Satellite Earth Station Network licences

Enabling NGSO maritime services and introducing new conditions on coexistence

Statement

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Contents

Section

Annexes

1. Overview

1.1 The launch and operation of Non-geostationary Orbiting (NGSO) satellite constellations - such as the Starlink/SpaceX and OneWeb systems - represents a relatively new way of delivering high capacity, high speed and low latency broadband services.

1.2 We want to encourage new NGSO services, for the benefit of UK consumers and businesses, while ensuring different systems can coexist without undue or harmful interference.

1.3 In support of this objective, we published a consultation in May 2023 on proposals to update our satellite Earth Station Network licence to ensure all providers of UK satellite services - both Geostationary Orbiting (GSO) and NGSO - can access radio spectrum in a similar manner, including for connectivity on ships and boats. This document sets out our decisions on those proposals.

What we have decided – in brief

After considering all consultation responses we have decided to introduce the following changes to the satellite Earth Station Network licence:

- Inclusion of NGSO maritime earth stations to ensure that all NGSO operators hold an Earth Station Network licence; and to clarify that these services are permitted in the territorial seas of the UK, Isle of Man and Channel Islands;
- New licence conditions to support the protection of GSO satellite services, radio astronomy and fixed links from harmful interference caused by NGSO systems;
- The addition of a definition of the geographical boundaries of the licence.

The new/updated licence will be issued to all new applicants granted an Earth Station Network licence in future. The updated terms will be issued to all existing licence holders in the form of a variation to their current licences.

2. Introduction and summary of proposals

2.1 Space based connectivity is increasingly important for UK consumers and businesses, with an ever-growing number of satellite operators offering a range of services.

2.2 Satellite services are able to deliver communications services to places that are difficult to serve by other means. They are ideal for connecting premises and businesses in remote geographic locations as well as to vehicles, ships and aeroplanes operating in locations where terrestrial services cannot reach.

2.3 Delivery of these services relies on radio spectrum, and every network operator providing Fixed Satellite Services (broadband) to UK based satellite terminals must hold an Earth Station Network licence. [1] For Non-geostationary Orbiting (NGSO) systems, the holder must be the satellite operator.

2.4 In our November 2022 Space Spectrum Strategy document we said we wanted to encourage as many NGSO communications systems as possible because they provide opportunities for the development of new and innovative services to users.

2.5 In support of this objective we said we would seek to ensure all providers of UK satellite services (NGSO and GSO) can access the spectrum in a similar manner, and can coexist with other users of the spectrum without causing harmful interference.

2.6 Our May 2023 consultation proposed specific changes to the wording of the Earth Station Network Licence to put this into practice. We said the overall effect of the proposed changes would be to:

- Explicitly allow NGSO satellite terminals on ships to use Ku band (14.0-14.5 GHz) and Ka band (27.5–27.8185 GHz, 28.4545–28.8265 GHz, and 29.5–30 GHz) radio frequencies in the territorial seas of the UK and Crown Dependencies;
- Introduce new conditions to support the protection of GSO satellite services, radio astronomy and other services from NGSO systems; and
- Define the geographic boundaries of the licence.

2.7 We said our proposals would give us additional options to intervene should any licence holder cause disruption to another system or service. This meant we could ensure consumers and businesses continued to have access to reliable services, and that accurate radio astronomy data can be collected for scientific research.

2.8 The consultation opened on 12 May 2023 and closed on 7 July. In the rest of this document we present our consideration of the consultation responses we received, before setting out our final decisions on the changes we are making to the Earth Station Network licence.

2.9 The May 2023 consultation set out the legal context within which these changes are being made. This is reproduced in this document at annex 1. A sample licence, with the changes we are making to the wording of the current licence template marked clearly in yellow, is set out at annex 2.

[1] In this document we use “user earth station” and “terminal” interchangeably. This is the equipment enabling a user to connect (via satellite) to the internet or a private network. Examples of such equipment could be a parabolic dish (Very Small Aperture Terminal) or flat panel antenna.

3. Assessment of consultation responses

3.1 We received nine submissions in response to our consultation. One of those responses was submitted on a confidential basis. The other eight responses are published on our website.

3.2 There was broad support for the general approach put forward in our proposals, although some of the respondents raised questions about the details of some proposed changes. In particular, there were comments about the proposed licence conditions on protecting GSO networks and on the wording of the proposed definition of the geographical extent of the licence.

