Your response

Question	Your response
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?	The market opportunity for D2D services is substantial, including hundreds of millions of individuals as well as companies in multiple industrial sectors with needs for connectivity outside the reach of terrestrial mobile networks. There are two distinct D2D models currently under consideration, each with different implications: • The first approach (MSS D2D) uses already allocated and licensed Mobile Satellite Service (MSS) spectrum, such as the L-and S-bands, which is feasible under the current regulatory framework supporting MSS services. • The second approach (MS D2D) involves satellite operators transmitting in spectrum allocated to terrestrial services (MS) and licensed to mobile operators, requiring significant regulatory changes both in the UK and globally to enable different spectrum uses and to manage interference with existing applications. Satellite operators have provided direct-to-device services in MSS spectrum bands, such as the globally allocated L- and S-bands, for many years. The emerging D2D services in these bands are an extension of this model, allowing access to both terrestrial and satellite bands with a single device. Advances in satellite technology, reduced deployment costs, and increasing convergence between terrestrial and satellite standardization (e.g., 3GPP NTN standards) are driving the momentum behind these new MSS D2D services.A 2022 study estimated a global population of 570 million (8.7% of the global adult population) who reside outside of terrestrial network coverage or in areas of marginal coverage.[1] This figure includes 300 million adults who live outside the range of terrestrial mobile networks as well as those who have limited or weak signals. This potential user base accounts for a significant proportion of the approximately 1.3 billion people worldwide who do not have a mobile device. By 2025, while overall connectivity figures are estimated to improve, 520 million adults are still expected to reside in areas without reliable coverage. This includes an estimated 7.3% of adults in Europe and Central Asia.

[1] GSMA Intelligence, Satellite 2.0: going direct to device, March 2022.

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	In a 2021 survey, 20-30% of companies in key sectors – manufacturing, utilities, healthcare, retail, and transportation, among others – indicated that they would consider employing satellite connectivity.[2] The two largest potential market opportunities are anticipated in the automotive and utility sectors, with the former driven by telematics, infotainment, and mapping as well as the connectivity needs of commercial hauling, while utility user needs are expected to be centred upon smart grids and meters as well as connectivity for renewable energy generation sites. In short, D2D services bring the potential to reach unconnected or marginally connected populations in the UK and globally, while also providing additional connectivity options to enterprise users across a wide range of industries.
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?	D2D services offer the potential to supplement the United Kingdom's widespread terrestrial networks, while also improving emergency connectivity and potentially reducing the humanitarian and economic impact of natural disasters (e.g. flooding). While the United Kingdom enjoys a substantial level of terrestrial mobile coverage, gaps may remain. For example, the 99.9% LTE/4G coverage level reported in 2023 does not consider areas with marginal coverage. As noted in the Call for Input (CFI), D2D services also have the potential to extend voice, messaging, and data services to areas outside the reach of mobile networks. The Shared Rural Network, intended to expand terrestrial coverage across the United Kingdom, is targeted to reach 95% geographic coverage, leaving a 5% coverage gap. In both marginal and unserved areas, D2D coverage would provide alternative connectivity options that are not reliant upon additional fixed or mobile network buildout or upgrades. In addition, as noted by Ofcom, D2D services provide an alternate connectivity option in the event of a natural disaster or other event that disrupts mobile network connectivity as well as improving access to emergency services in remote and unserved areas. Users in the United Kingdom should always have reliable access to emergency services, regardless of their location or the status of any communications network. D2D services may also have a role to play in reducing the impact of natural disasters. A 2022 study considered the cost of natural dis-

[2] GSMA Intelligence, Satellite 2.0: going direct to device, March 2022.

