

Your response

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<p>Question 1: Do you plan to use Q/V and/or E bands for gateways in the UK? Please provide further detail as follows:</p> <p>a) Which bands are you planning to use?</p> <p>b) When and for what purposes?</p> <p>c) How much spectrum do you anticipate will be needed in each band referred to in 1a) (indicating the total uplink and total downlink spectrum required)? Please provide evidence to support your capacity estimation.</p> <p>d) If you anticipate needing access to both Q/V and E band please explain the reasons. Provide supporting evidence explaining how you determine how much spectrum will be required for future gateways, and how this demand changes over time.</p> <p>e) What factors would influence your decision to place one or more gateway(s) in the UK? How many gateway locations do you anticipate needing in the UK for each of the frequency bands referred to in 1a). Why?</p>	<p>Confidential? – N</p> <p>Yes, as noted in Section 3.12 of the <i>Call for input</i>, Amazon has sought authority from the United States Federal Communications Commission to use Q/V band frequencies to expand its capacity and allow it to provide faster and more reliable service to customers.¹ Amazon plans to use most of the Q/V bands (specifically, the 37.5-42.5 GHz (space-to-Earth) and 47.2-50.2 GHz and 50.4-51.4 GHz (Earth-to-space) frequency bands) at both gateways and customer terminals.</p> <p>Expanded access to the Q/V bands in the UK and elsewhere would allow Amazon to (i) increase the available capacity of the first-generation Kuiper System, allowing Amazon to close the digital divide for even more customers; and (ii) include these frequencies on its second-generation system, which would expand coverage to higher latitudes, increasing the reach and capabilities of the Kuiper System. With respect to timing, Amazon plans to seek access to these bands in the UK over the next 1-2 years, as it expands the capabilities of its first-generation system and prepares for deployment of its second-generation system. For Amazon and other NGSO operators, the planning and design of a system often takes place years before actual deployment. Providing certainty about access to these bands, therefore, is important in ensuring that the spectrum is utilized as quickly as possible for the benefit of UK customers.</p> <p>Amazon expects NGSO systems—both the Kuiper System and others—to have an increasing demand for spectrum as these systems deploy and offer a growing range of services to residential, commercial, and government customers. As the consultation notes, Ofcom’s 2022 Space Spectrum Strategy recognized the potential of the Q/V and E bands in meeting this growing demand. See Consultation at Section 2.7. As other frequency bands become congested, the Q/V bands are particularly important expansion bands for NGSO systems. As noted by Ofcom, the</p>

¹ See *Application for Authority to Launch and Operate a Non-Geostationary Satellite Orbit System in V-band and Ku-band Frequencies*, ICFS File No. SAT-LOA-20211104-00145 (filed Nov. 4, 2021) (“Amazon V-band Application”).

