

# Spectrum Roadmap

## Delivering Ofcom's Spectrum Management Strategy



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# 1. Summary

The radio spectrum (the invisible waves that enable wireless technology) is a finite resource crucial to delivering a wide range of wireless applications benefiting different users, and Ofcom has the job of ensuring it is used in the best interests of all in the UK. This approach sits at the heart of Ofcom's mission to make communication work for everyone.

Wireless communication is playing an increasingly significant role across many sectors of the economy, delivering our news, connecting us to friends and family, automating factories, supporting public services and monitoring the natural environment. Technological developments are enabling new and innovative applications and business models, meaning more people and organisations are making use of wireless technology. In the face of this growing and, in many cases, competing demand for spectrum, Ofcom set out a new Spectrum Management Strategy in July 2021.

This document confirms our intention to progress the new areas of spectrum related

work that we proposed in the [Spectrum Roadmap](#) discussion document published in March. These new work areas will enable us to deliver the vision for spectrum management set out in our Spectrum Management Strategy. These new projects and programmes will be progressed in conjunction with the work areas that we have already set out in our [2022/23 Plan of Work](#).

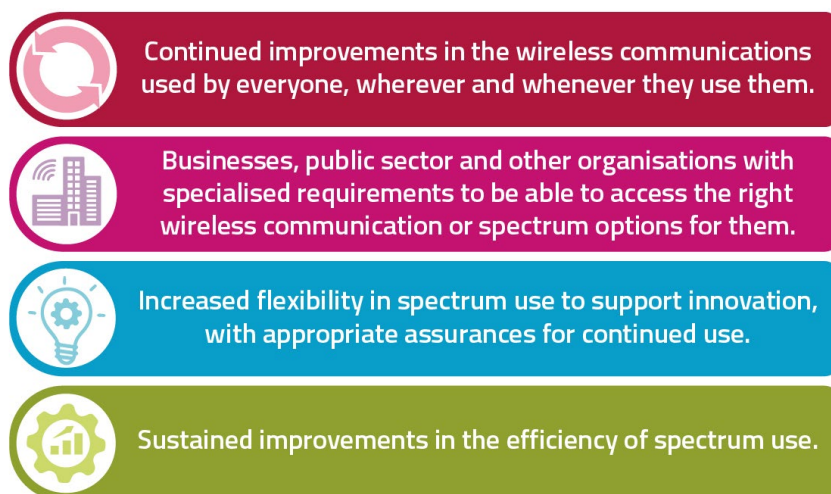
In this document we also outline our immediate next steps and provide information on how interested stakeholders can contribute to the work. Additional areas of work might arise in the future as a result of market and international developments. These will be considered alongside the areas of work outlined in this document and managed as part of our Plan of Work process.

An [annex](#) to this document provides a summary of responses we received to our proposals in the Roadmap discussion paper we published earlier in the year and how we have taken these comments into account in deciding on our future work programme.

## 2. Ofcom's future spectrum work

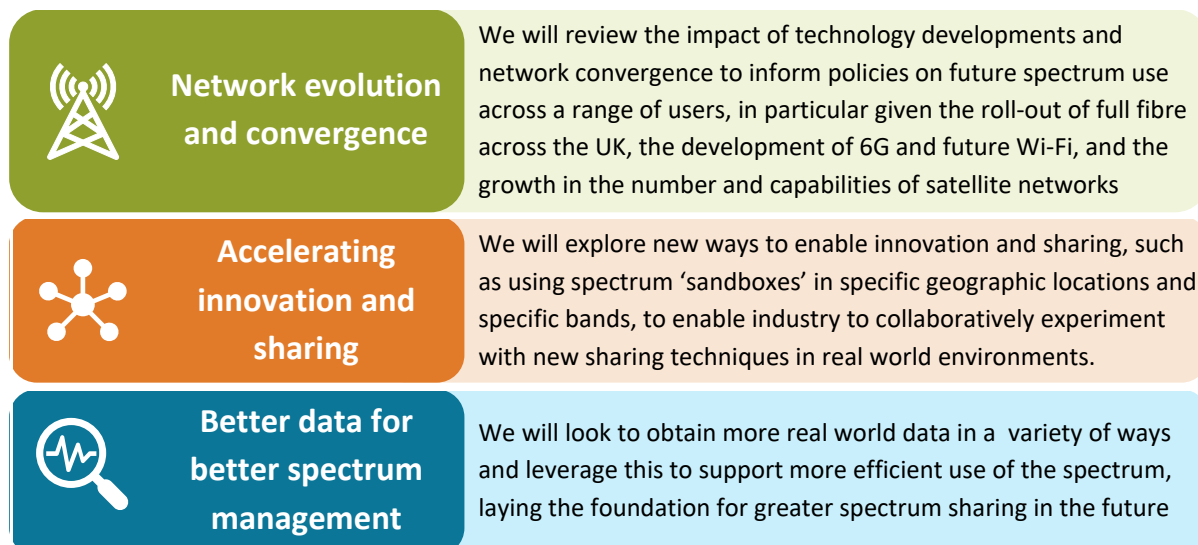
- 2.1 Demand for spectrum continues to grow and evolve, driven by technology innovation and wider market developments. New technologies not only drive the development and adoption of new wireless devices and services but also provide opportunities to better utilise this finite resource.
- 2.2 We believe that the use of spectrum will continue to transform the way we live and work – benefiting people throughout the UK and beyond, helping to make us more productive and supporting industries across the economy. In our [Spectrum Roadmap](#) discussion document, published on 31 March 2022, we outlined the work we plan to do to meet the challenges and seize the opportunities arising from the emerging market and technology trends to ensure we deliver on the vision we outlined in our [Spectrum Management Strategy](#).

