Your response

Question	Your response
We invite interested	Confidential? –N
parties to provide	
feedback on the Roadmap.	Federated Wireless, Inc. (Federated Wireless) hereby submits these comments in response to Ofcom's consultation, entitled "Spectrum Roadmap: Delivering Ofcom's Spectrum Management Strategy" (the Roadmap). Federated Wireless fully supports Ofcom's goals of: 1) en- suring continued efficient use of spectrum for existing and new uses by understanding the impact of technology and convergence; 2) enabling industry to experiment with ways to enable and accelerate greater spectrum sharing; and 3) obtaining more real world data to support more efficient use and sharing of spectrum.
	Given our experience with implementing automated dynamic spectrum sharing as a Spectrum Access System (SAS) administrator in the 3.5 GHz band and as a prospective Automated Frequency Coordination (AFC) system operator in the 6 GHz band, we offer our perspectives on how Ofcom can leverage existing automated spectrum management tech- nology and tools to achieve its goals. In fact, Federated Wireless be- lieves that the use of automated dynamic sharing technology is a critical component of Ofcom stated goals, rather than merely a subset of them.
	For the purpose of clarification, we would like to distinguish between the following approaches to automated licensing and spectrum sharing:
	 Human-to-machine automated licensing in which a prospective licensee uses a web-interface to submit an application, which is then processed automatically, and a licence (or licence-exempt authorisation) is issued without human intervention on the part of the regulator;
	 Machine-to-machine automated licensing – same as number one above, but with additional support for third-party auto- mated systems to submit an application on behalf of a prospec- tive licensee via an API and receive the licence (or licence-ex- empt authorisation);
	 Dynamic Spectrum Access (DSA) – same as number two, but with ongoing machine-to-machine interaction for the purposes of receiving spectrum authorization updates and for reporting back from the device throughout the duration of the licence (or licence-exempt authorisation).
	Such automated spectrum sharing technology has numerous benefits directly related to the achievement of Ofcom's goals, including:

Increasing spectrum efficiency and density of usage (e.g., per-• mitting re-use of frequencies to support both indoor and wide area operations in same geographic area and/or enabling more closely spaced deployments under the Shared Access licensing framework) Enabling Ofcom to process licence applications at a speed and scale not possible with manual processing, which will be critical to meet the demand Ofcom has projected in the Roadmap Supporting a seamless transition from automated licence applications to 'full' automated dynamic spectrum access (e.g. with an ongoing machine-to-machine update and reporting process) Enabling flexibility of spectrum use in keeping with changing demand across different classes of users and business models (e.g., some business models require only periodic, rather than consistent access to spectrum) Facilitating diverse private network deployments at scale by enabling licence applications to be made by third-party automated cloud-based services (e.g., "AWS Private 5G"¹) on behalf of a licensee; these rely solely on machine-to-machine interfaces and are not possible with human-to-machine automated licensing (e.g., a web form) Collecting timely, real-world data on noise floor, propagation, spectrum usage, and even interference reports Interfacing directly with Ofcom's licensing databases and other services, easing access, management, and support of offline analysis objectives Simplifying operation and management of spectrum sandboxes (note that even with the virtual sandbox known as DARPA SC2 Colosseum, there was as a need to arbitrate access dynamically for experiments) Simplifying regulatory evolution and innovation by: • Using same web / REST API interface for updating databases to support introduction of new regulations • Upgrading entire ecosystem at once, simplifying transition to new technologies and regulations (e.g., from spectrum sandboxes) • Enabling regulatory customisation by location / time / frequency (e.g., sparsely populated Highlands can operate under a more lightly managed regime than urban London where more frequent changes may be necessary). Given these myriad examples of how automated technology can assist Ofcom to achieve the objectives identified in the Roadmap, Federated

¹ <u>https://aws.amazon.com/private5g/</u>

Wireless urges Ofcom to implement machine-to-machine automated licensing across all shared bands as soon as possible, with a roadmap to supporting 'full' DSA where suitable. We also recommend that Ofcom consider creating a project team to identify how future sharing solutions can leverage automation to meet projected spectrum demands.

Ofcom need not develop such solutions from scratch. Rather, Ofcom should consider leveraging the many commercially available and proven spectrum sharing solutions that are on the market today, as well as technology developed through funding from the Department for Digital, Culture, Media and Sport (DCMS). Such reliance will greatly speed the transition from spectrum sandboxes to commercial reality.

A. Comments on Technology and Market Trends

Federated Wireless agrees with Ofcom's observations that there is an increasing demand for spectrum to support growing consumer broadband needs, as well as for wireless connectivity in the digital transformation of industry (i.e., private wireless networks). We also agree that a range of techniques and technologies, including the integration of cloud-based services, are making possible the use of spectrum on a localised or shared basis while also reducing risks for interference.

In keeping with these observations, Federated Wireless notes the following:

- Rapidly increasing adoption of the cloud for application deployment makes database-enabled spectrum access and management more synergistic and cultivates complementary and novel services (e.g., integrated provision of 5G hardware and licences via the same cloud-based system).
- Automated dynamic spectrum sharing is spurring the growth of private networks:
 - Without access to spectrum on a shared and/or localised basis, the hundreds of new private wireless deployments and over 230,000 CBRS devices in the 3 GHz band would not be possible.²
 - Enterprise users were previously unable to compete with mobile network operators (MNOs) for spectrum rights via auction or to right-size spectrum needs through secondary markets.
 - Now that direct access to carrier-grade spectrum and equipment is available through automated shared spectrum, this has put pressure on MNOs to offer their own private wireless network services for enterprises, further increasing competition and innovation.