3.3 The comments made by respondents are noted under relevant headings below, together with our assessment of the points made.

NGSO satellite terminals on ships

3.4 In the Space Spectrum Strategy statement we said we wanted to ensure that NGSO satellite systems could access the same spectrum (and in the same way) as GSO systems. One particular area of difference we identified in the Space Spectrum Strategy was over access to Ka and Ku band frequencies by NGSO satellite terminals on ships.

3.5 The May 2023 consultation therefore proposed to amend the Earth Station Network licence to clarify that NGSO terminals on maritime vessels and off-shore facilities were authorised to use Ku and Ka band frequencies within the territorial seas of the UK and Crown Dependencies (subject to the conditions set out in the Earth Station Network licence and notices).

3.6 We said, for ship connectivity, the Earth Station Network licence (covering the terms and conditions for NGSO systems) would operate alongside individual Ship Radio licences.[2] This is the same as our approach for authorising terminals operating to GSO satellites in UK waters and ensures all NGSO services operate under the same licence conditions.

3.7 In recognition that all four current NGSO licence holders planned to offer maritime services internationally, with OneWeb and SpaceX planning to roll out maritime terminals this year (2023) we varied the licences of existing NGSO Earth Station Network licensees 'by consent' on an interim basis to clear up any immediate ambiguity regarding the provision of these services within the territorial seas of the UK and Crown Dependencies.[3]

3.8 The May 2023 consultation proposed that this approach be extended as standard for future NGSO Earth Station Network licence holders, specifically requiring satellite operators to ensure that terminals on visiting ships do not cause interference to UK services.

[2] The Ship Radio Licence authorises the installation and use of maritime radio and associated equipment, as well as non-maritime radio equipment (such as a mobile phone picocell) on a named ship, subject to applicable licence conditions. The ship must be registered in the UK or one of the Crown Dependencies. The licence applies to the ship no matter where in the world it might be.

[3] We have published these updated licences. See NGSO licensing webpage.

3.9 We asked the following question:

> **Question 1:** Do you agree with our proposal to update the Earth Station Network Licence to include a new provision authorising NGSO maritime services in the territorial seas of the UK and the Crown Dependencies? If you do not agree, please explain your reasons.

Consultation responses

3.10 All respondents expressed support for our proposals to license NGSO maritime services, but one respondent [✂REDACTED] said Ofcom should not make any changes to the current licence until after this year's World Radiocommunication Conference (WRC-23). It said a range of issues related to NGSO Earth Stations in Motion (ESIM) would be discussed at WRC-23 and it would be premature to make changes ahead of those discussions.

3.11 The same respondent also said it was "inappropriate" of Ofcom to have varied the current NGSO Earth Station Network licences ahead of concluding this consultation, without providing an opportunity for affected stakeholders to comment. It said the variation risked changing the interference environment for GSO operators, and also risked the perception that Ofcom had already made up its mind on the issues.

Ofcom assessment

3.12 We note that NGSO maritime services can already operate in UK waters under Ship Radio licences (as per our 2016 NGSO Statement). Our proposal was simply to include these services under the Earth Station Network Licence regime to ensure that all the conditions that already apply to NGSO services operating on air platforms and on land also apply to maritime services.

3.13 This means that the new conditions we proposed for the protection of GSO services will apply to these services too, and so reduce the risk of interference for GSO satellite operators.

3.14 For the avoidance of any doubt, any ship carrying a satellite terminal connecting to an NGSO system should have the relevant frequencies listed in its Ship Radio Licence, and any NGSO satellite operator wishing to provide connectivity to those vessels should hold an Earth Station Network licence.

3.15 We note that all respondents supported the authorisation of NGSO maritime services, although we acknowledge the point made in one submission that we should await any outcomes arising from WRC-23 before making any changes to the licence.

3.16 We are aware that WRC-23 is considering issues for NGSO Ka band ESIM on air and maritime platforms as part of Agenda Item 1.16. This Item would bring NGSO ESIM in line with decisions taken regarding GSO aero and maritime ESIM at WRC-19.

3.17 The agenda item includes bands currently licensed to 28 GHz licence holders, which are not at present available to GSO or NGSO satellite services in the UK (although we note that Avanti holds a licence for three gateway sites, following our 2008 auction of frequencies in the 10, 28, 32 and 40 GHz bands).

