

## Your response

| Question   | Your response   |
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| <p><b>Question 1: Do you anticipate this NGSO system will pose coexistence challenges to existing NGSO systems?</b></p> <p><b>Question 2: Are the measures set out by the applicant to enable coexistence with future NGSO systems reasonable?</b></p> | <p>Confidential? – N</p> <p>Please note that Viasat has merged our responses for Questions 1 and 2 as the comments we wish to make are common for both the questions.</p> <p>While Ofcom’s non-geostationary (NGSO) system licensing procedure currently does not require applicants to have reached a coordination agreement, as set out by the ITU, it is important for Ofcom to ensure that coexistence can be achieved between existing licenses and all future licensees. Viasat’s comments below on the technical analysis conducted by Amazon applies generally for coexistence between NGSO systems and to both assessment scenarios, <i>i.e.</i>, the impact of Amazon’s NGSO system on existing NGSO and future NGSO systems.</p> <p><b>Fundamental flaw in coexistence analysis methodology</b></p> <p>Viasat is concerned about any use of the "increase in unavailability metric" and "average throughput degradation methodology", based on the existing framework provided in No. 22.5L, 22.5M, of Resolution 770 (Rev. WRC-23) and Resolution 769 (Rev. WRC-19), as this analysis is inherently flawed.</p> <p>As an initial matter, that approach is a partially-implemented solution for the 37.5-51.4 GHz range and it has not been considered or adopted for the Ku/Ka band frequencies in which Amazon proposes to operate.</p> <p>Moreover, it is well known that the average throughput degradation methodology masks the impact of NGSO interference on specific performance objectives and does not address the protection of the Service Level Agreements (SLAs). Resolution 769, (WRC-19), which adopts the same methodology for protection of GSO networks, <i>invites the ITU Radiocommunication Sector</i> to study the selection and use of C/N objectives, and the necessity of specifying one or more C/N objective points at associated percentages of time.</p> <p>The significantly ‘higher-than-average’ throughput degradation can be easily noticed in the difference between C/N and C/N+I cumulative distribution function</p> |

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|          | <p>plots at certain percentages of time, provided in Amazon's analysis for existing NGSO licensees. Any authorisation of Amazon's Kuiper NGSO system based on the 'time-weighted average' throughput degradation methodology, has the potential to cause coexistence issues between NGSO systems.</p> <p><b>Assumptions that lead to underestimation of interference potential</b></p> <p>Viasat does not agree with Amazon that their coexistence analysis is a "worst-case analysis" and that based on their analysis "coexistence also will be possible in realistic operation scenarios." The majority of assumptions in Amazon's analysis leads to an underestimation of the interference potential of their system into other NGSO systems.</p> <p>Amazon's coexistence analysis randomly selects satellites from the pool of eligible satellites. The random selection of satellites is not a worst-case selection and does not lead to a statistically-valid envelope of interference. The satellite selection methodology, implemented in operation, takes into account many factors including, but not limited to, traffic demands, optimum performance of NGSO systems and regulatory requirements. Moreover, the assumption of random satellite selection for both NGSO systems involved in Amazon's coexistence analysis significantly underestimates the NGSO system interference. For example, to serve hot spots (geographic areas of dense capacity demand), both NGSO systems would adopt a similar satellite selection method. Thus, randomising satellite selection in that case grossly underestimates the expected interference. Viasat urges Ofcom to consider measures that implement sharing of spectrum between NGSO systems based on angular separation and avoidance of inline events, which are spectrally efficient and long-standing interference mitigation techniques.</p> <p>While Amazon mentions the use of ITU-R Recommendation ITU-R P.618 for atmospheric losses, like rain attenuation, there is no information on how rain attenuation was considered on the wanted and interfering NGSO system link. A fully correlated rain attenuation, on both the wanted and interfering link, does not represent operational reality. The scenario</p> |

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|          | <p>where the wanted NGSO system link is attenuated by rain and the interfering NGSO system link is in clear sky conditions can and does occur, and statistically has a material influence on the increase of the unavailability of the NGSO system link. In addition, even when the rain attenuation affects both wanted and interfering NGSO system links, it is highly likely to be <i>uncorrelated</i> due to difference in elevation angles. These factors magnify the discrepancy between the Amazon analysis and reality and lead to an underestimation of expected NGSO interference.</p> <p>Furthermore, Amazon’s analysis does not consider the satellite antenna radiation pattern, and wrongly claims that it is not applicable for the collocated analysis. With thousands of satellites in the Kuiper constellation and several visible from any given location in the UK, the analysis should take into account the sidelobe emissions of all other ‘visible’ Kuiper satellites using accurate frequency re-use information and a realistic off-axis radiation pattern of the satellite antenna (phased array or parabolic technology). At the very least, emissions from all the Kuiper satellites within the main beam of the other NGSO system earth station, which are a main driver in the increase of unavailability, should be taken into account.</p> <p>Moreover, Kuiper’s standard customer terminal peak gain of 34 dBi does not represent the smallest terminal size announced for the system<sup>1</sup>. Amazon justifies use of a 34 dBi gain terminal “because it leverages the same peak EIRP density as the larger, high-throughput terminal but with a wider beamwidth, making it the worst-case for interference analysis.” It is necessary to conduct the analysis with the smallest user terminal (widest beamwidth) planned for deployment, and the associated EIRP density, to ensure that the worse interference impact is identified. Any authorisation provided based on a coexistence analysis with something other than the smallest user terminals planned would fail to factor in interference potential that is not even considered in Amazon’s current analysis.</p> |