Question	Your response
	<p>importance of the Q/V bands for NGSO systems was reflected at WRC-19, which established a spectrum sharing framework in the Q/V bands that is particularly suitable for modern GSO and NGSO operations. See Consultation at Sections 4.21, 4.36. While Amazon sees significant potential value in E-band frequencies as well, its plans for use of the E-band are less certain and remain in the early design stages. The E-band (81-86 GHz and 71-76 GHz) is valuable FSS spectrum for satellite operators, like Amazon, to employ for future capacity expansion at gateway earth stations and potentially at high-capacity customer sites.</p>
<p>Question 2: To help us understand the services that the gateways will support, please provide the following information:</p> <p>a) Which downstream services do you anticipate serving with Q/V or E band gateways deployed in the UK?</p> <p>b) For each service in your answer to 2a) please explain which, if any, of these services will be available in the UK and who they would serve.</p> <p>c) For your response to 2b) please indicate when these services are expected to become available globally and to UK consumers.</p> <p>d) Are gateways in the UK required in order to serve UK consumers? If not, do you have plans for gateways (which will use Q/V/E) in other countries, which could be used to serve the UK?</p> <p>e) Do you plan to deploy gateways in the UK to serve consumers in countries other than the UK? If yes, please provide reasons for this approach.</p> <p>f) Are there any other identifiable benefits to UK people and businesses of locating gateways in the UK? If so, please provide evidence of this.</p>	<p>Confidential? – N</p> <p>As noted above, Amazon plans to use the 37.5-42.5 GHz (space-to-Earth) and 47.2-50.2 GHz and 50.4-51.4 GHz (Earth-to-space) frequency bands at both gateways and customer terminals. Amazon plans to utilize these bands to serve both retail, enterprise, and government customers. Specifically, our service is uniquely suited to reach hard-to-serve areas within the UK and globally, particularly where it may be infeasible to serve areas with existing technologies such as fiber.</p> <p>The Kuiper System’s broadband communication service will enable reliable Internet connectivity to homes, schools, hospitals, libraries, and government facilities, both at fixed locations and on the move. We will also offer communication services to support disaster relief, humanitarian aid, and peace-keeping missions. Further, as innovative technologies continue to emerge, additional spectrum bands will provide critical capacity for Internet of Things and enterprise applications in industries as diverse as agriculture, medicine, finance, retail, and transportation. These services will be available globally, including in the UK, with customers ranging from individual consumers, business, and various branches of the UK government. The launch of the Kuiper System is expected to begin this year with commercial availability starting in 2025.</p> <p>There are engineering benefits (like line-of-sight visibility, satellite-to-earth station geometry, and link performance enhancements) that make it favourable to have gateways located in the UK to serve UK customers. However, it is</p>

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	<p>possible for the Kuiper System to serve UK customers with gateways located outside of the UK. Reciprocally, it is possible and sometimes technically desirable to use UK gateways to serve customers in neighbouring countries or in the international waters and airspace around the UK. Allowing regulatory flexibility to facilitate each of these configurations allows Amazon to ensure the highest possible user experience is provided to customers.</p> <p>Finally, there are several benefits to UK customers and businesses from having gateways located in the UK. The customer experience with certain applications benefits from having gateways at or close to UK data centres. For example, applications using virtual or augmented reality rely on low latency and distance impacts latency. The ability to collocate or closely locate gateways near the data centres running these applications ensures the best customer experience is achieved.</p>
<p>Question 3: Do you have any information on gateways that are planned to be deployed in the UK in the Q/V bands including technical parameters? If so, please provide details.</p>	<p>Confidential? – Y</p> <p>[REDACTED]</p>
<p>Question 4: Do you have any comments on the spectrum sharing considerations set out for the gateway downlink and uplink in the Q/V bands? If so, please provide details.</p>	<p>Confidential? – N</p> <p>First, Amazon strongly agrees with Ofcom’s feasibility assessment and proposed actions to allow gateway uplink operations. Specifically, Amazon agrees with Ofcom’s assessment that it is more feasible to focus on uplink operations in the 47.2-50.2 GHz and 50.4-51.4 GHz (Earth-to-space) frequency bands, given that the 42.5-43.5 GHz allocation is immediately adjacent to a downlink allocation. While Amazon encourages further study to facilitate more intensive use of the 42.5-43.5 GHz band, rapidly enabling access to the more limited frequency range of 47.2-50.2 GHz and 50.4-51.4 GHz would provide immediate benefits to capacity and service for UK customers while Ofcom and operators continue to consider these issues.</p> <p>Amazon also generally agrees with Ofcom’s assessment of feasibility for use of frequencies in the downlink direction. First, as Ofcom notes, existing international rules facilitate coexistence between the fixed service and gateway links</p>