**Figure 1: Our spectrum management vision**



- 2.3 Our spectrum work programme, in the short and long term, is driven by our duties, aimed at delivering our strategic vision and informed by external trends and developments. We have analysed a wide range of trends that continue to affect our work:
- i) The wider external context, including political and socio-economic developments.
  - ii) Increasing demand for spectrum as wireless technologies support a growing range of applications and new connectivity technologies and services emerge.
  - iii) Improvements and developments in spectrum use, exploring how technological developments are opening up opportunities to better utilise this finite resource.
- 2.4 In light of these trends, and the challenges and opportunities arising as a result, we have identified three future work themes to deliver on our strategy. In particular, we highlighted that using more sources of better quality data will become increasingly important in our future work, helping to facilitate better and more flexible spectrum management. Gathering, analysing and improving the transparency of this data will underpin our future spectrum work. Figure 2 below outlines the themes driving our future work areas.

Figure 2: Themes of future work areas



- 2.5 In parallel with our Spectrum Roadmap, we have today published our finalised Space Spectrum Strategy<sup>1</sup>. The space sector has undergone significant change and rapid expansion since the previous space strategy was published in 2017. Our Space Spectrum Strategy statement sets out our planned future work on space spectrum issues; these work areas are summarised in our spectrum roadmap to provide a comprehensive view of our programme of work.
- 2.6 Table 1 summarises our planned future programme of work. The table includes ongoing projects as well as the new work areas identified in our March discussion document<sup>2</sup>.
- 2.7 Some of the new work areas in our Roadmap will become ongoing, programmatic work that will inform our policy development. Other work areas will focus on more specific challenges and opportunities and trigger specific projects. More details on the timing of specific projects will be included in future versions of Ofcom's Annual Plan of Work.

<sup>1</sup> <https://www.ofcom.org.uk/consultations-and-statements/category-2/space-spectrum-strategy>

<sup>2</sup> Some projects that were included in our 2022/23 Annual Plan of Work have now completed or will complete soon. We have not included these projects in Table 1.



Table 1: Programme of work in this Spectrum Roadmap

## Key:



Continued improvements in the wireless communications used by everyone







Increased flexibility to support innovation, with assurances for continued use



Access for businesses, public sector and other organisations with specialised requirements



Sustained improvements in the efficiency of spectrum use

Project and Programmes					
Network Evolution & Convergence	Enabling more optimal use of spectrum (1.4 GHz, 2.1 GHz and mmWave)	✓	✓		✓
	Improving access to spectrum for satellite communications and other space-based services	✓	✓		✓
	Spectrum for Utilities		✓		✓
	Understanding industry demand for spectrum		✓		✓
	Developing a cross sectoral understanding of evolving spectrum demand at 6GHz	✓	✓	✓	✓
	Monitoring and influencing the development of next generation network technologies, such as 6G & direct to mobile handset satellite	✓	✓	✓	✓
	Impact of fibre roll-out on use of wireless fixed links		✓		✓
	Assessing the implications of new technologies on how we manage spectrum use		✓	✓	✓
	Review potential for migration from 'dedicated' to 'general purpose' networks		✓		✓
	Preparation for WRC	✓	✓		✓
Accelerating innovation & sharing	Spectrum sandboxes: working with industry to test new spectrum sharing scenarios, with an initial focus on 3.8 – 4.2 GHz band			✓	✓
	Exploring new adaptive and flexible approaches to spectrum management, including the future role of databases			✓	✓
	Ensuring effective spectrum sharing between space-based services, particularly NGSO systems			✓	✓
Better data for better spectrum management	Measuring utilisation of selected bands			✓	✓
	Using real world data to improve propagation models				✓
	Using real world data to improve spectrum assurance				✓
	Improve our understanding of active antenna systems				✓
	Improving receiver resilience				✓

2.8 This work programme will provide the data, market insight and operational capabilities we will need to prepare us for the coming decade and inform future policies. We do not expect the full benefits to be seen straight away – but they will provide an important foundation on which we can build in future years.

