Kepler Response to Ofcom's Informal Request for Information

Kepler hereby submits the following information in response to Ofcom's request for information for Kepler's Earth Station Satellite Network application, requesting to provide services in the United Kingdom using Ku-band frequencies. The information provided herein outlines how Kepler may coexist with existing operators in the band.

Summary of Simulation Parameters Methodology

This section outlines the methodology employed to find input parameters and select simulation conditions used in the technical analysis to demonstrate coexistence with incumbent license holders. Three figures of merit are provided for each incumbent for both uplink and downlink directions. A figure of availability versus carrier-to-noise ratio (C/N) will be provided to visually demonstrate how interference impacts C/N. Numerically, two figures of merit shall be stated. First is the percentage of throughput loss due to interference and second is the increase in unavailability due to interference. The figures of merit display how coexistence is possible with current licensees and how the performance impact is assessed.

In total, four simulations were completed. For each of the incumbent operators, one simulation was conducted per link direction, which is one uplink and one downlink scenario. Each analysis takes places over 60 days with a temporal resolution of one second. All simulations consider atmospheric attenuation, which was generated using the ITU's recommendation ITU-R P.676-13. At a given timestep, the p-value chosen to model atmospheric attenuation is randomly selected with values spanning 0-100 % uniformly distributed. All four analyses use a single Earth station for each operator and all Earth stations are collocated in London, England. The specific coordinates can be found in General Simulation Details table below.

Input parameters for each system rely on ITU filings. For Kepler, Network Access Associates, and Starlink Internet Services these are KELYPSIS, L5, and STEAM-1 respectively. Information regarding orbital structure, satellite RF beam characteristics, and Earth station RF beam characteristics was taken from said filings. All filings employ typical Earth stations; thus, a single collocated Earth station could be chosen for each scenario. Aside from filed parameters,

conditions were chosen to factor the antenna pointing of satellites and the strategy of how the Earth station points toward satellite targets. For all scenarios, Earth station antennas point toward a random visible satellite and the chosen random satellite's antenna points toward the collocated Earth station. This is true for both the interferer and victim systems.

Given the ITU filings, the worst affected links have been simulated. From these four simulations, key values and statistics can be drawn including the abovementioned figures of merit. Availability means the likelihood of achieving this C/N value or higher. The reciprocal of this figure is of course unavailability. The percent increase in unavailability at a given C/N objective is simply the relative percent increase from C/N to C/(I+N) at the C/N objective of 0dB. Throughput is calculated based on ITU recommendation ITU-R S.2131-1. The percentage of throughput loss is calculated as the relative percent decrease in throughput from C/N to C/(I+N) taking the entire time history of results into account. Together, these three figures of merit demonstrate a minimal impact on performance from the Kepler system into incumbent systems.

In each of the four scenarios, two criteria must be met to determine whether a given satellite is visible to an Earth station. This includes a minimum elevation and GSO exclusion angle. If a satellite in the sky of the Earth station is higher than the minimum elevation and outside the GSO exclusion angle, that satellite is deemed visible and capable of communications. The values of these parameters can be seen in the operator details tables below. In the case of downlink interference, the situation is as such where the incumbent collocated Earth station is designated as the victim. As time progresses, random satellites point toward the incumbent victim Earth station for communication. At the same time, the Kepler collocated Earth station also points toward random Kepler satellites. While the incumbent system engages in communication, the Kepler satellite (acting as the interferer) engages in communications with its Earth station. In the uplink scenarios, the incumbent collocated Earth station again points toward a random incumbent satellite. This satellite is designated as the victim. Simultaneously, the Kepler collocated Earth station points toward a random Kepler satellite. The Kepler Earth station is designated as the interferer in this case. As the incumbent Earth station engages in communication with a chosen victim satellite, the Kepler Earth station also communicates with the chosen Kepler satellite.

Simulation Parameters Kepler Orbit Details

Parameter	Value
Number of orbital planes	7
Satellites per orbital plane	20
Total number of satellites	140
Altitude [km]	575
Inclination [deg]	97.7

OneWeb Orbit Details

Parameter	Value
Number of orbital planes	103
Satellites per orbital plane	15, 20, 40, 52, 55
Total number of satellites	3952
Altitude [km]	800, 900, 950, 1200
Inclination [deg]	87.9, 88.2, 88.9

SpaceX Orbit Details

Parameter	Value
Number of orbital planes	190
Satellites per orbital plane	20, 22, 43, 58
Total number of satellites	4408
Altitude [km]	540, 550, 560, 570
Inclination [deg]	53, 53.2, 70, 97.6

