Coordinated Shared Spectrum and Small Cells

Opportunities missed or seized?

Simon Saunders
Agenda

● Google’s interest in this space
● Barriers
● Spectrum balance
● CBRS progress
● UK opportunity

Thanks to CBRS Alliance for permission to share its materials
Google’s activities

We depend on mobile connectivity and on our operator partners.

Google's mission is to organize the world's information and make it universally accessible and useful.

So we aim to help our operator partners to deliver abundant, high quality mobile connectivity everywhere.

See https://telecomsconnect.withgoogle.com/ for examples
Barriers to scaling indoor small cells

Investment

Multi-operator

Interoperability

Spectrum
A barrier and an opportunity to overcome the barriers
Balance of mobile spectrum bands and access mechanisms

Need a fully-featured **blend** of spectrum access and bands to support use cases:

<table>
<thead>
<tr>
<th></th>
<th>Licensed</th>
<th>Shared</th>
<th>Licence exempt</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low (&lt; 1 GHz)</strong></td>
<td>✔</td>
<td></td>
<td></td>
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<tr>
<td><strong>Mid (1 - 6 GHz)</strong></td>
<td>✔</td>
<td>✘</td>
<td>✔</td>
</tr>
<tr>
<td><strong>High (&gt; 6 GHz)</strong></td>
<td>?</td>
<td>?</td>
<td>✔</td>
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</table>
Current UK mobile spectrum balance

Current ‘horizontal’ shared mobile spectrum: 0.78%
Beyond bipolar spectrum management

Traditional options:

Exclusive licensed

Licence-exempt
Beyond bipolar spectrum management

Traditional options:
Exclusive licensed

Flexible authorisation:
Licensed, protected by regulation
Licence-exempt, assured by coordination

Balance varies by market need and technology capability, while assuring protection of rights holders
CBRS: Shared spectrum for all needs

- Brings underutilised spectrum into use without displacing incumbents
- Licensed for investment certainty
- Licence-exempt for rapid open innovation
CBRS Alliance Activities

- Technical Specifications for Networking & Coexistence
- OnGo Certification Program to ensure seamless integration and deployment
- Market advocacy
OnGo equips the entire ecosystem with three advantages:

- A simple, yet powerful platform for articulating the expanded business opportunities tied to the rapid and widespread adoption of spectrum-sharing wireless solutions;
- Access to the tremendous economies of scale provided by the prevalent global wireless standard for mobile cellular radio represented by 4G LTE, as well as a roadmap to progress towards 5G;
- A strong foundation, which guarantees interoperability and optimized product performance across the ecosystem with the OnGo Certification Program.

The OnGo Certification Program began accepting products for evaluation in May.
CBRS Alliance Membership

Includes:
- Three of the four largest operators
- rural providers
- private LTE providers
- the NFL
- Ports
- commercial real estate
- the petroleum industry
Spectrum Access System and ESC

- Google is providing a SAS and ESC capability compliant with FCC’s CBRS rules and WinnForum’s specifications.
- This will allow devices to access up to 150 MHz spectrum and to ensure coexistence with other systems.
- It also opens up an era of efficient automated spectrum management in high resolution 3D.
Imminent commercialisation

- First devices have successfully completed the ATL testing process and are now awaiting FCC review.
- Six SAS admins already have outline approval, testing against test harness well underway.
- **July**: FCC announced arrangements for initial commercial deployment, under GAA tier.
- **September**: Proposals due.
- Multiple announcements of intent.
- **First commercial operations expected by year end**
Shared spectrum and Europe

Tier 1: Protected incumbents

Tier 2: Local exclusive licences

No licence-exempt tier

Licensed Shared Access (as defined in Europe today)

Lost benefits:
- innovation
- democratised access
- new investment models
Minimum requirements for UK shared spectrum

● Sufficient spectrum
● Flexible coordinated access
● Assurance of access
● Support today by 3GPP and industry ecosystem
● Available soon
Golden opportunity for UK