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	asters and the potential impact of improved communications networks and reduced response times on such costs.[3] The report considered scenarios in which upper-middle and high-income countries improve their communications networks, improving median response times by 20%. The study projected that such increases could reduce the average annual economic impact of natural disasters by approximately 35% in Europe between 2025 and 2029. A global 20% reduction in response times is estimated to reduce loss of life by 26% and overall damage costs by 39% over the same period. Services that support a reduction in loss of life and lower overall economic impact from natural disasters should be considered as the United Kingdom addresses future disaster preparedness needs.
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?	Omnispace is interested in offering MSS D2D services in the United Kingdom. We anticipate that the target users of Omnispace MSS D2D services would primarily be in the following segments: • Enterprise IoT: MSS D2D services enable seamless satellite and wireless integration to support voice and data connectivity needs for enterprise-level connectivity of people and assets. The range of devices served is heavily dependent upon specific industry sectors and could include vehicle tracking, energy sector monitoring, and agricultural equipment monitoring and control. • Travelers: MSS D2D services provide individuals traveling in the United Kingdom (from overseas and domestic travellers out of reach of their home networks) with always-available connectivity on their mobile devices without the need for a separate subscriber identity module (SIM) card. Such connectivity will enable access to services that include mobile payment, remote healthcare, and education. • Emergency services: As noted in the response to Question 2, MSS D2D services expand the reach and resilience of emergency communications services. MSS D2D provides access in unserved and underserved areas every day and serves as an alternative option across larger areas in the event of a more widespread network outage, such as in the case of a natural disaster. Omnispace's MSS D2D services would complement services delivered over existing mobile networks.

[3] Fair Tech Institute, The Role of Satellite Communications in Disaster Management, 2022, https://accesspartnership.com/wp-content/uploads/2022/03/The-Role-of-Satellite-Communications-in-Disaster-Management.pdf.

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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**.	Omnispace is aware that different D2D technologies and network architectures will be characterized by different costs, performance characteristics, and spectrum efficiency trade-offs. We believe that the United Kingdom can achieve significant benefits by utilizing the 2 GHz S-band (1980-2010 MHz / 2170-2200 MHz) for MSS Non-Terrestrial Network (NTN) systems based on 3GPP specifications in Releases 17, 18 and beyond to bring 5G technology, including D2D connectivity, to all regions. Omnispace's current NGSO constellation, operating in both MEO and LEO, offers an innovative alternative or potential addition to the existing 2 GHz MSS licensees. This system can provide MSS today across the United Kingdom. Furthermore, by using lower orbital altitudes and LEOs for our future next-generation constellation, the first phase of which is anticipated in 2027, the Omnispace system can offer low latency and global coverage, therefore enhancing available service offerings and use cases.
Question 5: What capacity (e.g., Mbps/Km_2/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?	Omnispace seeks to provide services in accordance with 3GPP Release 17 and beyond, which is a candidate radio interface technology (or set of technologies) for the satellite component of IMT-2020. The minimum requirements of the satellite component of IMT-2020 are provided in Annex 1 of Report ITU-R M.2514 "Vision, requirements and evaluation guidelines for satellite radio interface(s) of IMT-2020." As Omnispace's next generation LEO constellation is launched, the capacity will continue to expand as additional satellites are added to keep pace with growing demand across the globe.
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?	Omnispace seeks to provide service using 3GPP band n256 (1980-2010 MHz/2170-2200 MHz). Band n256 is currently assigned to two MSS operators in the United Kingdom and across Europe, with the current licenses set to expire in 2027. Considering the proximity of the United Kingdom to EU markets and the ability of satellite services to serve the entire European region, Omnispace encourages Ofcom to closely monitor EU developments and to consider a licensing and spectrum assignment approach that will enable licensees to best and most efficiently serve UK users. The more bandwidth assigned to the MSS operator for NTN, the greater the capacity that can be offered to UK consumers, governments, and businesses. Within the 2 GHz S-band, two blocks of 2x15 MHz each are ideal for interested operators to implement the 5G NTN service. This block size provides equal spectrum resources for two MSS operators to co-exist and will allow the deployment of

