Your response

GSOA welcomes the opportunity to comment on Ofcom's consultation on Extending access in the Ku-band 14.25-14.5 GHz, published in July 2022. GSOA [1] (the Global Satellite Operators Association), the global CEO-driven association representing global and regional satellite operators, provides a platform for collaboration between satellite operators globally and a unified voice for the sector. Our vision is to help policymakers improve the state of the world by continuously bridging digital, education, health, social, gender and economic divides across diverse geographies and across mature and developing economies.

GSOA members welcome Ofcom's initiative for this consultation to extend access to satellite services under a Satellite Earth Station Network (ESN) license in the 14.25-14.5 GHz band to support the deployment of large numbers of terminals connecting to geostationary orbit and non-geostationary orbit satellite services that already operate in 14.0-14.25 GHz.

The spectrum in 14.25-14.5 GHz forms part of the FSS uplink in the "Ku band", which is one of the two main frequency bands used to provide satellite broadband services (the other one being Ka band). Any additional regulatory measures that doubles the existing Ku band capacity available to satellite communications is welcomed as this will enable a much wider range of satellite services in this band. As rightly mentioned by Ofcom, the whole 500 MHz in the wider 14-14.5 GHz band is already authorised in this way in Europe, the US and across the Asia Pacific region, in line with ITU-RR allocations. GSOA therefore welcomes Ofcom's proposal to bring the UK in line with international standard and practice, providing more seamless services in the air and at sea.

Globally, the Ku band is an important band for fixed satellite services (FSS) in both GSO and NGSO. The whole 14-14.5 GHz band has a primary allocation (Earth-to-space) in all three International Telecommunication Union (ITU) regions for FSS uplinks. It also has a secondary allocation for mobile satellite services (MSS) Earth-to-space uplinks. These two satellite allocations (primary and secondary) are used in combination to provide broadband services to mobile platforms in these frequencies (i.e. to ships, aircraft and vehicles).

GSOA fully supports Ofcom's proposal for an ESN type of license for the use of the 14.25-14.5 GHz band, as this will reduce costs and expand the range of satellite services available. To date, only PES and TES types of license have been authorised to use 14.25-14.5 GHz in order to protect other users of the band. An ESN license covers any number of satellite terminals operating as part of a GSO or NGSO network where data is routed by a satellite and a gateway earth station, whether to connect to the internet or undertake private communications.

GSOA thus welcomes expanding the ESN license regime to the 14.25-14.5 GHz which will complement the licensing conditions prevailing in the adjacent 14-14.25 GHz band already used to provide satellite connectivity for many industries. Furthermore, the expansion will help extend access to connectivity in UK areas which are currently unserved or underserved by other technologies.

[1] The members, activities, and other details about GSOA can be found at www.gsoasatellite.com

Question	Your response
Question 1: Have you identified an alternative use for the 14.25-14.5 GHz band which could lead to greater benefits for consumers and citizens than our proposal to extend satellite ESN authorisations? Please provide evidence to support your comments.	*Is this response confidential? – N* Extending the use of 14.25-14.5 GHz by the FSS operators is definitely expected to bring great benefits to UK consumers and citizens. There is a pressing and growing need for Ku-band spectrum to be available in the UK to meet the increasing demand for connectivity, particularly for ubiquitously deployed very small aperture satellite terminals (VSATs), aircraft-mounted Earth stations (AES) and other in-motion satellite terminals whether at sea, air or land. This growing demand has placed serious strain on the Ku-band spectrum for satellite services that is available today, or will soon be, available from the GSO and NGSO satellites covering the UK. Access to the frequency range 14.25-14.50 GHz will help to alleviate that strain. GSOA also believes satellite connectivity using Ku-band spectrum will provide greater benefit to UK cities, and GSOA considers that satellite service in the Ku-band will help close the gap for the remaining 0.4% of UK homes and businesses who do not yet have access to a decent broadband connection. [2] In previous consultation on its spectrum roadmap, Ofcom noted that there has been interest in the 7-20GHz range for 6G by some in the mobile industry. GSOA agrees with Ofcom's initial assessment outlined in its consultation that the spectrum under consideration should not be considered for mobile terrestrial use due to heavy usage by FSS. [3] Furthermore, before considering any additional International Mobile Telecommunications (IMT) frequencies, it is essential that the mobile industry demonstrates more efficient use of those IMT frequencies already identified. WRC-19 identified a total of 17.5 GHz of bandwidth for IMT and only a handful of countries have used it for 5G as of today; for those that have, only a very small portion of it has been licensed. Ofcom has already acknowledged in section 5.81 of its Mobile Spectrum Demand Discussion Paper that mobile spectrum holdings and spectrum already planned for release are likely to be broadly sufficient to meet future demand to 2030. [4]
Question 2: Do you agree with our proposal to extend access in the 14.25-14.5 GHz band for satellite connectivity, for future broadband, air, sea, energy and transport uses? Please provide evidence to support your comments.	*Is this response confidential? – N* GSOA supports Ofcom's proposal to extend the 14.25-14.5 GHz band for satellite connectivity, and as discussed further below, believes the spectrum can be efficiently exploited without causing harmful interference to existing users. Since fixed links, which today number only 30 sites, will eventually be migrated to different frequencies or ceased, we anticipate no coexistence challenges with FSS services because satellite services are obliged to coordinate under the ITU Radio Regulations. However, whilst we accept that new satellite services need to take account of radio astronomy operating between 14.47-14.5 GHz, we respectfully do not think that excluding the use of aero services in this 30 MHz is entirely necessary and would welcome a similar approach as envisioned for land and maritime ESIM. See question 3 below.

