other users

How: Automatic assignment of spectrum based on three-tiered dynamic sharing system, with strong restrictions on mobile use

Impact: Economic cost of $15-20 billion due to imposed restrictions

Overview

- A 2012 US government report identified 3550 – 3650 MHz as spectrum suitable for spectrum sharing rather than reallocation to mobile use.
- This led to the creation of the CBRS band (3550 – 3700 MHz) using a complex three-tiered priority system aimed at ensuring continued access to incumbent users and allowing access to newly licenced priority users as well as unlicenced users.
- Whilst the CBRS spectrum was auctioned successfully, with more than 90% of available licences sold, the following auction for adjacent 3.7 – 4 GHz spectrum raised four times the price per MHz, suggesting an economic cost of the sharing approach in the range of potentially $15 – 20 billion.
- With new unlicenced take-up being limited at present, this raises concerns about the success of the sharing approach applied for CBRS and points towards using traditional licencing models in future awards – an approach re-adopted by the FCC in subsequent auctions for similar spectrum bands.

Background

The US government's 2012 "PCAST" Report set out a suggested new direction for spectrum licensing. It suggested that the traditional method of reallocating spectrum from incumbent users to mobile services was outdated and spectrum must be shared. Instead, the report recommended dynamic sharing for certain bands, leading to the development of the Citizen's Broadcast Radio Service (CBRS).

- CBRS utilises three priority tiers, with higher-tier users protected from interference by lower-tier users.
- Incumbent military users occupy Tier 1, while Tier 2 (70 MHz in the 3550-3650 MHz range) is licenced to "Priority Access Licences" (PALs).
- In Tier 3, unlicenced users have access to the entire 3550-3700 when not in use by the incumbent or the priority PAL licence holders, with only an administrative fee charged for a licence.

70 MHz of PAL were auctioned in 2020, with a cap of 40 MHz per bidder at county level. Both priority and unlicensed users must adhere to strict power limits and are lower priority over the incumbent. Also, unlicenced users have no protection from interference, or expectation of exclusive use.

CBRS base stations for priority and unlicenced users are assigned frequencies by a dynamic automated spectrum access system. Environmental monitoring for incumbent users enables the automated system to reassign other users as necessary – including reallocating priority users and removing unlicenced users.

Main lessons

In the 2020 CBRS auction, 91% of the priority licences were sold for $4.5 billion. The proceeds pale in comparison to the subsequent 2021 auction for 3.7 – 4 GHz spectrum, which raised about four times the price per MHz for spectrum in the same band. This price disparity illustrates the economic cost of placing usage restrictions on valuable mobile bands.

At the same time, there is no evidence of strong take-up by unlicenced users in the CBRS band. Whilst the FCC does not maintain data regarding applications for access to the band, users include public schools, smart factories, and agriculture users. Furthermore, some mobile operators are utilising the unlicenced frequencies to supplement private network deployments. There are several factors contributing to the limited interest in unlicenced use. Interference between users is not managed, whilst different technologies such as Wi-Fi, WiMAX and other proprietary technologies are being deployed in parallel. Adding this to the lack of certainty regarding spectrum access and the severe power limitations means that the prospect of future widespread unlicenced use looks uncertain at best.



Tiered licensing model



Severe power restrictions



$10bn+ foregone government revenue



Low take-up to date (inefficient spectrum use)

Final impact

By creating the CBRS, the FCC made available up to 150 MHz of spectrum for shared spectrum use between incumbent users, mobile operators, and industry users. However, the power restrictions, uncertainty of access, and complex deployment methods have contributed to inefficient spectrum use in a valuable mobile band.

This has created a significant economic cost. By looking at final prices in the 2020 CBRS and 2021 3.7 – 4 GHz auctions, it follows that the CBRS restrictions reduced the economic value for mobile operators by about 75%.

With the CBRS auction having raised about USD 4.5 billion, this implies an economic cost of about $15 billion for the 100 MHz auctioned, rising to $20 billion if the full 150 MHz available in the band is considered.

These foregone auction proceeds could have contributed to efforts to relocate incumbent users in an economically efficient manner and finding more suitable spectrum bands for shared low-power use, increasing the social value for consumers and spectrum users alike.