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	the most advanced 5G NTN services. As Omnispace stated in its response to the December 2023 RSPG Draft Opinion on 2 GHz MSS[4], it supports the idea of maintaining two operators each with 2 x 15 MHz, *if* new entrants are allowed to compete for the licenses. While multiple operators such as 3 operators with 2 x 10 MHz would provide a competitive environment, too small an allocation could yield a severely limited technical system that will not have the capabilities to create a viable competitor. Omnispace recommends channelization of the spectrum into blocks of multiples of 5 MHz and using out-of-band emissions and frequency tolerance limitations consistent with 3GPP standards. While operators primarily rely on their dedicated frequencies, operators should be allowed to access other's spectrum through spectrum leases or other mutually agreeable arrangements.
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?	Omnispace's roadmap for enhancing its network to meet anticipated future growth is by leveraging work already completed by 3GPP in Releases 17 and beyond to bring satellite capability to mass-market mobile devices through the introduction of non-terrestrial networks (NTN) into the 5G industry standards. This will simplify and harmonize the implementation of satellite connectivity in the global 5G ecosystem, leading to growth as devices compliant with these releases continue to enter the market. In the future additional dedicated 2 GHz MSS spectrum will be required and WRC-27 Agenda Item 1.14 addresses this. In particular, Omnispace views that the 2010-2025 MHz band can be globally harmonized for Earth-to-space MSS operations as there is already an existing MSS allocation in Region 2. 3GPP is currently in the process of adding Band n252, for the Americas which is the band pairing of 2000-2020 MHz (Earth-to-space) and 2180-2200 MHz (space-to-Earth) as well as flexible duplex spacing that will enable different band pairings within the S-band to be utilised.
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?	Example use cases that MSS D2D will deliver include the delivery of IoT and automotive services. IoT use cases continue to expand across numerous sectors, including agriculture, energy production and distribution, and supply chain management, as well as in government uses. Similarly, automotive use cases benefit from MSS-enabled connectivity. Automobile manufacturers and potentially

[4] See Omnispace response to the *Draft RSPG Opinion on assessment of different possible scenarios for the use of the frequency bands 1980-2010 MHz and 2170-2200 MHz by the Mobile Satellite Services beyond 2027,* December 2023, *https://radio-spectrum-policy-group.ec.europa.eu/consultations-0_en* .

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	other industry stakeholders can leverage MSS connectivity to provide customers with a suite of safety, telematics, and intelligent connectivity solutions that are always-on and resilient. IoT services can leverage technologies including NB-IoT, LoRa, and LoRaWAN, as is the case with the open standards-based IoT network announced by Omnispace and Lacuna Space in 2022.[5] In a 2023 demonstration, Omnispace and its partners showed how the service offers low-power, ubiquitous connectivity worldwide for a broad range of IoT devices and markets.[6] D2D in MSS bands is advantageous for the provision of services as the bands are globally harmonized for fixed, mobile, and MSS, and therefore enable seamless transition between satellite and terrestrial networks. MSS D2D offers standardized solutions with global economies of scale and full integration with mobile networks to achieve ubiquitous connectivity.
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.	Within 3GPP, ongoing standardization activities related to NTN services include satellite as a key part of 5G systems in 3GPP Release 17 and beyond. This standard enables the 5G terrestrial system to integrate with satellite networks, including services directly to handheld devices, including mass-market consumer smartphones. In addition, for the first time, satellite services can leverage the economies of scale of the mobile industry that come with being included in the 3GPP ecosystem. Several MSS operators are planning to leverage this 3GPP-defined NTN standard to provide services to consumers' mobile devices, while chip, device, and infrastructure vendors are poised to provide devices and network equipment. These mass-market smartphones and IoT devices will be able to integrate with terrestrial mobile networks and/or with NTN-based systems when out of range of terrestrial connectivity to ensure ubiquitous connectivity. The continued development of 5G NTN services and their incorporation into 3GPP Releases 18 and 19, as noted in the CFI, will expand the opportunity to make efficient, effective use of MSS spectrum. The 3GPP 5G NTN standard is being incorporated into devices and offers economies of scale for development and deployment suitable for consumers and enterprises. As a result, users worldwide will see more robust coverage with minimal to no pricing difference. The alignment of devices and services with the 3GPP framework ensures higher and better spectrum usage and

[5] Omnispace, Omnispace and Lacuna Announce Collaboration to Deliver Global LoRaWAN® IoT Service, March 9, 2022, https://omnispace.com/omnispace-and-lacuna-announce-collaboration-to-deliver-global-lorawan-iot-service/.

