RIVADA
SPACE NETWORKS

[redacted]
[redacted]
Ofcom
2a Southwark Bridge Road London
SW1A 2ET
[redacted]

30 January 2024

Subject: Request for additional information

Dear [redacted],

We would like to thank you for your letter dated 12 January 2024. We are pleased to provide the following additional information regarding our application for a non-geostationary earth station network licence.

Q: Please clarify the assumptions made in your coexistence studies regarding the number of active co-frequency satellites, or the number of active co-frequency beams from your satellites. If there were any other assumptions made that might not have been explicitly captured in your application, you can also take this opportunity to explain them.

In the simulation model for downlink traffic, the scenario modeled a single Rivada's earth station placed in the territory of the UK. The victim's earth station is placed exactly at the same location to ensure that worst-case scenario is considered. It is assumed that the earth stations operate in the same frequencies and that the carriers overlap completely. In real life conditions, when there is a certain distance between earth stations, depending on beam size, satellite antenna pattern and elevation angle, the interference will be even less than that calculated in the simulation. During the simulation, only one Rivada satellite transmits to the Rivada earth station at a time. This also means that at a specific location, there is always only one co-frequency beam illuminated by the satellite. The satellite communicating with the earth station is chosen based on a random tracking strategy, to ensure that all possible geometries are considered.

For simulation of uplink traffic, both Rivada's earth station and the victim's earth station are placed in the same location as for the downlink simulation. The same assumptions are made, i.e. use of the same frequencies and total carrier overlap. Rivada's earth station connects to a single Rivada satellite at a time and transmits towards only the connected Rivada satellite. In real life conditions, the distance between earth stations or the partial overlap of carriers can also be advantageous, as is the case for the downlink. The satellite communicating with the earth station is chosen based on a random tracking strategy.

In conclusion, the number of active co-frequency satellites in Rivada's system is set at one for both directions, which also reflects the planned operations.

Q: Can you please explain the rationale for choosing a C/N objective of -5 dB?

In the co-existence simulation, the equations of Rec. ITU-R S.2131-1 are used to calculate the change in spectral efficiency. In this Recommendation, a widely used standard, DVBS2X, in satellite communications is chosen to derive the equations whereas same principle may apply to different ACM techniques depending on the victim system characteristics. Although DVB-S2X allows C/N values lower than -5dB, when second order polynomial curve fitting is applied to the spectral efficiency curve of a DVB-S2X ACM carrier over a non-linear satellite channel, the first derived equation allows the calculation of spectral efficiency for a C/N value of -5dB or above. The simulation results show that coexistence is possible under typical operating conditions. Additional to this, Rivada is already coordinating its filings with the non-GSO satellite operators to ensure that operational requirements are also taken into account.

Q: Please provide more details on your proposed "lookaside method" to mitigate interference between non-GSO systems. Although we understand it may not be possible to provide all details, we wish to understand what information is required to implement the method, and the expected responsibilities of the different stakeholders involved.

Recommendation ITU-R S.1431 provides some information about possible interference mitigation techniques to allow co-existence of non-GSO satellite systems. The "Lookaside method" is one of the highly accepted techniques which can be used to mitigate interference between Rivada's system and another non-GSO satellite system, to allow co-existence of systems. Satellite operators have been taking advantage of angular separation between cofrequency and co-coverage satellites for a very long time as a successful method to avoid harmful interference. Rivada's satellites are capable of creating beams of different shapes and sizes anywhere on Earth within the satellite's coverage area. This ensures that all visible satellites can serve the same earth station depending on the service requirements and available resources (e.g. bandwidth). Whenever an in-line event occurs, the earth station has the capability to switch to another visible satellite. Rivada has designed its system so that several satellites are always visible in the UK. In any case, Rivada is committed to reviewing the measures in a case by case basis when the ones being proposed are proven to be insufficient.

***** Start of confidential information.**

[redacted]

End of confidential information. ***

While Rivada's system has all the capabilities detailed in our application and this additional document to allow coexistence with other systems, implementation requires collaboration between the affected non-GSO satellite operators. The operators need to know at least the orbital parameters of the affected system. The possibility of long-term resource planning and exchange of beam pointing information may improve the efficiency in implementation. ITU Radio Regulations require non-GSO satellite operators to coordinate under No. 9.12. Rivada is already coordinating with these operators to find the best possible solutions.

Q: One respondent to the consultation mentioned a potential discrepancy between the exclusion angle of 4 degrees used in the coexistence studies, and the exclusion angle that could be inferred from the PFD mask that Rivada summitted as part of its filing to the ITU. We would like to give you the opportunity to respond to this point.

The ITU-R Bureau has published the favorable results upon examination, proving that Rivada non-GSO satellite system complies with the EPFD limits in order to protect the operations of GSO satellite networks. The PFD masks of the Rivada filings submitted to the ITU-R Bureau reflect the power levels, taking into account the sidelobes of the satellite antenna. The masks were used to verify the compliance with the EPFD limits of Article 22 of the Radio Regulations. Rivada is committed to respecting the EPFD limits and stresses that its system has all the capabilities to do so (e.g. power level adjustment, implementation of the GEO arc avoidance angle, beam sizing).

Yours sincerely,

[redacted]

[redacted]

[redacted]

Rivada Space Networks