<sup>1</sup> [A 7-inch square design will be Project Kuiper’s smallest and most affordable customer terminal.](#)

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|   | <p>Further, the claim by Amazon that the analysis based on collocated user terminals is a worst-case assumption, is false. The reality is that the user terminals of different NGSO systems in a residential or commercial area will very likely be collocated without any material distance between them, especially in areas of high demand. As with other unreasonably 'favourable' assumptions explained above, the analysis results in an underestimation of interference from the Kuiper NGSO system.</p> <p>Viasat urges Ofcom to consider the above points when assessing the potential of interference from the Kuiper NGSO system into existing and future NGSO systems, and the ability of other NGSO systems to serve the UK.</p>  |
| <p><b>Question 3: Do you assess that the measures put forward will allow this NGSO system to coexist with other services?</b></p> | <p>Confidential? – N</p> <p>Ofcom requires NGSO system license applicants to demonstrate, where relevant, how their NGSO system will protect the following users of spectrum in the UK:</p> <ul style="list-style-type: none"> <li>• GSO networks;</li> <li>• radio astronomy in 10.6-10.7 GHz and 14.47-14.5 GHz; and</li> <li>• fixed links in the 17.7-19.7 GHz band</li> </ul> <p>Viasat commends Ofcom for inclusion of an explicit licence condition that requires NGSO systems to comply with Article 22 of the ITU Radio Regulations.</p> <p>No demonstration has been provided, however, by Amazon regarding compliance of the Kuiper NGSO system with all of the Article 22 EPFD limits in the UK. Instead, Amazon merely claims that <i>"The Kuiper System by design meets the equivalent power flux density ("EPFD") limits in the 17.7-18.6 GHz and 19.7-20.2 GHz bands."</i></p> <p>Moreover, with Amazon's license application, Ofcom is now considering licensing 7<sup>th</sup> NGSO systems in the Ka band:</p> <ol style="list-style-type: none"> <li>1. Mangata Edge ltd</li> <li>2. Telesat</li> <li>3. Rivada</li> <li>4. NSLComm</li> <li>5. Starlink Gen1 (Gateway)</li> </ol> |

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|          | <p data-bbox="692 271 1043 300">6. Starlink Gen2 (Gateway)<sup>2</sup></p> <p data-bbox="692 309 836 338">7. Amazon</p> <p data-bbox="643 367 1326 591">The Starlink system, although limited to Gateways in the Ka band, will have UK-wide EPFD interference contribution, given the sheer number of gateways licensed in the UK and the sidelobe emissions from more than a hundred satellites communicating to those gateways and visible from the UK at any given time.</p> <p data-bbox="643 618 1318 960">Viasat would like to strongly reiterate that the single-entry EPFD limits, that every NGSO system must meet individually, was derived from the aggregate EPFD limits on the basis of 3.5 NGSO systems operating in the same frequency band. With seven NGSO systems potentially operating in the UK, Ofcom must require the NGSO operators <i>collectively</i> demonstrate compliance with the aggregate EPFD limits provided in Resolution 76 (Rev. WRC-23).</p> <p data-bbox="643 987 1331 1487">In the lead up to WRC-23, Ofcom’s position on AI 7 Topic J was to support changes to Res. 76 to define a procedure to ensure that the aggregate EPFD limits in Ku/Ka band are met. Critically, Ofcom also supported incorporating ways to deal with potential exceedances of the aggregate limits before a methodology to compute aggregate EPFD was agreed within ITU and to have a deadline for consultation meetings to begin with or without the aforementioned methodology. WRC-23 decided against having such a deadline and, instead, conditioned the beginning of consultation meetings on development and availability of a methodology to evaluate aggregate EPFD.</p> <p data-bbox="643 1514 1321 1895">Ofcom must not wait for the multilateral administration consultation meetings, that are scheduled to begin after 2027, to assess the potential of all these seven NGSO systems to exceed the aggregate ITU EPFD limits in the UK. Should interference issues arise, isolating and identifying individual EPFD contributions of every NGSO system toward the aggregate EPFD will be an impossible task. While the existing license conditions give “powers” to Ofcom to address any coexistence issues that may arise, Ofcom will not be able to utilize those powers if it</p> |

<sup>2</sup> The U.S Federal Communications Commission (FCC) has considered Starlink Gen 1 and Gen 2 as separate systems for purpose of evaluating the EPFD levels they are likely to generate. Viasat disagrees with that artificial division of the Starlink system.