[6] Omnispace, Omnispace and Lacuna Showcase Breakthrough NGSO IoT Satellite Connectivity, September 26, 2023, https://omnispace.com/omnispace-and-lacuna-showcase-breakthrough-ngso-iot-satellite-connectivity/.

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	establishes a sound, reliable spectrum policy that will give certainty and predictability for ongoing investment. Omnispace has been at the forefront of the NTN developments, working at 3GPP, and additionally partnered with Thales Alenia Space to build and launch two LEO satellites in the 2 GHz MSS band. IoT, broadband, and high-reliability communications are included in the 3GPP specification for NTN finalized in 2022 in Release 17. Standardization of NTN within 3GPP, as well as continued development incorporated into Releases 18 and 19, will have a positive impact on economies of scale. We also note that the use of devices in compliance with 5G NTN 3GPP specifications promotes cryptographically secure communications, an increasingly important consideration for all users.
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.	Multiple satellite operators can only be supported within MSS spectrum bands utilising geographic and frequency separation. Temporal separation (i.e., coordinated and synchronised time-based access to common spectrum) is not a feasible method of allocating common spectrum as multiple entities/operators/systems are involved Given the size of the UK landmass as compared to a satellite coverage area – or even considering harmonization with the European Union to enable a pan-European allocation, spatial allocations covering unique areas is also not a feasible solution as these could cause significant border-area interference between operators, or exclusion zones which will result in uncovered areas. Geographical coordination is challenging because it would yield potentially large exclusion zones (up to hundreds of kilometres) to protect the two geographic areas from co-channel interference resulting in a loss of contiguous service territory across a landmass. Omnispace therefore supports the continuation of a UK MSS authorization regime comprising of at least two operators with a dedicated segmented spectrum assignment approach to ensure coexistence and quality of service between different MSS operators. The spectrum needs of competing MSS providers serving the same region – in this case, the whole of the United Kingdom – is analogous to long-recognized arrangements for terrestrial mobile operators, in which licensees offering service in the same geographic area are assigned discrete, dedicated spectrum to avoid interference and degradation of service quality for users. Implementing a spectrum-sharing arrangement between MSS providers would create conditions in which the services provided by any licensee

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	would not meet desired quality of service levels and would not reliably provide a service that would enable the socioeconomic benefits described in the responses to Questions 2 and 3, in particular. While 3GPP-based systems require a minimum of 5 MHz channels, a single 5 MHz paired spectrum block may not provide sufficient capacity to produce an economically viable system. To alleviate this issue, operators should have the flexibility to access other's spectrum through spectrum leases or other mutually agreeable arrangements between licensees.
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?	Yes, D2D in MSS spectrum is already available. Emergency SOS via satellite service has been authorised and offered by Apple (via Globalstar) in many countries (UK, Australia, Austria, Belgium, Canada, France, Germany, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Portugal, Spain, Switzerland, and the United States). Initially launched in North America in 2022, the service enables users with certain Apple iPhone models to contact emergency services and request roadside assistance.[7] The launch of the next version of Apple's mobile operating system will enable non-emergency messaging and device location services.[8] In August 2024, Google launched its satellite SOS feature on Pixel 9 series of devices in partnership with Skylo and Garmin.[9] Garmin Response is a satellite SOS emergency response service that connects Pixel 9 users with local and international emergency services. Skylo is a NTN service provider that works with multiple satellite network operators (SNO) with licensed spectrum that enables Pixel 9 users to connect in remote areas, with potential for global expansion. The availability of such services, including Apple's Emergency SOS feature, is already providing UK consumers with expanded emergency services contact options, ensuring the ability to access critical services regardless of terrestrial mobile network coverage. The upcoming expansion of the Apple/Globalstar service to include non-emergency messaging and device location services and the planned launch of Omnispace-enabled service in markets around the world will enable an extension of everyday communications