[2] See Connected Nations from UK Ofcom: https://www.ofcom.org.uk/__data/assets/pdf_file/0035/229688/connected-nations-2021-uk.pdf

[3] See Ofcom Consultation, More spectrum for satellite connectivity – Extending access in the Ku band (14.25-14.5 GHz) at para 4.14 "we also acknowledged that requirements [for mobile data] beyond 2030 are more uncertain, including the requirements of future mobile technologies like 6G, with no clear frequency bands yet identified. Given this uncertainty, we are minded not to consider mobile as a potential use for the 14.25-14.5 GHz band."

[4] Discussion paper: Meeting future demand for mobile data (ofcom.org.uk)

Question 3: Do you agree with our proposed protection requirements for a) radio astronomy users of 14.47-14.5 GHz; b) remaining fixed link users (at specified frequencies and locations) and c) Crown users?

Is this response confidential? – N

Table 3: Summary of proposed protection requirements for radio astronomy and fixed links

	Service		Proposed protection requirements	
	Site/location	Frequency band (GHz)	FSS land ES and FSS/mss land and maritime ESIM terminals	FSS/mss aeronautical ESIM terminals
Radio astronomy	Jodrell Bank and Cambridge	14.47-14.5	Must not transmit between 14.47-14.5 GHz within a 175 km radius[36] from focus points (NGRs): SJ5739392556, TL5439992385.	Must not transmit between 14.47-14.5 GHz.
Fixed links: bespoke example provided for Gairloch and Isle of	Gairloch	14.305-14.333	Must not transmit between the specified frequencies within the **106 km x 34 km** (widest point) **trapezium** and area formed by the following four NGRs:	Must not exceed the PFD limit below, when transmitting between **14.25-14.5 GHz**:
Skye receivers			NB7228407904, NG7936474883, NF8143745693, NF7860350086.	$-132 + 0.5 \cdot \theta$ dB(W/(m^2 · MHz)) for $\theta \leq 40°$ -112 dB(W/(m^2 · MHz)) for $40 < \theta \leq 90°$ where θ is the angle of arrival of the radiofrequency wave (degrees above the horizontal)
	Isle of Skye	14.445-14.473	Must not transmit between the specified frequencies within the **104 km x 20 km rectangle** and area formed by the following four NGRs: NC3070732585, NC3528011256, NG4435766759, NG3676382388.	

Overall, GSOA appreciates Ofcom's concern to ensure protection of other users in the band, in line with ITU recommendations and ECC decisions. More specifically, we have the following comments:

(a) Radio Astronomy:

The protection of RAS stations performing observations in the secondary RAS allocation in the 14.47-14.5 GHz band can be achieved through areas around such stations where any GSO and NGSO FSS earth station will have to cease transmissions on channels overlapping with the 14.47-14.5 GHz band. The size of the areas has to be determined on a case-by-case but according to ECC Report 271 FSS terminals with an e.i.r.p. towards the horizon of -20 dBW/(40 kHz) can produce an area size up to 340 km (single entry analysis), thus we don't believe Ofcom needs to limit the use of aero terminals in the upper 30 MHz across the entire UK territories but rather only areas near these RAS

stations[5]. Furthermore, GSOA notes that in the US, the radius of protection zones for astronomical observatories is a maximum of 160 km, with the majority only requiring 50 km. Therefore GSOA would encourages Ofcom to reconsider the technical conditions necessary to ensure no harmful interference is caused by FSS stations operating with GSO and NGSO FSS satellite systems to stations of the radio astronomy service.