2.9 We note that market and international developments will continue to affect the way consumers and businesses use wireless connectivity and will likely require us to

continuously evolve to respond to these changes by introducing additional work areas and projects during the period covered by our Roadmap. We will include additional projects in Ofcom's annual Plan of Work as appropriate.

- 2.10 We plan to review progress and refresh the Spectrum Roadmap in 2026.

## **Stakeholder contribution and engagement is key to support the delivery of our objectives**

- 2.11 To successfully deliver our spectrum vision we will need stakeholders to contribute to and engage with our work. Our work on Spectrum Sandboxes and the development of a solution to allow automated reporting of interference events will require early engagement and collaboration with industry and below we set out how stakeholders can contribute to this work in the coming months.

### **Spectrum sandboxes: working with industry to test new spectrum sharing scenarios.**

- 2.12 We will work with industry and academia, in a defined geographic area, to explore how equipment can coexist in the real world. Participants will be given scope to experiment with different approaches and algorithms for sharing spectrum, laying the basis for a quicker and more innovative approach to agreeing sharing conditions.
- 2.13 We plan to hold an initial workshop with interested parties before the end of the year to explore potential sandbox ideas and provide an opportunity for stakeholders to meet together, ask questions and share ideas. Our initial focus is on exploring more flexible access to 3.8 – 4.2 GHz<sup>3</sup>, but we also welcome proposals from stakeholders on additional sandboxes. Stakeholders that wish to provide additional ideas can email us at [spectrum.roadmap@ofcom.org.uk](mailto:spectrum.roadmap@ofcom.org.uk) (please include 'Sandboxes' in the subject line). We will announce details of the workshop through our [e-mail update system](#): please subscribe to 'Radio Spectrum' to receive relevant updates.

### **Using real world data to improve spectrum assurance.**

- 2.14 We are developing a proof-of-concept API (application programming interface) to allow spectrum users to log interference events automatically and in real time. This could bring benefits to users in that it could allow Ofcom to more accurately identify potential or actual instances of interference on a real-time basis and allow more effective and proportionate targeting of interference investigations. The API could also be a valuable tool for the Spectrum Sandbox projects.
- 2.15 A number of stakeholders have already expressed an interest in this work, and we will now begin our engagement with them to discuss what data is available and how it could be

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<sup>3</sup> In the March discussion document, we also suggested sandboxes could be useful for exploring new ways to access lower 6GHz and Terahertz spectrum. We will consider proposals for these bands for subsequent sandboxes.

submitted. If you are interested in participating in the proof-of-concept trial then please email us at [spectrum.roadmap@ofcom.org.uk](mailto:spectrum.roadmap@ofcom.org.uk) (please include 'Spectrum Assurance' in the subject line). Depending on the level of interest, we may hold a workshop with industry to present our plans for the trial and seek stakeholder views on how to optimise the solution.

## Invitation to contribute to our technology programmes

- 2.16 With the increased convergence of communications networks and services and the rapid rate of technology innovation it is more important than ever that Ofcom has a detailed understanding of emerging technologies and standards. Currently, this is particularly the case in the area of space-based communications, including growing interest in direct to mobile handset satellite services, and research into new technologies that might form the basis of future 6G systems.
- 2.17 We will be bolstering our existing horizon scanning activities over the coming months, seeking insights from academic and industry researchers in the UK and overseas. If you would like to contribute to our ongoing technology programme please email us at [spectrum.roadmap@ofcom.org.uk](mailto:spectrum.roadmap@ofcom.org.uk) with 'Technology Programme' in the subject line, setting out your areas of interest and relevant experience. We are particularly interested in developments that:
- a) Could enable more efficient and more flexible access to spectrum, including sharing, and new techniques for managing spectrum;
  - b) Technologies that may be relevant to 6G networks, both for terrestrial and airborne or space-based systems.

## Other programmatic work

- 2.18 As explained above, our drive to use better data will underpin our future spectrum work. Our work on improving propagation models, measuring spectrum utilisation and improving our understanding of active antenna systems and more resilient receivers will be taken forward and embedded within existing projects and our ongoing programme of international activities.

## Responses to our Roadmap discussion document

- 2.19 We received 32 responses to our discussion document and have published all non-confidential responses on our [website](#).
- 2.20 We welcome this feedback and have considered it carefully. Many responses focused on the current projects highlighted in our discussion document. For these responses, we have passed the feedback to the project teams who are managing this work for their consideration.
- 2.21 Responses that commented on our future work areas were broadly supportive of the ideas we outlined and did not suggest that we should be focusing on different areas. As outlined



above, we are planning to progress all the future work areas set out in our discussion document.

- 2.22 An [annex](#) to this document provides a summary of responses we received to our proposals in the Roadmap and how we have taken these comments into account in deciding on our future work programme.