[7] Apple, Emergency SOS via satellite available today on the iPhone 14 lineup in the US and Canada, November 15, 2022, https://www.apple.com/newsroom/2022/11/emergency-sos-via-satellite-available-today-on-iphone-14-lineup/.
[8] Apple, iOS 18 makes iPhone more personal, capable, and intelligent than ever, June 10, 2024, https://www.apple.com/newsroom/2024/06/ios-18-makes-iphone-more-personal-capable-and-intelligent-than-ever/.
[9] Google Brings Satellite SOS Feature to Android With Pixel 9, August 14, 2024, https://www.satellitetoday.com/connectivity/2024/08/14/google-brings-satellite-sos-feature-to-android-with-pixel-9/ .

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	and convenience services that users already expect in their mobile devices. While no further authorizations are required to enable D2D services in MSS spectrum, there are currently haring studies in process for D2D operations in MS/IMT bands in preparation for WRC-27. Any authorization of D2D in MS/IMT prior to WRC-27 must be carefully considered as there are risks associated with authorizing such operations before these studies are completed. Any decision made at this stage to permit commercial use of MS/IMT spectrum could prematurely lock in a regulatory regime ahead of the conference, or complicate the implementation of WRC-27 outcomes, potentially affecting previously approved plans and consumer services.
Question 12: Are there any mobile bands that should be prioritised for satellite based D2D?	As an MSS network operator, our preferred bands for satellite based D2D is MSS spectrum within the existing International Telecommunication Union (ITU) allocations and national licensing frameworks that enable today's MSS services – particularly the S-band MSS allocations represented by band n256. This approach takes advantage of the work already completed by 3GPP in Releases 17 and beyond to bring satellite capability to mass-market mobile devices through the introduction of NTN into the 5G industry standards. This will simplify and harmonize the implementation of satellite connectivity in the global 5G ecosystem. Omnispace supports the work being done within WRC-27 Agenda Item 1.14 to expand the global MSS S-band allocation. Within the mobile bands and within WRC-27 Agenda Item 1.13, Omnispace views LTE band 1, 1920-1980 MHz (uplink) paired with 2110-2170 MHz (downlink) as a potential priority for study for satellite-based D2D as it is a natural extension of the MSS S-band.
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?	Using MS bands for D2D must be provided on a secondary, non-interference, non- protection basis with the invocation of ITU Radio Regulations (RR) Art 4.4. However, enforcing Article 4.4. in practice can be challenging. Consequently, such operations may pose a significant risk of interference to other systems and services. In addition, conflicts on directionality (e.g. reverse band use) with bands already allocated to the MSS should be avoided. As noted above, sharing studies for D2D operations in MS/IMT bands are currently underway in preparation for WRC-27, and there are risks associated with authorizing such operations before these studies are completed. Any decision made at this stage to permit commercial use of MS/IMT spectrum could prematurely lock in a regulatory regime ahead of the conference, or complicate

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	the implementation of WRC-27 outcomes, potentially affecting previously approved plans and consumer services.
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.	No changes to the UK regulatory regime are required for the operation of D2D services in MSS bands. As noted in the CFI, the Apple/Globalstar service is already operational under the existing authorization framework and relevant exemptions. As outlined above, licensing D2D services in MS/IMT bands would necessitate a new regulatory framework capable of effectively managing the potential interference risks that could emerge from the proposed operations.
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.	Thank you for the opportunity to provide comments to this call for information.

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