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	<p>in 37.5-39.5 GHz. See Consultation at Section 4.7. Second, with respect to 40.5-42.5 GHz, Ofcom is in the process of revoking fixed links within High Density areas and will revoke many of these Spectrum Access licenses by 2028. Outside of High Density areas, Amazon notes that coordination is readily achievable where the location of fixed links are known. Because NGSO downlinks can employ mitigation measures to facilitate coexistence with fixed links, Amazon respectfully urges Ofcom to promote information sharing about existing fixed links (such as location, antenna reference pattern, and link azimuth direction) outside of High Density areas and offer licenses prior to 2028. Among other things, this will allow NGSO operators to mitigate interference concerns by selecting gateway sites that raise few concerns to begin with.</p> <p>Within High Density areas, Ofcom could permit gateways but make such operations unprotected with respect to Spectrum Access licensees. This would allow for greater spectrum use on an opportunistic basis without constraining the Spectrum Access licensees.</p>
<p>Question 5: Do you have any additional information which could facilitate our consideration of coexistence between gateway uplink/downlink and other services in the Q/V band and adjacent bands, as appropriate? If so, please provide details.</p>	<p>Confidential? – N</p> <p>Amazon notes that design elements inherent to most NGSO systems—including the Kuiper System—make NGSO systems uniquely capable of mitigating interference to and coexisting with other operators. For example, Kuiper’s gateway earth stations employ minimum elevation angles that preclude direct pointing at horizon-pointing fixed links. Further, the narrow beams in the Q/V bands, combined with this angular separation, allow NGSO systems to coexist with fixed links without the need for large separation distances.</p> <p>To the extent interference concerns warrant separation distances, however, NGSO operators such as Amazon can mitigate such concerns by selecting gateway sites a reasonable distance from the nearest fixed link. Accounting for angular separation and narrow beams, any interference at even relatively close distances would be minimal and readily manageable through site-specific solutions such as shielding and managing off-axis gain.</p>

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	<p>Together, these features of both NGSO gateway earth stations and the Q/V bands, combined with tools that can effectively mitigate interference, make coexistence with other services feasible with modest separation distances.</p>
<p>Question 6: What are your views on enabling NGSO gateway earth stations to access the 51.4 – 52.4 GHz band before WRC-27 concludes?</p>	<p>Confidential? – N</p> <p>Amazon respectfully urges Ofcom not to wait for the outcome of WRC-27 to adopt rules for the NGSO FSS gateways in the 51.4-52.4 GHz frequency band. As Ofcom notes, it could instead implement its own protection measures prior to WRC-27, and review those regulations following decisions at WRC-27. See Consultation at Section 4.25. Ofcom could, for example, fashion such measures on those widely expected to be adopted at WRC-27. Recognizing that these rules may change following WRC-27, those operators that choose to deploy gateway earth stations in these bands would do so at their own risk. At the same time, Amazon expects that other operators will share its confidence in the outcome of WRC-27 and would choose to act now to utilize this valuable spectrum. Acting now to enable access, therefore, would ensure the prompt and intensive use of this spectrum to deliver valuable services to UK citizens—rather than leaving it fallow for years pending the outcome at WRC-27.</p>
<p>Question 7: What are your views on initially enabling access to 37.5 – 40.5 GHz for gateways, with a later consideration of the 40.5 – 43.5 GHz frequency range? Do you consider 42.5 – 43.5 GHz to be usable in the uplink?</p>	<p>Confidential? – N</p> <p>Amazon supports Ofcom’s proposal to enable access to downlink gateway earth stations in the 37.5-40.5 GHz band, but respectfully urges Ofcom not to wait until after the removal of fixed links in 2028 to enable access for gateway downlinks in the 40.5-42.5 GHz band. Ofcom could instead enable quicker access to this spectrum by facilitating the sharing of information among licensees of existing fixed links and satellite operators, as well as through adoption of a self-coordination framework which would place on prospective satellite licensees the burden of coordinating with existing services prior to deployment. This model would leverage the many tools that NGSO operators have to facilitate coexistence in high-frequency spectrum, such as angular separation and narrow beams in the Q/V bands. By proceeding in this manner,</p>