<table>
<thead>
<tr>
<th>Band 42</th>
<th>UK auction</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Band 48
US CBRS

| 3.55    | 3.70       |

| 3.4     | 3.55       | 3.6       | 3.70       |

Band 43

| 3.8 - 4.2 |

UK call for inputs

“the primary band suitable for the introduction of 5G-based services in Europe”

- Radio Spectrum Policy Group opinion, Nov. ‘16

“Preparation for 2019 auction”

“Potential for increased sharing”

Ofcom considering approach
Future Telecoms Infrastructure Review Published 23 July 2018

- Promote new, innovative 5G services from existing and new players, through the release of additional spectrum. We should consider whether more flexible, shared spectrum models can maintain network competition between MNOs while also increasing access to spectrum to support new investment models, spurring innovation in industrial internet of things, wireless automation and robotics, and improving rural coverage.

185. Given the greater number of cell sites likely required for 5G over the longer-term, the traditional model of cell deployment is likely to be too expensive and impractical to adopt. Operators will need to work together with local stakeholders to improve processes to enable more efficient small cell deployment.

- Market Expansion Model. This relies on competition between multiple national networks but also enables new infrastructure and spectrum access models. In this model, the UK would continue to benefit from network competition between multiple national operators. National networks would be supplemented by ‘neutral host’ infrastructure and private networks to, for example, deliver small cell deployments in urban areas and in-buildings, or to expand rural coverage beyond that delivered by the MNOs, or to serve new micro-markets such as industry ‘verticals’. Such infrastructure models could be supported by promoting access to 5G spectrum, through spectrum trading or potentially new spectrum sharing models. At the service level, enhanced mobile broadband services would be provided by MNOs and MVNOs, alongside new services enabled by existing and new players.

223. We would, therefore, encourage Ofcom to assess the feasibility, costs and benefits of potential flexible licensing models, and also consider the trade-offs involved, as part of its continuing consultation on the planned release of spectrum in the 3.6 – 3.8 GHz band, in addition to its work on the 3.8 – 4.2 GHz band.
# Addressing frequent misconceptions

<table>
<thead>
<tr>
<th>Misconception</th>
<th>Comment</th>
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</thead>
<tbody>
<tr>
<td>Reduces the spectrum for 5G?</td>
<td>No, it enhances efficiency of spectrum access for all, including mobile operators.</td>
</tr>
<tr>
<td>Operator certainty?</td>
<td>Mix of licensed and open access gives all the opportunity for guaranteed access. Licensed users will still have certainty of their investment.</td>
</tr>
<tr>
<td>Unproven?</td>
<td>The mechanisms are well established in standards and trials, designed for the US CBRS spectrum but easily adaptable to UK context. Why forego the benefits? Should we have waited to see if Wi-Fi would be successful? UK should be a leader, not a laggard in 5G.</td>
</tr>
<tr>
<td>White spaces?</td>
<td>White space spectrum does not have a strong ecosystem. 3.6-3.8 GHz has a very strong ecosystem of attractive mobile phones and network components.</td>
</tr>
<tr>
<td>Wait for 3.8-4.2 GHz?</td>
<td>This does not have the ecosystem for mobile devices. Waiting for this delays the benefits well past the ramp-up of 5G in the UK.</td>
</tr>
</tbody>
</table>
Time for the UK to get into the small cell fast lane?

- Virtual reality zone inside stock car race cars operating at the Richard Petty Driving Experience, creating a full "in car" 360° 4K video experience in real time
- Speeds in excess of 180 mph
- Nokia, Google and Qualcomm Technologies

Nokia, Alphabet, and Qualcomm Demo Private LTE Network Over CBRS Shared Spectrum

7 February 2017 — Las Vegas, Nevada — Nokia, Alphabet’s Access Group and Qualcomm Technologies, Inc. joined forces to showcase the first live demo of a private LTE (Citizens Broadband Radio Service) network at the 2017 CES. The demonstration highlighted the potential of a CBRS network to provide reliable, high-speed internet access for a variety of applications, including connected vehicles, autonomous vehicles, and IoT devices.