

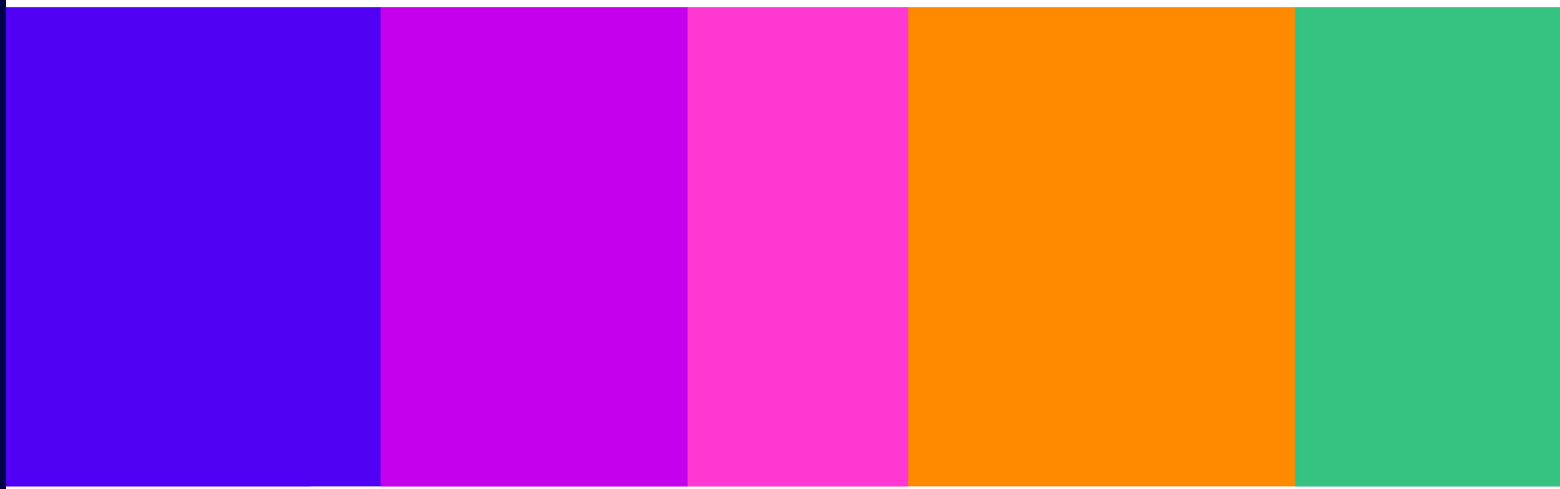
Improving mobile connectivity from the sky and space

Spectrum for Direct to Device and Mobile
Satellite Services

Call for Input

Published 23 July 2024

Closing date for responses: 13 September 2024



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1. Overview

- 1.1 New technologies are enabling a wider set of mobile connectivity solutions from the sky and space.
- 1.2 A new generation of 'Direct to Device' (D2D) services that enable mobile handsets to connect to satellites and airborne platforms is starting to emerge. These new D2D services have the potential to improve connectivity in the UK by extending mobile coverage and providing a degree of back-up connectivity when there are outages on the terrestrial networks. Unlike traditional satellite phones, that serve more specialist use cases, D2D services are being developed to connect to mass market consumer handsets.
- 1.3 In addition to supporting emerging D2D services, satellite networks operating in spectrum allocated for Mobile-satellite services (MSS) are also evolving to support a broader range of use cases and growth in existing services. For example, as well as connectivity for satellite phones, MSS satellite networks have enabled the development of the European Aviation Network (EAN), a variety of emergency services, and provide connectivity for location trackers and Internet of Things (IoT) devices.
- 1.4 MSS and D2D services require access to suitable radio spectrum. As the UK's spectrum manager, we are considering whether to develop new specific authorisation proposals for this spectrum access. Any future proposals will need to take account of a number of factors including the potential demand for, and benefits of these services, alongside ensuring optimal spectrum use through efficiency and sharing with other services.

What we are seeking views on – in brief

In this document we are seeking stakeholder views on the potential supply of, and demand for, direct to device services (D2D) and MSS in the UK, and the associated spectrum needs. We also set out our initial thinking on the implications for how we manage spectrum that these services might use.

We are seeking views from stakeholders on:

- The interest in offering D2D services in the UK, delivered by satellites or airborne platforms;
- The potential demand for spectrum to support D2D services;
- The potential for new technology developments to improve spectrum sharing between D2D services and spectrum sharing between D2D services and existing spectrum users; and
- Potential demand changes for Mobile-satellite service (MSS) spectrum for existing, or developing, mobile satellite services (such as the European Aviation Network and IoT applications).
- The role that High Altitude Platform Stations (HAPS) might play in delivering D2D type mobile services.

- 1.5 We are undertaking this work now because (a) there is increasing activity on this topic in international spectrum fora (such as the International Telecommunication Union (ITU) in preparation for the World Radiocommunications Conference (WRC) in 2027), (b) technological

developments and new standards have the potential to enable greater use of D2D services going forward, (c) we believe there could be benefits for UK consumers and businesses, subject to appropriate regulatory frameworks being in place, and (d) the existing 2 GHz MSS licences held by Inmarsat and EchoStar are due to expire in May 2027.

- 1.6 Some potential regulatory approaches to D2D services might require changes to domestic or international spectrum regulatory frameworks. For the avoidance of doubt, Ofcom is not at this stage proposing to introduce any new spectrum authorisations; but the responses to this call for input will inform our future policy thinking on this topic. Any future proposals we make for policy changes or new authorisations will be subject to our normal consultation process, including an impact assessment, in line with our statutory duties and regulatory principles.
- 1.7 This call for input closes on 13 September 2024. We plan a further publication on our next steps in Q4 2024.

2. Introduction

- 2.1 This call for input (CFI) discusses and seeks input on the future of direct to device services (D2D) and other mobile satellite services (MSS) in the UK. Specifically, we are seeking input on:
- a) Interest in offering D2D services in the UK, delivered by satellites or airborne platforms;
 - b) The potential demand for spectrum to support D2D services;
 - c) The potential for new technology developments to improve spectrum sharing between D2D services, and spectrum sharing between D2D services and existing spectrum users; and
 - d) Potential demand changes for Mobile-satellite service (MSS) spectrum for existing, or new mobile satellite services.
 - e) The role that High Altitude Platform Stations (HAPS) might play in delivering D2D type mobile services.
- 2.2 Inputs from stakeholders in response to this CFI will inform our work on how we might approach spectrum authorisation for these services. We are especially interested to hear from:
- a) organisations that represent people and businesses that are currently underserved by existing mobile networks;
 - b) companies that already offer, or plan to offer, D2D services in the UK; and
 - c) companies providing or interested in providing services in MSS spectrum.

What are direct to device services?

Some of the terms used in this document do not have universally recognised definitions. In this document we use the following definitions:

Direct-to-device (D2D) services: voice, SMS and/or data services delivered from satellites or airborne platforms to mass market mobile handsets.

MSS Spectrum: Spectrum allocated to the Mobile-Satellite Service (MSS) by the International Telecommunications Union (ITU).

MSS Services: Satellite services operated in MSS Spectrum.

Non-terrestrial networks (NTN): the airborne and satellite platforms and associated telecommunications equipment that deliver D2D services.

- 2.3 Mobile devices in the UK have traditionally connected to one of the terrestrial mobile networks for calls, SMS, and data. These networks are made up of thousands of base stations (also known as cell sites) mounted on towers, rooftops, and street furniture across the UK.
- 2.4 Satellite operators are developing offerings that would extend the coverage of existing terrestrial networks, using satellites (operating in a range of orbits¹) to connect directly to

¹ Orbits include geostationary earth orbit (GEO), medium earth orbit (MEO) and low earth orbit (LEO). The different types of orbits are linked to the satellite's altitude above the earth, ranging from c. 400 Km to c. 36,000 Km.

handsets that are out of range of the terrestrial networks. There is also interest in airborne platforms operating at different altitudes² to provide a similar service.