² <u>https://ongoalliance.org/news/ongo-alliance-announces-winners-of-the-2021-ongo-awards-as-it-passes-milestone-of-200000-installed-cbrs-devices/</u>

- Automated dynamic spectrum sharing can accommodate new business models and use cases that were previously too complex for traditional licensing frameworks.
 - Many short-term spectrum needs (e.g., for events) can best be supported through spectrum sharing arrangements and may necessitate automated sharing and database management in particular, given their shortterm nature and unique geographic requirements.
- Automation is not only necessary for private network spectrum access, but is also critical for infrastructure deployment, provisioning, and customer service.
- The growth of edge-computing capabilities means that "database" enablement does not have to mean fully centralised.
 - Coordination and sharing can be facilitated on smaller timescales and geographies with:
 - Dynamic beam forming deconfliction
 - Shorter latencies for response
 - Even with databases moving to the "edge," the benefits of scale can be achieved when such databases are joined with centralised databases to:
 - Collect data / measurements
 - Provide single point of top-level management.

B. Comments on Accelerating innovation and spectrum sharing with spectrum sandboxes.

Federated Wireless agrees with Ofcom that spectrum sandboxes are an effective and efficient way to test new ideas and approaches, while accelerating the introduction of new technology and regulatory frameworks. Having direct involvement of the regulator in experiments can reduce uncertainty, promote confidence, and facilitate commercial adoption. As an example, we note that in the United States, the National Science Foundation (NSF) is exploring the use of National Radio Dynamic Zones (NRDZ) for experiments when incumbent users are not operating.³ We believe this trend is a positive one that Ofcom can further promote.

In addition to adopting technologies fostered in spectrum sandboxes, Federated Wireless encourages Ofcom to leverage technologies developed under the DCMS prototyping efforts, such as through its 5G Testbeds and Trials Programme.⁴ As Ofcom is likely aware, Federated Wireless is part of the Rural Connected Communities (RCC) Project

³ <u>https://beta.nsf.gov/funding/opportunities/spectrum-innovation-initiative-national-radio-dynamic-zones-sii-nrdz</u>

⁴ <u>https://www.gov.uk/guidance/5g-testbeds-and-trials-programme-complete-list-of-5g-projects</u>

funded by DCMS. Through that project, Federated Wireless has developed and demonstrated a software tool for the Shared Access licensing framework that, if adopted by Ofcom, would enable both human-tomachine and machine-to-machine automated licence applications, a streamlined process for inquiring about shared spectrum availability, as well as additional support for ongoing machine-to-machine dynamic spectrum access if and where required.

Finally, we note that use of automated dynamic spectrum sharing technology for access and management can also help Ofcom to manage the boundary between the sandboxes and the "real world," manage access within the sandbox across competing experiments, and simplify the transition of technologies from sandbox to commercial use.

C. Comments on Better data for better spectrum management

Federated Wireless strongly agrees with Ofcom's assessment that effective spectrum sharing and increased spectrum efficiency are both dependent on accurately understanding, modelling, and measuring current use as well as anticipated future use of spectrum.

We believe that measurements should be used to progressively refine models, not just for propagation, but also for patterns of use, access, and interference to continually improve spectrum access and increase efficiency. API-enabled automated dynamic spectrum sharing technology with reporting mechanisms can be used for real-world data gathering, measurement, and validation of actual use. Use of an API together with a regular heartbeat or check-in with the spectrum management system is especially important in this context insofar as reporting mechanisms for spectrum sharing can be leveraged to report interference. Measurement reports can provide the data and justification necessary to more quickly and automatically resolve interference incidents.

Furthermore, API-enabled automated spectrum sharing technology can be utilised by incumbents to dynamically reserve and release spectrum. For example, in the U.S. CBRS band, the U.S. Department of Defense currently uses a portal interface to schedule its use of frequencies at specific times and in specific locations. An even more dynamic system, called TARDyS3,⁵ is currently in development for cooperative scheduling and interference resolution. Similarly, the MoD recently announced an intent to study Government Controlled DSA,⁶ which would presumably also lead to a similar interface that enables dynamic spectrum coordination and sharing.

⁵ <u>https://gcn.com/emerging-tech/2020/06/disa-plans-spectrum-sharing-scheduling-system/315025/</u>

⁶ https://bidstats.uk/tenders/2022/W12/771358800

D. Conclusion

Federated Wireless appreciates the opportunity to provide comments and offer our perspectives on Ofcom's Roadmap. We believe that the increasing adoption of cloud-computing technology and solutions is synergistic with Ofcom's spectrum management goals. The use of automated dynamic spectrum sharing capabilities will enhance Ofcom's efforts to increase spectrum efficiency and access, while accelerating new, diverse use cases and business models. We look forward to working with Ofcom to explore how these capabilities can be implemented in the near-term to bring Ofcom's vision to reality.

Please complete this form in full and return to spectrum.roadmap@ofcom.org.uk.