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	<p>Ofcom could adequately protect existing services prior to 2028, while in the meantime promote rapid and efficient deployment of satellite services to benefit UK customers.</p> <p>At the same time, Amazon acknowledges that sharing may be more complex for uplink operations in the 42.5-43.5 GHz bands. While it is possible to operate uplinks in the 42.5-43.5 GHz, it would be technically difficult to shield the satellite receiver from high-power downlink transmissions that operate in the frequencies below 42.5 GHz. For this reason, satellites generally have frequency isolation between the uplink and downlink spectrum.</p>
<p>Question 8: Do you have any information on gateways that are planned to be deployed in the UK in E band including technical parameters? If so, please provide details.</p>	<p>Confidential? – N</p> <p>As noted above, Amazon is currently in the design stages of our E-band satellite payload and does not have immediate or concrete plans for E-band gateways in the UK. Nevertheless, given the potential of E-band to expand gateway capacity and improve service for customers in the UK, Amazon encourages Ofcom not to discount the value of this band based on any lack of concrete plans for deployment. As discussed in response to question 5, the sparse existing use of this band, and the feasibility of sharing with its narrow beams, make it a highly promising option for gateway operations.</p> <p>As Amazon and other satellite operators design payloads for future generation systems, expanded access to E-band will provide the certainty needed to invest in both space and gateway operations that make more intensive use of this band. By opening E-band to these uses now, Ofcom can encourage operators in the design and planning phases of their systems to make more intensive use of this band.</p>
<p>Question 9: Do you have any comments on the spectrum sharing considerations set out for the gateway downlink and uplink in E band? If so, please provide details.</p>	<p>Confidential? – N</p> <p>Recognizing that FSS and FS share many frequencies, Amazon does not foresee any issues in complexity for shared, coordinated use of the Ofcom coordinated frequencies or the self-coordinated frequencies.</p>

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<p>Question 10: Do you have any additional information which could facilitate our consideration of coexistence between gateway uplink/downlink and other services in E band and adjacent bands, as appropriate? If so, please provide details.</p>	<p>Confidential? – N</p> <p>As discussed more fully in response to question 5, satellite gateways in high-frequency bands such as the E-band employ narrow, high-gain beams. Combined with angular separation and the use of other mitigation techniques, where necessary, coexistence with other services is feasible without large separation distances.</p>
<p>Question 11: What are your views on considering enabling gateways to use E band before WRC-27 concludes?</p>	<p>Confidential? – N</p> <p>As stated above in Amazon’s answer to question 6, Ofcom need not wait for the conclusion of WRC-27 to authorise gateway use of E-band spectrum. As with other spectrum bands, including the Ka and Q/V bands, there is an increasing and near-term need for access to this spectrum, the use of which will be important to meet increasing customer demand by expanding the capacity of gateways within the UK. As with NGSO FSS gateways in the 51.4-52.4 GHz frequency band, Ofcom could instead implement service rules and a sharing framework that anticipates the likely outcome of WRC-27, including power and unwanted emissions limits, and make clear that such rules are subject to the outcome of WRC-27. This would free operators to deploy and utilize these bands immediately, promoting both NGSO deployment and more intensive use of this band in the years preceding WRC-27.</p>
<p>Question 12: Are there any other points that you deem would be helpful in our consideration of Q/V and E bands for future gateways? In providing your response, please include as much supporting evidence as you can.</p>	<p>Confidential? – N</p> <p>As discussed above, Amazon again notes here that the design and development phase of NGSO deployment can occur years in advance of deployment, and is highly dependent on the global availability of gateway earth station spectrum. To the extent that Ofcom concludes that it should wait in expanding access to portions of the Q/V or E-bands, Amazon respectfully urges it to issue more concrete guidance on the timing of future decisions to aid operators in the planning of their system design.</p>

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