2.5 We are currently seeing two models that enable D2D services. The first is to introduce new mobile handsets that include the radio frequencies used by existing satellites (we refer to these services as “D2D in MSS spectrum”). The second is to enable satellites and airborne platforms to use the radio frequencies that are identified for International Mobile Telecommunications (IMT) use and already supported by mobile phones (we refer to these services as “D2D in mobile bands”). We explain both in more detail below.

2.6 D2D services have the potential to:

- a) extend voice, messaging, and data coverage beyond the reach of terrestrial networks³.
- b) act as back-up coverage during power outages or network faults which affect terrestrial base stations, enhancing the resilience of mobile networks; and
- c) improve access to emergency ‘999’ services in more remote parts of the UK, including in coastal waters.

2.7 Around 93% of the UK landmass is served by at least one 4G network.⁴ As such, the potential benefit from D2D to UK consumers, businesses, and the public sector may be more limited compared to some other countries where terrestrial mobile rollout is more challenging; in particular, during the early phases of commercial D2D when services may be limited in capacity. Nonetheless, we think there could be potential benefits to enabling further D2D services in the UK.

D2D in MSS spectrum

2.8 Satellites have long been used to provide some voice calls and data using spectrum allocated internationally (by the ITU) for MSS⁵. We refer to these bands as ‘MSS spectrum’ in this document and services operated in them as ‘MSS services’. Existing MSS services include:

- a) Safety-of-life and operational data services which provide connectivity to ships and aircraft. Some of these services are legal requirements for their users, for example, ships over a certain tonnage must carry specific radio equipment;⁶
- b) Satellite phones used by those who are often out of range of terrestrial networks and require high reliability but don’t need lots of capacity;
- c) Broadband services for aircraft, such as the European Aviation Network (EAN); and

² Airborne platforms range from low altitude platforms (LAPs) operating at altitude up to a few kilometres to high altitude platforms (HAPS) that can operate at c. 20km. The term HIBS is used internationally to mean ‘high altitude platform station as IMT base station’. IMT stands for ‘International Mobile Telecommunications’ and is the term used in the International Telecommunications Union to refer to the mass market mobile phones and associated networks.

³ Including beyond areas served the Shared Rural Network. The Shared Rural Network [aims to have 95% combined coverage across the whole of the UK by the end of 2025](#). More information is available on the [Shared Rural Network](#) website.

⁴ [Connected Nations: Spring 2024 update](#), Ofcom.

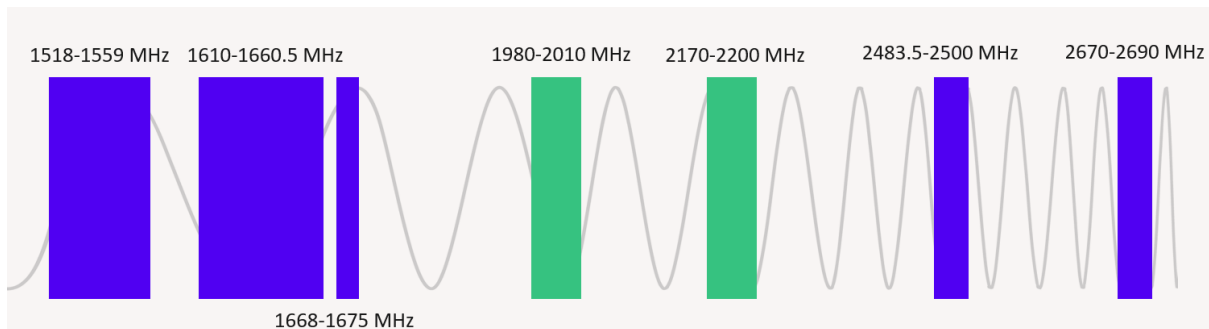
⁵ The ITU defines MSS in Article 1.25 of the Radio Regulations as: “A radiocommunication service: – between mobile earth stations and one or more space stations, or between space stations used by this service; or – between mobile earth stations by means of one or more space stations. This service may also include feeder links necessary for its operation.”

⁶ [Safety radio survey: how the ship administration should prepare for it. GMDSS Radio Survey Blog \(gmdsstesters.com\)](#)

d) Satellite data services, such as Internet of Things (IoT) networks, used for various applications.

2.9 The following figure sets out the current allocations for MSS spectrum between 1 GHz & 3 GHz.⁷ The green blocks represent the pan-European, exclusively licensed, 2 GHz frequencies.

Figure 1: UKFAT allocations for Mobile-satellite services (MSS) between 1 GHz – 3 GHz⁸



2.10 Satellite and mobile operators have been working on new technologies and standards for mass market mobile handsets that will allow them to operate in MSS spectrum i.e., D2D in MSS spectrum. This approach can make the most of existing satellite hardware but requires consumers to adopt new handsets to access the service. For example, Apple has incorporated technology to enable iPhone 14 and 15 models to connect to Globalstar’s satellites operating in MSS spectrum for emergency messaging when terrestrial base stations are not available, such as in remote areas and not-spots or in the event of natural disasters, such as flooding.

2.11 New industry-wide standards are being developed that could lead to D2D in MSS bands being supported in a wider range of mass market handsets. These new technology standards are likely to result in greater availability, and improved performance and capacity of D2D services operated in MSS spectrum.

2.12 As explained above, several important services already make use of MSS spectrum. In addition to potential new demand for MSS spectrum to offer D2D services, we anticipate that existing operators may want to evolve and grow their current services. There may also be demand from new entrants for MSS spectrum to enable non-D2D services. We are therefore seeking more information on potential future demand for MSS spectrum from existing and potential new operators so that we have a better understanding of overall demand for D2D and other MSS services.

D2D in Mobile spectrum

2.13 Proponents of D2D services using mobile spectrum point out that there are billions of phones worldwide which could potentially take advantage of these services when they are rolled out (although capacity will be limited in comparison to terrestrial networks). This would be particularly advantageous in parts of the world where terrestrial connectivity is difficult to establish.

2.14 We are now seeing a generation of new satellite constellations operating in Low Earth Orbit (LEO), as well as companies developing airborne platforms that can connect to existing mass market mobile handsets using mobile spectrum. Satellite beam sizes have shrunk, allowing

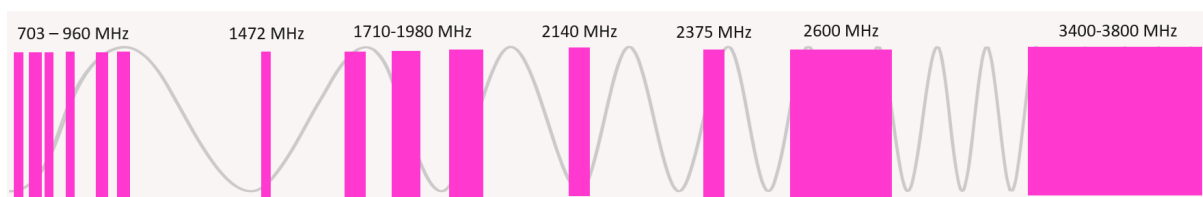
⁷ See Annex 6 for the UK Frequency Allocation Table of MSS allocations.

⁸ Note that some frequencies are not visible in the diagram due to their bandwidth being too small. Please refer to Annex 6 for a complete breakdown of the frequencies or see the [UK Frequency Allocation Table](#).

operators to target their services more accurately in areas where there are no terrestrial base stations.

- 2.15 The ITU Radio Regulations does not currently include any MSS allocations in the frequency bands allocated to the mobile service and used by terrestrial mobile networks ('mobile spectrum'), below 3 GHz. This is because coexistence between satellite and mobile services has, historically, been considered very difficult. However, at the next ITU World Radio Conference in 2027 (WRC-27) agenda Item 1.13 will consider the results of new studies looking at coexistence of D2D satellite services and terrestrial mobile services. As a consequence of the studies, WRC-27 may decide to add MSS allocations in some mobile bands. In the interim, some administrations are considering introducing domestic authorisations for such services, relying on article 4.4⁹ of the Radio Regulations.¹⁰

Figure 2: Licensed spectrum for use by mobile network operators below 3 GHz in the UK¹¹



We are seeking evidence on the evolving potential of D2D and MSS services to deliver benefits in the UK

- 2.16 Ofcom's vision is to get everyone in the UK connected, enable wireless services in the wider economy and support investment and innovation in secure, strong networks.¹² Part of the way we do this is through the management of spectrum, ensuring innovative and efficient spectrum use.
- 2.17 In this document we are seeking stakeholder views on the supply of, and demand for, D2D and MSS services in the UK and the associated spectrum needs. We also set out our initial thinking on the potential approaches we might take to spectrum authorisation for these services.