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|          | <p>cannot identify the amount of EPFD reduction required from every NGSO system, in the event of interference caused due to aggregate EPFD exceedance.</p> <p>A critical component of the aggregate EPFD assessment would be to define a methodology by which multiple NGSO operators would reduce EPFD levels in case of any exceedance. Such a reduction in EPFD level must be proportional to the contribution of each NGSO system towards the aggregate EPFD. Notably, based on FCC's authorisation, SpaceX, as a single operator, contributes towards aggregate EPFD with two separate NGSO systems. There is a major risk of unequitable sharing of the aggregate EPFD budget amongst NGSO systems that would hinder opportunities for other parties including new entrants. These underlying issues can only come to the fore if an assessment on the aggregate EPFD is conducted.</p> <p>Before licensing a seventh NGSO system in the UK, Ofcom should define a methodology for how the aggregate EPFD budget can be shared amongst all NGSO systems and how the NGSO systems will reduce the NGSO system EPFD levels, in case of exceedances. It is unreasonable to expect that NGSO licensees will adapt their operations if the aggregate EPFD exceedance is evaluated in the UK at a later time, especially when there is no methodology defined upfront at the time of license grant. At the very least, it will be a long process that will cause harm to geostationary (GSO) operations throughout the time of the aggregate EPFD exceedances by the NGSO systems.</p> <p>It is prudent, and now necessary, to conduct an aggregate EPFD analysis, within the UK, for all NGSO systems licensed or seeking licenses to operate. Viasat is pleased to work with Ofcom on such evaluations.</p> <p>In order to conduct a representative aggregate EPFD analysis, it is necessary to have information regarding the ITU filings under which each of these NGSO systems will operate in the UK. For some of the systems, this information is known.</p> <p>In case of Amazon, however, the application does not contain any information regarding the ITU filing on which Amazon is relying. This information is necessary to extract the data for the EPFD analysis. In addition,</p> |

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|          | <p>where, the NGSO systems operate under multiple filings, each application should contain EPFD input files (e.g., SRS and masks database) that represent their system as a whole. We believe that there may be up to three ITU filings which make up the entire Kuiper NGSO systems, namely USASAT-NGSO-8A, USASAT-NGSO-8B and USASAT-NGSO-8C. Similarly, Telesat in their ‘additional information’ document named three ITU filings – COMSTELLATION, CANSAT-LEO and TELSTAR-LEO, that received favourable finding under Resolution 85. It is necessary to identify a single filing that represents the entire Telesat NGSO system. Viasat also notes that the generic characteristics provided by Telesat in their ‘technical annex’ provided to Ofcom do not entirely match with characteristics in any of these ITU filings.</p> <p>As a start, <u>Viasat urges Ofcom to seek the necessary NGSO system information from all NGSO applicants and already licensed NGSO operators in order to be able to conduct the aggregate EPFD analysis</u> and to make the information available publicly for all stakeholders for analysis and comment. Such information should, at a minimum, include:</p> <ul style="list-style-type: none"> <li>• For each of the current and proposed licensees (and those under consideration) either the name of the ITU filing applicable for the system, or, in case the system is represented by more than one published ITU filings, the applicable EPFD input files (SRS and mask databases)<sup>3</sup> of the NGSO system <i>as a single system</i>.</li> </ul> <p>Viasat also requests Ofcom to <b>extend the time frame</b> for commenting on the consultation to provide stakeholders time to conduct the necessary aggregate EPFD analysis once the necessary data is made available.</p> <p>Finally, and looking ahead, Ofcom should also amend the NGSO system licensing conditions to include a provision for applying, in the UK, any decisions that are taken by the Resolution 76 consultation meetings in the event of exceedances of aggregate EPFD.</p> |

<sup>3</sup> In the latter case, it is noted that these input files should be consistent with submitted ITU filings.

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| <p><b>Question 4</b> Do you believe the NGSO system in the application would benefit or harm future competition between NGSO services in the UK? Please provide details.</p> | <p>Confidential? – Y / N</p> |
| <p><b>Question 5:</b> Do you have any additional concerns or comments regarding the application?</p>   | <p>Confidential? – Y / N</p> |
| <p><b>Question 6:</b> Do you agree with our assessment of the potential impact of our proposal on specific groups of persons?</p>  | <p>Confidential? – Y / N</p> |
| <p><b>Question 7:</b> Do you agree with our assessment of the potential impact of our proposal on the Welsh language?</p>  | <p>Confidential? – Y / N</p> |

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