General Simulation Details

Parameter	Value
Duration [days]	60.0
Atmospheric Attenuation Model	ITU-R P.676-13
P-Value [%]	Uniform random distribution 0-100
C/N Objective [dB]	0
Satellite Propagation Model	Point mass
Ground Propagation Reference Ellipsoid	WGS84
Earth Station Location [latitude, longitude]	51.5080, -0.0952

OneWeb Uplink

Parameter	Kepler Communications Inc.	Network Access Associates Ltd.
Carrier Frequency [MHz]	14005.0	14005.0
Bandwidth [MHz]	10.0	10.0
Transmit Power [dBW]	23.0	19.5
Noise Temperature [K]	600.0	600.0

Satellite Gain [dBi]	21.2	21.6
Satellite Beam Pattern	ITU-R S.1528	ITU-R S.1528
Ground Station Gain [dBi]	52.2	21.6
Ground Station Beam Pattern	APENST806V01	AP8
A Coefficient	29.0	-
Ground Station Antenna Diameter [m]	2.0	3.5
Ground Station Minimum Elevation [deg]	10.0	5.0
Antenna Tracking Strategy	Tracking target	Tracking target
Link Selection Strategy	Random	Random

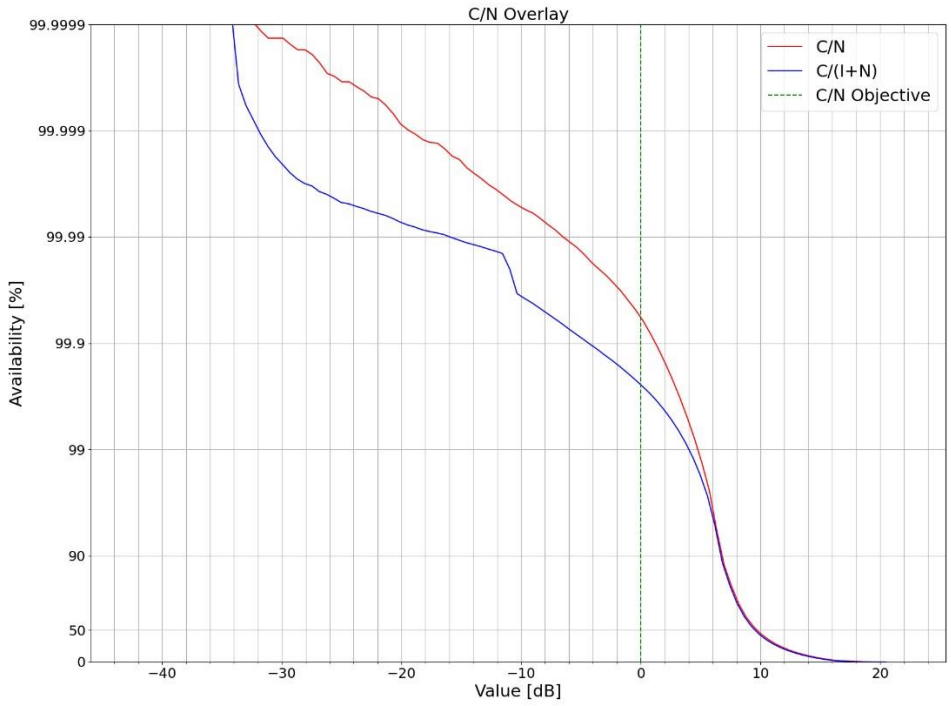

Figure of Merit	Value [%]
Throughput Loss	2.14
Increase in Unavailability	0.19

OneWeb Downlink

Parameter	Kepler Communications Inc.	Network Access Associates Ltd.
Carrier Frequency [MHz]	10955.0	10955.0
Bandwidth [MHz]	10.0	10.0
Transmit Power [dBW]	-10.5	3.7
Noise Temperature [K]	140.0	120.0
Satellite Gain [dBi]	27.2	19.9
Satellite Beam Pattern	ITU-R S.1528	ITU-R S.1528
Ground Station Gain [dBi]	29.4	39.9
Ground Station Beam Pattern	APENST806V01	AP8
A Coefficient	29.0	-
Ground Station Antenna Diameter [m]	2.0	3.5
Ground Station Minimum Elevation [deg]	10.0	5.0
Antenna Tracking Strategy	Tracking target	Tracking target
Link Selection Strategy	Random	Random