Potential for HAPs to support similar services

- 2.18 High Altitude Platform systems (HAPS) have the ability to provide a similar service to D2D via satellite in mobile spectrum in remote areas, albeit over a smaller area.
- 2.19 High Altitude Platform systems (HAPS) acting as mobile base stations have a secondary allocation in the Radio Regulations for use in the frequency bands 1710 – 1980 MHz, 2010 –

⁹ Article 4.4 sets out that administrations of the Member States shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations in this chapter or the other provisions of these Regulations, except on the express condition that such a station, when using such a frequency assignment, shall not cause harmful interference to, and shall not claim protection from harmful interference caused by, a station operating in accordance with the provisions of the Constitution, the Convention and these Regulations.

¹⁰ If an administration wishes to file a satellite network to use spectrum that is not allocated to satellite services in the Radio Regulations, it may only do so on a non-interference, non-protection basis, relying on article 4.4 of the Radio Regulations.

¹¹ See our website for the list of frequencies [licensed for use by mobile under 5 GHz in the UK](#).

¹² [Supporting the UK's wireless future](#) - Ofcom, 2021

2025 MHz, 2100 – 2170 MHz, and 2500 – 2690 MHz, following WRC-23.¹³ These frequency bands continue to have a primary allocation for terrestrial mobile networks; the UK has not yet authorised HAPs use in these bands.

2.20 Through this CFI we are interested in gathering information on the demand for, and role that, HAPS might play in delivering these services in the future and how that might relate to D2D from satellite.

Ofcom's duties

2.21 Ofcom's statutory powers and duties in relation to spectrum management are set out primarily in the Communications Act 2003 and the Wireless Telegraphy Act 2006. These are summarised in Annex 1, where we also address our approach to impact assessments.

Structure of this document

2.22 The rest of the document is structured as followed:

- **Section 3** sets out the evolution of the market for direct to device and other mobile satellite services and discusses the international standards and regulations that could enable these services globally.
- **Section 4** considers the potential future D2D services and MSS spectrum use in the UK.
- **Section 5** explores the potential for improved spectrum sharing and sets out our initial thinking around potential future authorisations for D2D services and NTN.
- **Section 6** details our next steps in relation to this CFI.

¹³ WRC-19 agreed that allocations to fixed services in 31 – 31.3 GHz and 38 – 39.5 GHz would be identified for worldwide use by HAPs. WRC-19 also confirmed that existing worldwide identifications for HAPs in the bands 47.2 – 47.5 GHz and 47.9 – 48.2 GHz are available for worldwide use by administrations.

3. Market context

3.1 In this section we describe how new D2D services have developed from the evolution of the MSS market and new technology solutions, and how applications have expanded from specific use cases (such as operational data communications for maritime vessels and aircraft) to new mass market offerings like industrial IoT and the European Aviation Network (EAN). We then set out how D2D services proposing to use MSS spectrum differ from those proposing to use mobile spectrum and discuss how standardisation initiatives can facilitate market access for these services, and how some other countries are approaching the authorisation of D2D services.

Services operating in MSS spectrum

- 3.2 MSS spectrum¹⁴ is allocated for satellite services that provide two-way voice or narrowband data communications to users on the move or in remote locations.
- 3.3 Some commercial MSS services support communications for particular sectors – such as safety of life communications for mariners (e.g., Global Maritime Distress and Safety System) or operational data for aircraft and maritime vessels. Other MSS operators provide voice calls and data services via satellite phones or satellite terminals. MSS services can also offer secure communications or act as a backup service when resilient communications are needed.
- 3.4 Until recently, the size of equipment and cost of service has led to the primary customers of MSS services being government or commercial users who need dedicated communications to operate in remote locations currently not covered by terrestrial networks.
- 3.5 MSS services are continuing to evolve, extending both broadband and narrowband IoT networks, providing resilience for utilities networks, and supporting a wider range of government services. More recently, several MSS providers have also expressed interest in providing D2D services to consumer handsets.¹⁵
- 3.6 Looking forward, satellite operators have announced plans to expand the overall capacity available for D2D and other MSS services. For example, Omnispace has recently announced successful launches¹⁶ and Globalstar, in collaboration with Apple, has stated plans to launch 17 satellites by the end of 2025 which will support Apple’s emergency messaging service.¹⁷ In 2023, EchoStar announced the construction of a global S-band satellite network, aimed at delivering global IoT, machine-to-machine, and other data services.¹⁸ Iridium has also recently

¹⁴ In the UK and Europe, MSS have generally operated systems in L-band (the frequency range between 1-2 GHz. MSS allocated spectrum in this range is 1518 – 1559 MHz, 1610 – 1660.5 MHz, and 1668 – 1675 MHz) or S-band spectrum (S-Band is the frequency range between 2 – 4 GHz. MSS allocated spectrum in this range is: 1980 – 2010 MHz, 2170 – 2200 MHz and 2483.5 – 2500 MHz). They typically provide connectivity via GEO satellites and LEO constellations.

¹⁵ We discuss this further in paragraphs 3.13 – 3.16.

¹⁶ [Lynk Successfully Deploys Two More Orbital ‘Cell Phone Towers in Space’ - Lynk, Omnispace Spark-2™ Satellite Successfully Launches into Orbit](#) - Omnispace, LLC

¹⁷ [Apple lends Globalstar \\$252 million for satellite-enabled iPhones - SpaceNews](#)

¹⁸ [EchoStar begins construction of Global S-band Network](#) – EchoStar.

announced an evolution of its direct to device strategy, signalling a shift towards standards-based solutions.¹⁹

2GHz MSS

- 3.7 The 2GHz band (1980 – 2010 MHz and 2170 – 2200 MHz) is one of the globally allocated MSS spectrum bands. In 2009, the European Union (EU) selected Inmarsat (now Viasat) and Solaris (now EchoStar) to provide mobile satellite services, which could also include one or more Complementary Ground Components,²⁰ across Europe.²¹ Member States (including the UK at that time) were required to grant authorisations to those operators.²² The authorisations were awarded for a fixed period and are due to expire in 2027.
- 3.8 EchoStar operates a range of voice and data services in the allocated spectrum, offering a LoRa-enabled²³ IoT network which extends the reach of LoRaWAN²⁴ across Europe and enables sensors to remotely collect and transmit data by leveraging satellite capabilities.²⁵ EchoStar has recently become a partner of Skylo²⁶ to offer direct-to-device connectivity utilising the awarded 2 GHz frequencies.
- 3.9 In 2016, Inmarsat and Deutsche Telekom requested to use Inmarsat’s awarded spectrum for the European Aviation Network (EAN).²⁷ The EAN combines satellite coverage with terrestrial base stations operated by Deutsche Telekom, to deliver an in-flight connectivity system designed to serve short-haul flights across Europe. This service launched in 2019 and operates across several airlines, with approximately 300 terrestrial base stations.²⁸
- 3.10 The process of reviewing the awarded licences, and the future of the spectrum, in Europe has begun as the licences are set to expire in May 2027.
- 3.11 We are reviewing the current use of this spectrum to inform a future consultation on UK authorisation of this spectrum beyond 2027. We will take account of responses to this CFI in developing proposals for that consultation.

¹⁹ [Iridium Unveils Project Stardust: Developing the Only Truly Global, Standards-Based IoT and Direct-to-Device Service](#), Iridium, Press Release: 24 January 2024.

²⁰ In this context, a Complementary Ground Component is a ground-based station at a fixed location used to improve the availability of MSS in geographical areas within the footprint of the system’s satellite(s), where communications with one or more space stations cannot be ensured with the required quality.