GSOA believes that the use of the band for aero FSS terminals is compatible with radio astronomy usage. This is because modern FSS terminals on board aircrafts have interference management functions, including, capabilities to avoid interference and actions if interference is detected of earth stations operating on aircraft and vessels. The interference management of ESIM operations is comprised of two components:

1) software on the FSS aero antenna system, which allows acquisition of the satellite, self-monitoring and muting of transmissions while in operation, geo-fencing and

2) the Network Control and Monitoring Center (NCMC) facility that is used to control and monitor the aero terminal in case it enters an exclusion zone.

The NCMC monitors the operation of these earth stations to determine if the aero terminal in the network is meeting the technical and regulatory requirements contained in the Radio Regulations or those required in national authorizations in this case Ofcom's updated ESN provision. The NCMC has the capability to track the location of the aero terminal, adjust the transmission level or shut down an aero terminal, change the frequency or modulation and confirm antenna pointing accuracy. Geo-fencing, another control technique, uses global positioning satellites to define geographical boundaries and to trigger changes in operational parameters when the terminal enters (or exits) a defined boundary. For example, if an authorization for aero operations has not been obtained in a certain area (say one of the current Radio Astronomy sites over the UK) a boundary around that area can be defined and no transmission will be allowed in that defined area. Geo-encing may incorporate google earth, that allows defining boundaries on a satellite view. The particular operational parameters for a defined boundary can be adjusted to ensure operations meet the current regulatory constraints in a particular area.

The NCMC also has a database of the antenna pattern of the Aero terminals on the network at different skew angles since there could be a change as the main beam scans in elevation, to ensure that the allowed power spectral density limits are met without causing interference to existing Radio Astronomy sites. The NCMC draws upon this comprehensive and detailed database of allowed levels and continually monitors feedback from the aero terminal to ensure emissions are fully compliant with regulatory limits. Ofcom simply needs to provide to the NCMC a record of the RSA locations, the latitude, longitude and the affected frequency. This NCMC data can be made available to Ofcom for the purposes of detecting and resolving interference events.

[5] see ECC Report 271.

	(b) Remaining Fixed users: GSOA notes that only 30 pairs of fixed links are currently active in the UK and that the majority of these will be retired by the end of 2022. The locations of those remaining links beyond 2022 and clear plan for their removal should be made available publicly. GSOA also notes that ITU-R recommendation M.1643 was developed in 2002-2003 specifically for AES terminals operating to GSO networks operating in the secondary MSS allocation. As such the compatibility assumption used for the AES might not be applicable to NGSO Earth Stations Terminals installed on aircraft for Ku-band systems operating under the co-primary FSS allocation. Since then, CEPT conducted more studies between 2016 to 2018 and developed a PFD mask to protect FS microwave links in ECC report 271. PFD mask for NGSO terminals installed on Aircraft to protect Fixed Service receivers: ○ -122 dB(W/(m² · MHz)) for $\theta \leq 5°$; ○ $-127 + \theta$ dB(W/(m² · MHz)) for $5° < \theta \leq 40°$; ○ -87 dB(W/(m² · MHz)) for $40° < \theta \leq 90°$ With θ being the elevation angle above the horizontal plane at a point in the Earth. GSOA strongly recommends Ofcom to adopt the PFD mask from the more recent ECC report 271 as this would lead to more efficient usage of spectrum for ESN licensees than recommendation M.1643, especially considering that most fixed links to be protected are scheduled to be decommissioned by the end of 2022. **(c) Crown users**: No comment
Question 4: Do you agree with our proposed authorisation approach and draft licence conditions for a) ESN licences, and b) other licensees wishing to take advantage of enhanced satellite connectivity (i.e. aircraft, ships, unmanned aircraft systems).	*Is this response confidential? – N* GSOA welcomes Ofcom's proposals on licensing satellite networks and users of the 14.25-14.5 GHz band for the provision of fixed and mobile broadband services. To the extent Ofcom agrees with GSOA's revisions above, the relevant conditions should be adjusted accordingly.
Question 5: Do you have any other comments on our proposals?	*Is this response confidential? – N* No comment