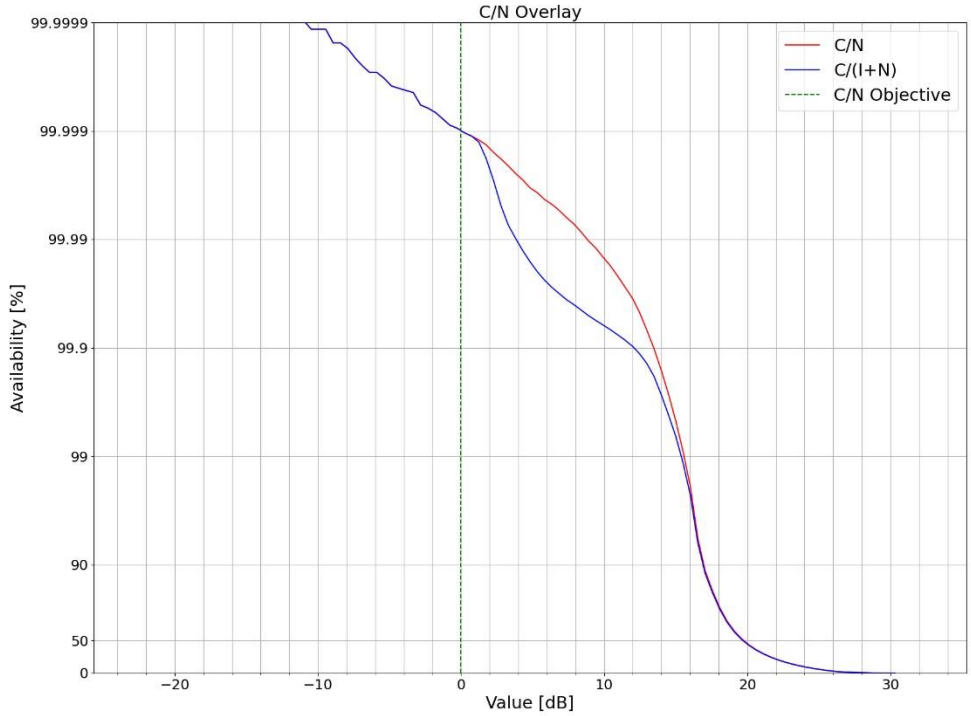

Figure of Merit	Value [%]
Throughput Loss	0.30
Increase in Unavailability	0.00

SpaceX Uplink

Parameter	Kepler Communications Inc.	Starlink Internet Services Ltd.
Carrier Frequency [MHz]	14005.0	14058.0
Bandwidth [MHz]	10.0	116.0
Transmit Power [dBW]	23.0	8.0
Noise Temperature [K]	600.0	424.0
Satellite Gain [dBi]	27.3	26.3
Satellite Beam Pattern	ITU-R S.1528	ITU-R S.1528
Ground Station Gain [dBi]	52.2	44.0
Ground Station Beam Pattern	APENST806V01	AP8
A Coefficient	29.0	-
Ground Station Antenna Diameter [m]	2.0	1.47
Ground Station Minimum Elevation [deg]	10.0	25.0
Antenna Tracking Strategy	Tracking target	Tracking target
Link Selection Strategy	Random	Random