²¹ [Authorisation under the Wireless Telegraphy Act 2006 of Inmarsat Venture Limited’s ground-based stations forming part of its system for provision of mobile satellite services for aeronautical use](#), Ofcom, 2017.

²² The relevant legal framework is set out in Decision No 626/2008/EC of the European Parliament and of the Council of 30 June 2008 on the selection and authorisation of systems providing mobile satellite services (MSS); 2009/449/EC: Commission Decision of 13 May 2009 on the selection of operators of pan-European systems providing mobile satellite services (MSS); and The Authorisation of Frequency Use for the Provision of Mobile Satellites Services (European Union) Regulations 2010 (SI 2010/672) (UK).

²³ LoRa technology connects battery-powered devices to the internet through long-range connectivity and low-power communications.

²⁴ LoRaWAN is a low-power, wide area networking protocol built on top of the LoRa radio modulation technique.

²⁵ [LoRa-Enabled Massive IoT Network Across Europe](#), EchoStar.

²⁶ <https://www.skylo.tech/partners>

²⁷ [Authorisation under the Wireless Telegraphy Act 2006 of Inmarsat Ventures Limited’s ground-based stations forming part of its system for provision of mobile satellite services for aeronautical use](#), Ofcom, 2017.

²⁸ Air-to-Ground (ATG) services also operate in S-band in the US and Canada and other administrations, such as Australia, are currently consulting on the future use of S-band, including the potential for ATG services.

D2D in MSS spectrum

- 3.12 The first commercial, mass market, D2D services were rolled out in September 2022, with Apple offering an emergency messaging service on the iPhone 14 models.
- 3.13 Apple is using Globalstar’s existing satellite constellation and allocated MSS spectrum to support the service. Thus, this emergency messaging service is only available on more recent handset models whose chipsets have incorporated these MSS frequencies. The capabilities of this service are currently restricted to emergency messaging as the constellation was not originally designed to support modern (4G/5G) mobile services.
- 3.14 D2D in MSS spectrum uses new chipsets for mobile phones that extend the frequencies the phone can use into MSS bands. This means the number of consumers that might immediately access these services is limited for two reasons:
- Only newer mobile handsets have chipsets including the MSS frequencies; and
 - Current MSS satellite constellations were not designed with mass market consumer services in mind and typically only have capacity to support a small number of users, and very low data rate services.

D2D in Mobile spectrum

D2D via satellite in mobile spectrum

- 3.15 Several operators have demonstrated successful voice calls over satellite. In March 2020, Lynk Global became the first company to demonstrate that unmodified Android handsets could connect to a satellite,²⁹ and more recently, has performed successful tests of its direct ‘satellite-to-mobile-phone’ connectivity in the UK.
- 3.16 In August 2022, SpaceX announced a partnership with T-Mobile to deliver D2D service in the US,³⁰ and has recently referenced D2D services as part of its application to expand the number of antennas for its UK gateways.³¹ It has also been reported that Starlink are in talks with BT/EE to extend their mobile coverage in the UK.³²
- 3.17 AST SpaceMobile has partnered with Vodafone Group globally, and AT&T and Verizon in the US, with plans to provide its own D2D service globally.³³ AST SpaceMobile has also announced successful 4G and 5G voice calls from unmodified handsets over satellite.³⁴

D2D via High Altitude Platforms in mobile spectrum

- 3.18 As well as developments in the satellite industry, there is ongoing technological innovation and investment in HAPs and other airborne platforms to improve connectivity in rural and hard-to-reach areas. Stratospheric Platforms has developed a hydrogen powered HAP that can carry a 4G or 5G base station³⁵ and is currently undertaking trials in the UK. Similarly, Airbus

²⁹ [Lynk proves direct two-way satellite-to-mobile-phone connectivity](#), Lynk Press Release: 29 September 2021.

³⁰ [T-Mobile takes coverage above and beyond with SpaceX](#), T-Mobile: Press Release, August 2022.

³¹ [SpaceX application for variation of non-geostationary gateway licence](#), Ofcom, 2024.

³² [Elon Musk’s Starlink in talks to boost EE rural coverage](#), Telegraph 18 May 2024.

³³ [AST SpaceMobile shares take off after it announces Verizon partnership](#), Reuters, 29 May 2024.

³⁴ [Vodafone and AST SpaceMobile complete world’s first space-based 5G call using a conventional smartphone](#), Vodafone: Press Release, 19 September 2023.

³⁵ <https://www.stratosphericplatforms.com/>

has developed a solar based HAP named Aalto Zephr intended to support D2D services.³⁶ We have also seen successful trials of this technology overseas; for example, HAPS Mobile demonstrated a 5G connection over Rwanda in 2023.³⁷

Evolutions in standards to support D2D

- 3.19 International standards and regulations facilitate global market access for satellite and mobile services. They aim to harmonise the use of spectrum and standardise equipment for satellite operations worldwide, and ensure uniform functionality of mobile handsets, regardless of the user's location. The development of such regulations and standards can enable faster deployments, support easier interoperability and cheaper equipment costs.
- 3.20 In recent years, the international mobile standards body 3GPP³⁸ has explored enabling communication via satellite systems and HAPS, resulting in the first NTN standards in Release 17 of 3GPP technical standards.³⁹ The new standard supports:
- a) D2D services based on 5G New Radio (5G NR-NTN), targeting mobile broadband, and
 - b) low-rate applications via NB-IoT-NTN for IoT and other low bandwidth applications.
- 3.21 Specific parts of Release 17, dealing with NTN, focus on a transparent 'bent pipe' satellite architecture,⁴⁰ in MSS spectrum bands below 6 GHz. The aim of this was to support NTN connections with minimal changes, allowing mobile handset manufacturers to start integrating MSS bands into new mobile handsets and use some existing satellites. However, in this initial release there is limited integration between the terrestrial and non-terrestrial services.
- 3.22 For future releases,⁴¹ proposals are in place that include improving the convergence between terrestrial networks and NTN,⁴² such as supporting lower latency and enhancing mobility management. These releases also support 5G NR-based satellite access above 10 GHz (where there is more spectrum bandwidth available) and improved performance by mounting the mobile base station directly on the satellites.

Early indications of national approaches to D2D authorisations

- 3.23 While the satellites themselves are coordinated in accordance with international regulations, each country takes national decisions on the use of spectrum within its borders.

³⁶ <https://www.aaltohaps.com/>

³⁷ [Rwanda, SoftBank claim 5G HAPS stratosphere first](#) – Mobile World Live, 2023.

³⁸ 3GPP is the 3rd Generation Partnership Project. It is an umbrella term for a number of standard organisations which develop protocols for mobile telecommunications.

³⁹ 3GPP TR 21.917, Technical Specification Group Services and System Aspects - Release 17 Description, 12-2022.

⁴⁰ Bent-pipe architecture refers to transparent payloads, which can only amplify and switch the frequency bands of the incoming signals without digitisation, advanced detection, and transmission techniques.

⁴¹ 3GPP TR 21.918 V0.2.0, Technical Specification Group Services and System Aspects - Release 18 Description, 02-2024.

⁴² Terrestrial network/non-terrestrial network convergence

- 3.24 Several countries, including Canada,⁴³ Japan and Australia, have put out consultations, and initial frameworks, on authorising D2D services across their geographies, indicating that they are considering national authorisations in the near future.
- 3.25 In March 2024, the Federal Communications Commission (FCC) in the USA voted to adopt its new ‘Supplemental Coverage from Space Framework’⁴⁴ which aims to enable terrestrial networks to expand their coverage in collaboration with satellite operators. This is discussed further in paragraph 5.19.

⁴³ [Consultation on a Policy, Licensing and Technical Framework for Supplemental Mobile coverage by Satellite – Innovation, Science and Economic Development \(ISED\) Canada, June 2024.](#)

⁴⁴ [Report and Order and Further Notice of Proposed Rulemaking: Single Network Future: Supplemental Coverage from Space, FCC, 2024.](#)

4. The future of D2D services and MSS spectrum use in the UK

- 4.1 We want to gather evidence on the potential for D2D services to enhance mobile connectivity for UK consumers and businesses. We are interested in understanding the benefits these services could provide, the necessary infrastructure, and the spectrum required for optimal performance.
- 4.2 We also want to understand the evolving demand for MSS spectrum from existing and new non-D2D services. Responses to the questions below will inform our future approach to both MSS spectrum and other spectrum for D2D services.
- 4.3 We welcome input from all stakeholders on the questions set out below and in subsequent sections (there is a consolidated list in Annex 5). We are especially interested to hear from:
 - a) organisations that represent people and businesses that are currently underserved by existing mobile networks;
 - b) companies that already offer, or have an interest in offering, D2D services in the UK; and
 - c) companies with an interest in the use of MSS spectrum for non-D2D services.

Information sought regarding D2D services

- 1) What is the market opportunity for D2D services? What is the nature of the benefits that could be delivered to people and business in the UK and what do you estimate the magnitude of the benefits to be?
 - 2) Are there any wider citizen or societal benefits that D2D services could deliver that the market might not deliver? What is the nature of these benefits and why might the market fail to deliver them? For example, what role could D2D have in improving the availability of 999 services in the UK?
 - 3) Subject to suitable regulatory frameworks being in place, do you have an interest in offering D2D services or expanding an existing service, in the UK? Which customer segments, devices and use cases would be served? Would your D2D service complement or compete with services delivered over existing mobile networks?
- If you have considered launching or expanding a D2D service in the UK:**
- 4) What technology and network architecture do you consider appropriate to use to deliver D2D services? For example, what altitude and how many HAPS, LAPs or satellites would be required to deliver an initial service?
- We're aware that different technologies and network architectures will have different costs, performance, and spectrum efficiency trade-offs.**
- 5) What capacity (e.g., Mbps/Km²/MHz) and quality of service (e.g., latency) could be delivered with the D2D service you are proposing? What percentage of the UK landmass could be covered, and would coverage be provided indoors?
 - 6) To inform our future policy development, which spectrum band do you consider would be best to deploy the service in? How much bandwidth do you think would be required to provide the service at launch?

7) What take-up profile do you assume in your planning? For example, the number of active devices, monthly calls made, and data transferred per device. What is the roadmap for enhancing your network to meet anticipated future growth? What additional infrastructure and/or spectrum would be required? When?

Non-D2D services in MSS spectrum

4.4 We are interested in future demand for existing and new non-D2D services using MSS spectrum, including the introduction of IoT and the evolution of the use of complementary ground components, such as that available in 2GHz.

8) What are the use cases and the benefits these services would deliver? What technology, network infrastructure and frequencies would be required to deliver the service? What are the advantages of using this MSS spectrum compared to other bands?

5. Spectrum Authorisation and Spectrum Sharing

- 5.1 Ofcom’s mission is to make communications work for everyone in the UK. As set out in our Spectrum Management Strategy,⁴⁵ we do this by supporting innovation and growth of existing, and new, services whilst ensuring optimal use of the spectrum. As innovation stimulates greater demand for limited spectrum resource, spectrum sharing becomes more important.
- 5.2 When considering the potential benefits of innovative D2D, and other new MSS services, we must also consider how best to minimise the risk of harmful interference to others to ensure service quality of terrestrial networks and protect other users. There are several incumbent services, including in adjacent bands; these include mobile, fixed links, radioastronomy and space research, meteorological-satellite and (aeronautical) radionavigation. Any new service wishing to use these frequencies would therefore need to coexist with or protect these incumbent users.
- 5.3 This section explores the potential for improved spectrum sharing or coexistence and sets out our initial thinking around potential future authorisations for D2D services. To ensure optimal spectrum use, support innovation and enable fair competition, we believe Ofcom may need to consider introducing new authorisations for D2D services, and other services operating in MSS spectrum, to operate in the UK.

Existing authorisations of satellite networks

Space component

- 5.4 Ofcom does not issue licences for radio transmissions by satellites in space.⁴⁶
- 5.5 The regulations governing the operation of satellites in space (in particular the transmissions of signals from those satellites to the ground) are set out in the ITU Radio Regulations.⁴⁷ In order to use these frequencies in space, a satellite operator must apply (via its filing administration) for a satellite filing and, for communications satellites, must coordinate with other satellite services using the same frequencies in accordance with articles 9 and 11 of the ITU Radio Regulations.

Ground Component

- 5.6 National authorisations govern the use of spectrum by Earth Stations connecting with the relevant satellites and operating within the borders of each country. In the UK, TT&C (tracking, telemetry, and control) and gateway earth stations are authorised through individual

⁴⁵ [Supporting the UK’s wireless future](#), Ofcom 2024.

⁴⁶ The 2GHz licences granted by Ofcom to Inmarsat and EchoStar, mentioned in paragraph 3.7, are exceptions. These licences are issued under regulations which are limited to the 2GHz band.

⁴⁷ The frequencies that satellite services are allocated are listed in Article 5 of the Radio Regulations. Footnotes in Article 5 and Recommendations in later volumes of the Radio Regulations set out the criteria which enable satellite services to coexist with other spectrum users in these bands. In return satellite services are also recognised and protected by other users when operating in these frequencies.

licences.⁴⁸ User terminals are authorised either through an Earth Station Network (ESN) licence or a licence exemption. We typically exempt equipment from requiring a licence if their installation or use is, amongst other things, not likely to cause undue interference (e.g., they operate at low power), lead to inefficient use of the spectrum, or inhibit the development of effective sharing arrangements.

- 5.7 For satellite services, Fixed Satellite Services (FSS)⁴⁹ terminals are typically authorised through an ESN licence whereas terminals operating in MSS spectrum are typically licence exempt. In our Space Spectrum Strategy, we stated that we would consider moving MSS terminals onto ESN licences too.

Potential future authorisations for MSS spectrum

- 5.8 When considering possible spectrum authorisations for D2D services (and other services using MSS spectrum), the radio transmissions of both the satellite and the user terminal (such as a mobile handset) need to be considered.⁵⁰
- 5.9 Apple and Globalstar launched their emergency messaging service in 2022. The service makes use of existing satellite constellations using MSS spectrum and serves next generation handsets whose chipsets have incorporated MSS frequencies. This service can operate under the existing licence exemptions for mobile-satellite services, provided that the mobile handsets comply with existing licence exemption conditions for satellite terminals when operating in these frequencies.⁵¹
- 5.10 The introduction and growth of D2D services could result in a greater number of users utilising MSS spectrum, relative to existing services. An increase in the number of users in certain bands could potentially result in greater aggregate interference to some existing users (e.g., Radio Astronomy). A move toward more spectrum sharing (see below) in MSS bands could also increase the risk of interference between D2D service providers.
- 5.11 As new satellite services emerge and seek to provide consumer services operating in MSS spectrum, it may be appropriate for us to consider withdrawing the current handset licence exemption and instead introduce a licensing regime as a result of the increased risk of interference.⁵²

⁴⁸ Permanent Earth Station (PES) licences are used for GSO gateways, NGSO Earth Station licences are used for NGSO gateways, and non-FSS licences are used for TT&C.

⁴⁹ Fixed Satellite Services are a radiocommunication service between earth stations at given positions, when one or more satellites are used; the given position may be a specified fixed point or any fixed point within specified areas; in some cases this service includes satellite-to-satellite links, which may also be operated in the inter-satellite service; the fixed-satellite service may also include feeder links for other space radiocommunication services.

⁵⁰ Some satellite systems generally also require authorisations to operate Earth Station gateways in the UK, and there are existing authorisations in place for these systems.

⁵¹ Licence exemption regulations for land mobile satellite systems are listed in [IR 2016](#).

⁵² We stated in our Space Spectrum Strategy that we would consider moving MSS operators on to a network licence going forward.