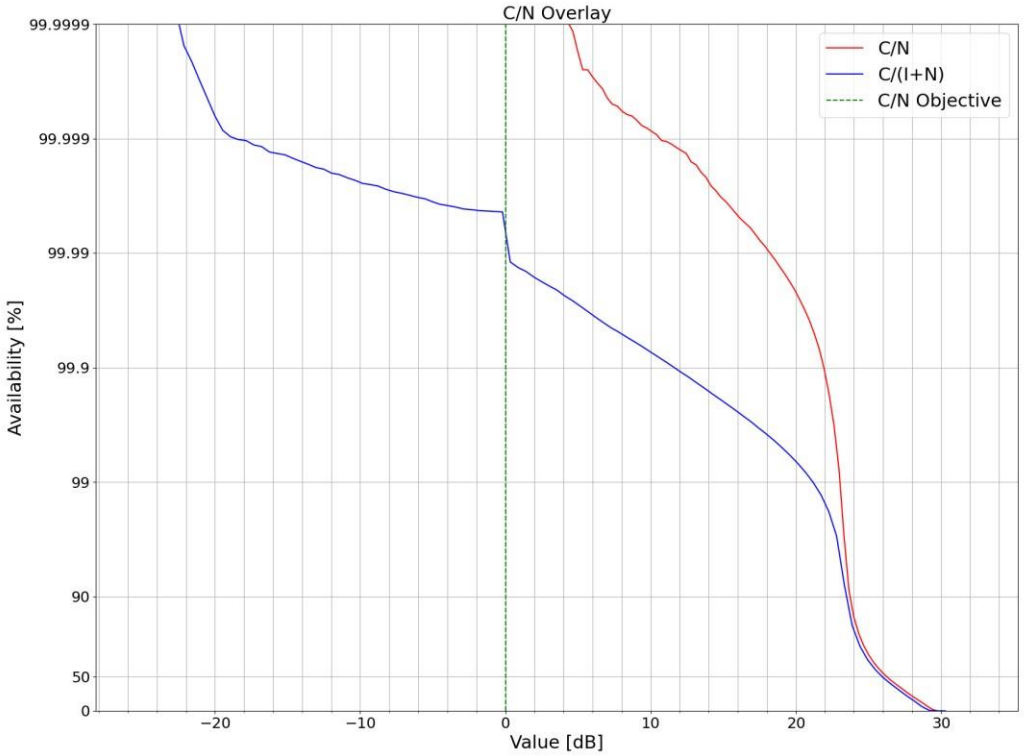

Figure of Merit	Value [%]
Throughput Loss	0.80
Increase in Unavailability	0.01

SpaceX Downlink

Parameter	Kepler Communications Inc.	Starlink Internet Services Ltd.
Carrier Frequency [MHz]	11695.0	11642.0
Bandwidth [MHz]	10.0	116.0
Transmit Power [dBW]	-8.7	11.0
Noise Temperature [K]	140.0	374.0
Satellite Gain [dBi]	27.2	26.3
Satellite Beam Pattern	ITU-R S.1528	ITU-R S.1528
Ground Station Gain [dBi]	29.4	35.0
Ground Station Beam Pattern	APENST806V01	AP8
A Coefficient	29.0	-
Ground Station Antenna Diameter [m]	2.0	1.47
Ground Station Minimum Elevation [deg]	10.0	25.0

Antenna Tracking Strategy	Tracking target	Tracking target
Link Selection Strategy	Random	Random

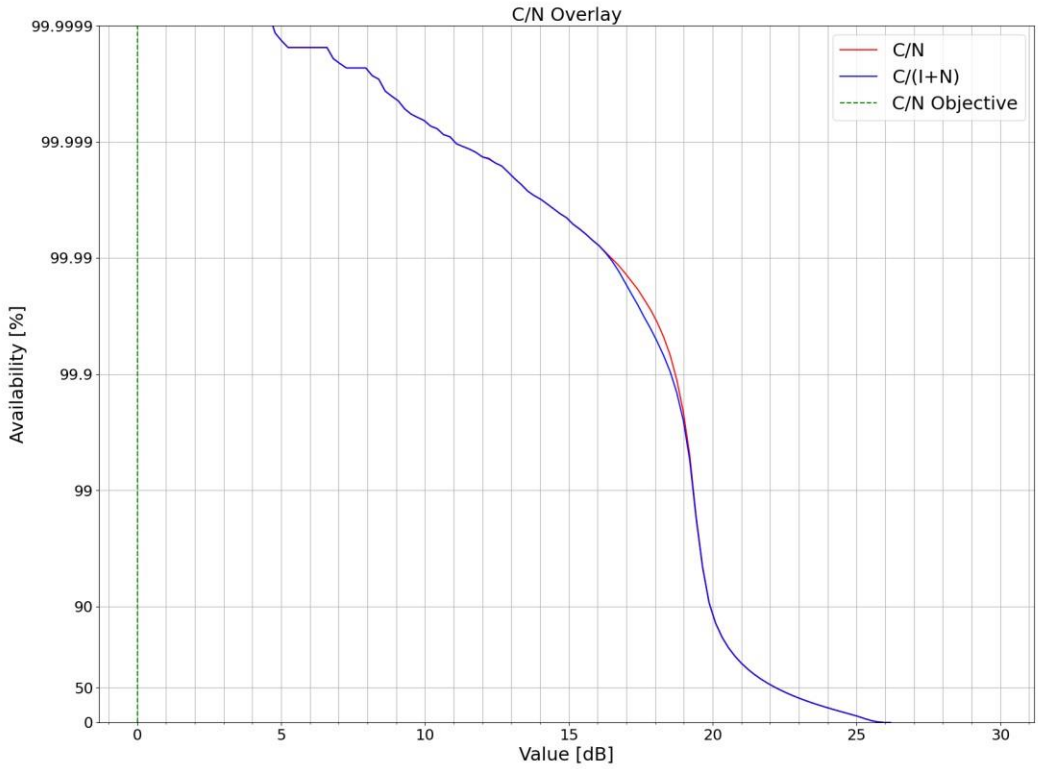

Figure of Merit	Value [%]
Throughput Loss	0.06
Increase in Unavailability	0.00

Please reach out if you have any further questions regarding Kepler's application.

Respectfully submitted,

[redacted]

Kepler Communications Inc.