Co-channel MSS Spectrum Sharing

- 5.12 Traditionally MSS spectrum has been segmented between operators (by frequency) to avoid interference between the systems, as terminals typically use low power omni-directional antennas.⁵³
- 5.13 Looking forward, if there is demand for access to MSS spectrum from new entrants, it is likely that co-channel spectrum sharing may be required to accommodate them. Whilst co-channel sharing is not common in MSS spectrum, co-channel sharing between satellites is commonplace in bands allocated for Fixed Satellite Services (FSS).⁵⁴ Traditionally, GSO satellite systems in FSS spectrum achieved co-channel sharing through angular separation between satellites and the use of directional antenna on terminals. Recently there has been increased deployment of NGSO satellite constellations in FSS bands, and we have seen co-channel sharing between satellite broadband providers even when terminals are on the move.
- 5.14 We are interested in potential technology developments that might allow greater co-channel sharing within the MSS spectrum, both to allow new entrants and enable more efficient use of spectrum.

- 9) What current, or future, technology developments will offer the opportunity for more efficient use of MSS spectrum? E.g., more spectrally efficient, or greater ability to share spectrum.
- 10) Could your existing, or proposed, service coexist with other users of the same frequencies within the MSS spectrum bands? If so, how is coexistence achieved? If not, please explain why sharing is not possible.

Potential future authorisations for D2D mobile spectrum

- 5.15 As described in section 3, companies such as Lynk, Starlink and AST Space Mobile have announced plans to launch D2D services that utilise terrestrial mobile spectrum via next generation satellites. This approach intends to provide connectivity to existing, unmodified mass market handsets.
- 5.16 The licences held by MNOs to provide communications services to consumers do not authorise transmissions from space, and current licence exemptions for mobile handsets were not put in place with the intention to cover communications directly with satellites.⁵⁵
- 5.17 The introduction of D2D services in terrestrial mobile bands would raise a number of issues. First, it could increase the risk of interference between the satellite and the ground infrastructure of the MNO that holds spectrum rights. To mitigate this potential interference, we assess that coordination would be required between a satellite operator and the MNO(s) with the relevant spectrum band holding. Further consideration would also need to be given to avoiding harmful interference to other co-channel, adjacent channel, and cross border spectrum use, which might result in exclusion zones being needed to protect non-MNO incumbent users of the spectrum.

⁵³ Systems operating in MSS spectrum typically can't share frequencies as the antennas don't have the ability to direct beams, like we see in FSS spectrum.

⁵⁴ Co-channel sharing refers to two devices using the same radio wave frequencies.

⁵⁵ Satellite phones are exempted if they fall within Schedule 5 of the [Wireless Telephony \(Exemption\) Regulations 2003](#). Whereas mobile handsets can only use the MNO networks' licensed frequencies (uplink) without a licence if the handset is built to the correct IR specification and connects to the licensed network.

- 5.18 To enable globally harmonised spectrum for these services, the International Telecommunications Union Radiocommunications sector (ITU-R) is undertaking studies for possible allocations for MSS in bands between 694/698 MHz and 2.6 GHz ahead of WRC-27. In Europe, study group FM44 is currently exploring the regulatory and technical elements, with respect to national authorisations, of satellite-based direct-to-device communications via existing available smartphones.
- 5.19 Recently the FCC set out its proposed framework for regulating D2D services in the United States (US).⁵⁶ The framework recommends:
- a) A secondary allocation for MSS in some terrestrial mobile bands.⁵⁷
 - b) That a satellite operator may only provide a D2D service if it has been leased spectrum from the incumbent mobile network operator.
 - c) Applicants wishing to launch these services will be required to provide detailed interference analyses showing that operations will not cause harmful interference to adjacent band and cross-border uses.
- 5.20 While the framework is being established ahead of the ITU process, the FCC stated that it will continue to participate in all international studies.

Potential UK authorisation of D2D services

- 5.21 We are considering potential authorisation options for D2D services in the UK prior to WRC-27, given the potential for initial D2D services to be made available in the UK in the next couple of years. The responses to this CFI will inform any future authorisation proposals.
- 5.22 If we were to introduce a UK authorisation framework prior to WRC-27 we would continue to participate in studies and negotiations pertaining to D2D services at the ITU and we would review any such authorisation based on the outcome of decisions made at WRC-27. As noted above, any policy changes we make, or new authorisations we offer in the future, will be subject to our normal consultation process, including an impact assessment, in line with our statutory duties and regulatory principles.

- 11) Do you think that D2D services are likely to be needed in the UK prior to WRC-27? What services and benefits do you think an authorisation prior to WRC-27 might bring to UK consumers and businesses?
- 12) Are there any mobile bands that should be prioritised for satellite based D2D?
- 13) Are there existing systems that you consider could be subject to an increased risk of harmful interference from the introduction of satellite based D2D using mobile bands? If yes, are there specific mobile bands that you consider should be avoided to reduce this risk?

⁵⁶ [Report and Order and Further Notice of Proposed Rulemaking on Single Network Future: Supplemental Coverage from Space](#), FCC, 2024.

⁵⁷ In the proposed framework, the following bands are being considered for the provision of supplemental coverall from space: 600 MHz: 614-652 MHz and 663-698 MHz; 700 MHz: 698-769 MHz, 775 MHz-799 MHz, and 805-806 MHz; 800 MHz: 824-849 MHz and 869-894 MHz; Broadband Personal Communication Service: 1850-1915 MHz and 1930-1995 MHz; and Advanced Wireless Services-H Block: 1915-1920 MHz and 1995-2000 MHz.

Future authorisation of airborne base stations operating in mobile bands

- 5.23 HAPs are considered different to satellites within the ITU Radio Regulations, as a HAP is seen as a terrestrial station, and it is therefore up to individual administrations to licence HAPs. The interference risks of these airborne platforms operating in mobile bands are similar to those associated with satellite platforms in mobile bands. To support the deployment of these platforms, the ITU has already agreed rules and technical parameters for operation of airborne platforms in certain bands,⁵⁸ but how interference is managed within a country is a matter for the national spectrum regulator.
- 5.24 The MNO licences and the current licence exemption regulations for handsets were not written with deployment of base stations on airborne platforms in mind. The deployment of airborne platforms that utilise mobile spectrum could result in a higher risk of interference to the mobile networks and the interference environment is likely to be further complicated if airborne platforms are operating using the same frequencies as satellite platforms.
- 5.25 In view of this, we are considering whether a specific spectrum authorisation is needed for airborne base stations operating in mobile bands in the UK. If we were to introduce a new framework to authorise satellite D2D services in mobile bands, there could be benefits from using a similar authorisation regime for airborne platforms - i.e., a new licence specifically covering transmission from airborne platforms. One advantage of this approach is that it could allow non-MNOs to deploy systems in areas where an MNO is not using the spectrum, but there is consumer demand for improved connectivity. This is a similar approach to the existing 'Local Access' licences that enable a third-party terrestrial network operator to use spectrum licenced to one of the MNOs in areas where it is not being used. An alternative approach would be to introduce new conditions to the MNO spectrum licences to manage any new interference risks related to HAPS.

14) Do you have any views on how spectrum for airborne services should be authorised? Does this vary by band, or type of airborne platform? Please explain the reasoning behind your preference.

⁵⁸ The bands and technical parameters agreed, at WRC23, for use on HIBS are: 1710 – 1980 MHz, 2010 – 2025 MHz, 2110 – 2170 MHz and 2500 – 2690 MHz.

6. Next steps

- 6.1 This call for input will close on 13 September 2024. The responses from stakeholders will enable us to prioritise our next steps, including determining timelines for any future consultations on specific proposals.
- 6.2 We will publish an update in Q3 2024/25, setting out our next steps and summarising the responses we have received as part of this CFI. For the avoidance of doubt, Ofcom is not at this stage proposing to introduce any such new spectrum authorisations. The responses to this call for input will inform our proposals on authorising these services in the UK.
- 6.3 Any stakeholders wishing to begin testing services in the UK should consult our guidance on [innovation and trials licences](#).

15) Are there any other points that you think we should take account of in our considerations? In providing your response, please provide as much evidence as possible.

A1. Legal framework and impact assessments

A1.1 This annex explains the relevant legal framework derived from both the Communications Act 2003 ('2003 Act') and the Wireless Telegraphy Act 2006 ('WT Act'). It is not a full statement of all the legal provisions which may be relevant to our functions and wireless telegraphy licensing. This annex also sets out our impact assessments.

Communications Act 2003

A1.2 Our principal duties under the 2003 Act, when carrying out our functions, are to further the interests of citizens and consumers in relation to communications matters, and to further the interests of consumers in relevant markets, where appropriate by promoting competition. In doing so, we are also required (among other things) to secure the optimal use of spectrum and the availability throughout the United Kingdom of a wide range of electronic communications services.

A1.3 We must also have regard to, amongst other things:

- a) the desirability of promoting competition in relevant markets;
- b) the desirability of encouraging investment and innovation in relevant markets;
- c) the desirability of encouraging the availability and use of high-speed data transfer services throughout the UK;
- d) the different needs and interests, so far as the use of the electro-magnetic spectrum for wireless telegraphy is concerned, of all persons who may wish to make use of it; and
- e) the different interests of persons in the different parts of the United Kingdom, of the different ethnic communities within the United Kingdom and of persons living in rural and in urban areas.

A1.4 The 2003 Act also sets out certain regulatory principles which we must have regard to when performing our duties. Specifically, regulatory activities should be transparent, accountable, proportionate, consistent, and targeted only at cases in which action is needed.

A1.5 Further, in exercising certain regulatory functions, we must have regard to the desirability of promoting economic growth.⁵⁹

Wireless Telegraphy Act

A1.6 In carrying out our spectrum functions we have a duty under section 3 of the Act to have regard in particular to:

- a) the extent to which the spectrum is available for use, or further use, for wireless telegraphy;
- b) the demand for use of that spectrum for wireless telegraphy; and
- c) the demand that is likely to arise in future for such use.

⁵⁹ Deregulation Act 2015, s 108. Section 111 defines 'regulatory function'. The Economic Growth (Regulatory Functions) (Amendment) Order 2024 applies the duty set out in s 108 to Ofcom.

- A1.7 We also have a duty to have regard to the desirability of promoting:
- a) the efficient management and use of the spectrum for wireless telegraphy;
 - b) the economic and other benefits that may arise from the use of wireless telegraphy;
 - c) the development of innovative services; and
 - d) competition in the provision of electronic communications services.
- A1.8 We permit the use of the radio spectrum by either granting wireless telegraphy licences under the WT Act or by making regulations exempting the use of particular equipment from the requirement to hold such a licence. It is unlawful and an offence to establish or use a wireless telegraphy station or install or use wireless telegraphy apparatus without holding a licence granted by Ofcom unless the use of such equipment is exempted.
- A1.9 Under section 9 of the WT Act, Ofcom may grant wireless telegraphy licence subject to such terms as Ofcom thinks fit.
- A1.10 Under section 8(3) of the WT Act, Ofcom may make regulations exempting from the licensing requirements the establishment, installation or use of wireless telegraphy stations or wireless telegraphy apparatus of such classes or description as may be specified in the regulations, either absolutely or subject to such terms, provisions and limitations as may be specified.
- A1.11 Ofcom may only approve regulations under section 8(3) within the limits set out in section 8(3B). In particular, the latter requires that section 8(3) exemptions must be:
- a) objectively justifiable in relation to the wireless telegraphy stations or wireless telegraphy apparatus to which they relate;
 - b) not such as to discriminate unduly against particular persons or against a particular description of persons;
 - c) proportionate to what they are intended to achieve; and
 - d) transparent in relation to what they are intended to achieve.
- A1.12 Further, under section 8(4) of the WTA, we must make regulations to exempt equipment from the requirement for a licence if its installation or use is not likely to:
- a) involve undue interference with wireless telegraphy;
 - b) have an adverse effect on technical quality of service;
 - c) lead to inefficient use of the part of the electromagnetic spectrum available for wireless telegraphy;
 - d) inhibit the development of effective arrangements for the sharing of frequencies;
 - e) endanger safety of life;
 - f) prejudice the promotion of social, regional, or territorial cohesion; or
 - g) prejudice the promotion of cultural and linguistic diversity and media pluralism.

Impact assessment

- A1.13 Section 7 of the Communications Act requires us to assess and publish the likely impact of implementing a proposal which would be likely to have a significant impact on businesses or the general public, or when there is a major change in Ofcom's activities. As a matter of policy Ofcom is committed to carrying out and publishing impact assessments in relation to the great majority of our policy decisions, although the form of that assessment will depend on the particular nature of the proposal. This [guidance](#) sets out our general approach to how we assess and present the impact of our proposed decisions.

A1.14 Ofcom is an evidence-based organisation and welcomes responses to this consultation. We note that this document is not yet making firm proposals, only seeking input. We have therefore not undertaken an impact assessment in this document. If in future we propose to make regulatory changes, this would be subject to our normal consultation process, including impact assessment, in line with our statutory duties and regulatory principles.

Equality impact assessment

A1.15 Section 149 of the Equality Act 2010 (the 2010 Act) imposes a duty on Ofcom, when carrying out its functions, to have due regard to the need to eliminate discrimination, harassment, victimisation, and other prohibited conduct related to the following protected characteristics: age; disability; gender reassignment; marriage and civil partnership; pregnancy and maternity; race; religion or belief; sex and sexual orientation. The 2010 Act also requires Ofcom to have due regard to the need to advance equality of opportunity and foster good relations between persons who share specified protected characteristics and persons who do not.

A1.16 Section 75 of the Northern Ireland Act 1998 (the 1998 Act) also imposes a duty on Ofcom, when carrying out its functions relating to NI, to have due regard to the need to promote equality of opportunity and regard to the desirability of promoting good relations across a range of categories outlined in the 1998 Act. Ofcom's Revised NI Equality Scheme explains how we comply with our statutory duties under the 1998 Act.

A1.17 To help us comply with our duties under the 2010 Act and the 1998 Act, we assess the impact of our proposals on persons sharing protected characteristics and in particular whether they may discriminate against such persons or impact on equality of opportunity or good relations. We fulfil these obligations by carrying out an Equality Impact Assessment ('EIA'), which examines the impact our policy is likely to have on people, depending on their personal circumstances. EIAs also assist us in making sure that we are meeting our principal duty of furthering the interests of citizens and consumers, regardless of their background and identity.

A1.18 We do not consider this document has equality implications under the 2010 Act or the 1998 Act.

Welsh language impact assessment

A1.19 Ofcom is required to take Welsh language considerations into account when formulating, reviewing, or revising policies, publishing consultation documents or commissioning or undertaking research.

A1.20 As above, we note that this document is not making proposals, only seeking input. We have therefore not undertaken a Welsh language impact assessment in this document.

A2. Responding to this call for input

How to respond

- A2.1 Ofcom would like to receive views and comments on the issues raised in this document, by 5pm on 13 September 2024.
- A2.2 You can download a response form from <https://www.ofcom.org.uk/spectrum/space-and-satellites/improving-mobile-connectivity-from-the-sky-and-space/>. You can return this by email or post to the address provided in the response form.
- A2.3 If your response is a large file, or has supporting charts, tables, or other data, please email it to mobilefromskyandspace@ofcom.org.uk, as an attachment in Microsoft Word format, together with the cover sheet. This email address is for this consultation only and will not be valid after 13 September 2024.
- A2.4 Responses may alternatively be posted to the address below, marked with the title of the consultation:
- Mobile from sky and space.
Ofcom
Riverside House
2A Southwark Bridge Road
London SE1 9HA
- A2.5 We welcome responses in formats other than print, for example an audio recording or a British Sign Language video. To respond in BSL:
- send us a recording of you signing your response. This should be no longer than 5 minutes. Suitable file formats are DVDs, wmv or QuickTime files; or upload a video of you signing your response directly to YouTube (or another hosting site) and send us the link.
- A2.6 We will publish a transcript of any audio or video responses we receive (unless your response is confidential)
- A2.7 We do not need a paper copy of your response as well as an electronic version. We will acknowledge receipt of a response submitted to us by email.
- A2.8 You do not have to answer all the questions in the consultation if you do not have a view; a short response on just one point is fine. We also welcome joint responses.
- A2.9 It would be helpful if your response could include direct answers to the questions asked in the consultation document. The questions are listed at Annex X. It would also help if you could explain why you hold your views, and what you think the effect of Ofcom's proposals would be.
- A2.10 If you want to discuss the issues and questions raised in this consultation, please contact mobilefromskyandspace@ofcom.org.uk.

Confidentiality

- A2.11 Consultations are more effective if we publish the responses before the consultation period closes. This can help people and organisations with limited resources or familiarity with the issues to respond in a more informed way. So, in the interests of transparency and good regulatory practice, and because we believe it is important that everyone who is interested in an issue can see other respondents' views, we usually publish responses on the Ofcom website at regular intervals during and after the consultation period.
- A2.12 If you think your response should be kept confidential, please specify which part(s) this applies to and explain why. Please send any confidential sections as a separate annex. If you want your name, address, other contact details or job title to remain confidential, please provide them only in the cover sheet, so that we don't have to edit your response.
- A2.13 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and try to respect it. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.
- A2.14 To fulfil our pre-disclosure duty, we may share a copy of your response with the relevant government department before we publish it on our website.
- A2.15 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's intellectual property rights are explained further in our Terms of Use.

Next steps

- A2.16 Following this period, Ofcom plans to publish an updated in Q3 2024/25.
- A2.17 If you wish, you can register to receive mail updates alerting you to new Ofcom publications.

Ofcom's consultation processes

- A2.18 Ofcom aims to make responding to a consultation as easy as possible. For more information, please see our consultation principles in Annex x.
- A2.19 If you have any comments or suggestions on how we manage our consultations, please email us at consult@ofcom.org.uk. We particularly welcome ideas on how Ofcom could more effectively seek the views of groups or individuals, such as small businesses and residential consumers, who are less likely to give their opinions through a formal consultation.
- A2.20 If you would like to discuss these issues, or Ofcom's consultation processes more generally, please contact the corporation secretary:
- A2.21 Corporation Secretary
Ofcom
Riverside House
2a Southwark Bridge Road
London SE1 9HA
Email: corporationsecretary@ofcom.org.uk

A3. Ofcom's consultation principles

Ofcom has seven principles that it follows for every public written consultation:

Before the consultation

A3.1 Wherever possible, we will hold informal talks with people and organisations before announcing a big consultation, to find out whether we are thinking along the right lines. If we do not have enough time to do this, we will hold an open meeting to explain our proposals, shortly after announcing the consultation.

During the consultation

A3.2 We will be clear about whom we are consulting, why, on what questions and for how long.

A3.3 We will make the consultation document as short and simple as possible, with an overview of no more than two pages. We will try to make it as easy as possible for people to give us a written response.

A3.4 We will consult for up to ten weeks, depending on the potential impact of our proposals.

A3.5 A person within Ofcom will be in charge of making sure we follow our own guidelines and aim to reach the largest possible number of people and organisations who may be interested in the outcome of our decisions. Ofcom's Consultation Champion is the main person to contact if you have views on the way we run our consultations.

A3.6 If we are not able to follow any of these seven principles, we will explain why.

After the consultation

A3.7 We think it is important that everyone who is interested in an issue can see other people's views, so we usually publish the responses on our website at regular intervals during and after the consultation period. After the consultation we will make our decisions and publish a statement explaining what we are going to do, and why, showing how respondents' views helped to shape these decisions.

A4. Consultation coversheet

Basic details

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

Confidentiality

Please tick below what part of your response you consider is confidential, giving your reasons why

- | | |
|--------------------------------|--------------------------|
| Nothing | <input type="checkbox"/> |
| Name/contact details/job title | <input type="checkbox"/> |
| Whole response | <input type="checkbox"/> |
| Organisation | <input type="checkbox"/> |
| Part of the response | <input type="checkbox"/> |

If you selected 'Part of the response', please specify which parts:

If you want part of your response, your name, or your organisation not to be published, can Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

Yes No

Declaration

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those which are marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

Ofcom aims to publish responses at regular intervals during and after the consultation period. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here.

Name

Signed (if hard copy)

A5. Consultation questions

A5.1 We invite responses to the following questions we have asked in this CFI:

Question 1: What is the market opportunity for D2D services? What is the nature of the benefits that could be delivered to people and business in the UK and what do you estimate the magnitude of the benefits to be?

Question 2: Are there any wider citizen or societal benefits that D2D services could deliver that the market might not deliver? What is the nature of these benefits and why might the market fail to deliver them? For example, what role could D2D have in improving the availability of 999 services in the UK?

Question 3: Subject to suitable regulatory frameworks being in place, do you have an interest in offering D2D services or expanding an existing service, in the UK? Which customer segments, devices and use cases would be served? Would your D2D service complement or compete with services delivered over existing mobile?

If you have considered launching or expanding a D2D service in the UK:

Question 4: What technology and network architecture do you consider appropriate to use to deliver D2D services? For example, what altitude and how many HAPS, LAPS or satellites would be required to deliver an initial service?

We're aware that different technologies and network architectures will have different costs, performance, and spectrum efficiency trade-offs.

Question 5: What capacity (e.g., Mbps/Km²/MHz) and quality of service (e.g., latency) could be delivered with the D2D service you are proposing? What percentage of the UK landmass could be covered, and would coverage be provided indoors?

Question 6: To inform our future policy development, which spectrum band would you like to deploy the service in? How much bandwidth would be required to provide the service at launch?

Question 7: What take-up profile do you assume in your planning? For example, the number of active devices, monthly calls made, and data transferred per device. What is the roadmap for enhancing your network to meet anticipated future growth? What additional infrastructure and/or spectrum would be required? When?

Question 8: What are the use cases and the benefits these services would deliver? What technology, network infrastructure and frequencies would be required to deliver the service? What are the advantages of using this MSS spectrum compared to other bands?

Question 9: What current, or future, technology developments will offer the opportunity for more efficient use of MSS spectrum? E.g., more spectrally efficient, or greater ability to share spectrum.

Question 10: Could your existing, or proposed, service coexist with other users of the same frequencies within the MSS spectrum bands? If so, how is coexistence achieved? If not, please explain why sharing is not possible.

Question 11: Do you expect D2D services to be available prior to WRC-27? What services and benefits do you think an authorisation prior to WRC-27 might bring to UK consumers and businesses?

Question 12: Are there any mobile bands that should be prioritised for satellite based D2D?

Question 13: Are there existing systems that you consider could be subject to an increased risk of harmful interference from the introduction of satellite based D2D using mobile bands? If yes, are there specific mobile bands that you consider should be avoided to reduce this risk?

Question 14: Do you have any views on how spectrum for D2D services should be authorised? Does this vary by band, or type of NTN? Please explain the reasoning behind your preference.

Question 15: Are there any other points that you think would be useful in our considerations? In providing your response, please provide as much evidence as possible.

A6. UKFAT MSS Allocations

MSS (Allocated in UK)

137-138 MHz*

148 – 150.5 MHz

156.7625-156.7875 MHz

156.8125-156.8375 MHz

161.9625-161.9875 MHz

162.0125-162.0375 MHz

162.0125-162.0375 MHz

235-328.6 MHz*

335.4 – 399.9 MHz *

399.9-400.05 MHz

400.15 – 401 MHz*

406 – 406.1 MHz⁶⁰

1518 – 1559 MHz

1610 – 1660.5 MHz

1668 – 1675 MHz

1980 – 2010 MHz

2170 – 2200 MHz

2483.5 – 2500 MHz

2670 – 2690 MHz

A6.1 This table shows frequencies allocated to MSS in the UK Frequency Allocation Table (excluding maritime mobile-satellite frequencies) below 3 GHz. Note that not all bands allocated to MSS in the UKFAT are authorised for use in the [Interface Requirements 2016](#), which concern land mobile satellite systems.

⁶⁰ The use of the band 406-406.1 MHz by the mobile-satellite service is limited to low power satellite emergency position-indicating radio beacons.

A6.2 Bands marked with an asterisk are 'UK2.1' frequencies, meaning responsibility for granting permission to use frequencies in this allocation rests with Defence. More information can be found in the [UK Frequency Allocation table](#).