3.18 We plan to consult on whether to implement any decisions to extend the frequencies available to satellite services under the Earth Station Network licence - subject to agreement at WRC-23 and in accordance with the conditions laid out in the ITU Radio Regulations.

3.19 Having considered all the points made by respondents, we have decided to proceed with our proposal without waiting for WRC-23 considerations. In part, this is informed by the reality that NGSO maritime services are already permitted and being operated in UK waters. We believe it is sensible to clarify the authorisation framework in a timely manner. We do not expect the interference environment to change.

Protection of other services from interference

3.20 In the May 2023 consultation we set out proposals for new provisions in the Earth Station Network Licence to address protection of GSO services, radio astronomy and fixed links from interference. We said the changes to the licence would enable us to take swifter, more direct action should harmful interference arise from NGSO downlinks.

3.21 In the following sub-sections we consider responses from stakeholders to each of these other uses in turn.

Protection of GSO services from NGSO interference

3.22 The way NGSO systems and GSO networks coexist is primarily managed through the ITU Radio Regulations, which are part of an international treaty that is binding on ITU Member States. However, as noted in the Space Spectrum Strategy, the process for resolving harmful interference can be slow, and outcomes can be uncertain if the NGSO system causing interference is operated under a non-UK filing.

3.23 We therefore proposed a new licence condition in respect of the NGSO satellite downlinks to gateways and terminals in the UK based on equivalent power flux density limitations already included in Article 22 of the ITU Radio Regulations (with which operators are already expected to comply).

3.24 We asked the following question:

> **Question 2:** Do you agree with our proposal to introduce a licence condition in relation to NGSO downlinks to protect GSO satellites, and earth stations communicating with GSO satellites? If you do not agree, please explain your reasons.

Consultation responses

3.25 There was broad support 'in principle' for our proposals on protecting GSO. However, one respondent [✂REDACTED] said our proposed licence condition (requiring licence holders to respect the relevant limits in Article 22 of the ITU Radio Regulations) was not sufficient to ensure that the UK's existing GSO networks are protected. Its response said Article 22 did not apply in some parts of the Ka band anyway – and it identified 17.7-17.8 GHz; 18.6-19.7 GHz; and 28.6-29.5 GHz, which are covered by separate footnotes. The response said the licence should therefore specifically state a requirement to ensure "compliance with ITU Radio Regulations", rather than just Article 22.

3.26 The same respondent also said it was not enough for NGSO applicants to self-confirm they will comply with regulations. They should show evidence (e.g. of adherence to NGSO milestone procedures; of progress in co-ordination with other networks; or evidence of how co-ordination will be completed).

3.27 Another respondent, Viasat, also supported our proposals but said they did not go far enough. Its response said NGSO systems were already breaching (or bending) the rules on EPFD levels.[4] In both its answer to Question 2 and in its answer to Question 5 (Additional matters – see below), it said Ofcom should introduce a range of procedures before granting authorisations for NGSO services covering the UK. It also said licence applicants should be required to provide more information than at present.

3.28 Viasat also urged Ofcom to impose a wide range of further conditions and requirements and said we should ourselves carry out examination and verification of compliance prior to issuing licences, including conducting analysis of the aggregate EPFD levels from all NGSO systems seeking to serve the UK.

3.29 It said NGSO systems should have an operational feature to cease operations immediately on notice of unacceptable interference until it was corrected. It was particularly concerned (particularly in its answer to Question 5) that we needed to take greater account of aggregate interference caused by multiple NGSO systems.

3.30 Finally, it said Ofcom should reconsider its characterisation of NGSO systems as "next generation satellite constellations". It said GSO systems also offered innovative high-speed services.

3.31 Another respondent, Rivada, offered an alternative view to those expressed by Viasat. While not actually objecting to the proposals to include licence conditions requiring the protection of GSO services, Rivada said they were not necessary - because operators already have to comply with the ITU Radio Regulations (including the relevant provisions in Article 22) anyway. Mangata supported the proposals but warned against any additional regulatory burden in compliance.

3.32 In its answer to question 5 (Additional matters) Telesat was particularly supportive of our approach to ESIM in general, and our expectation that licensing would be extended to aeronautical networks.

Ofcom assessment

3.33 We acknowledge the point that Article 22.2 does not apply in the bands at 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space), which are subject to Article 5.523A of the Radio Regulations instead.

3.34 GSO networks and NGSO systems in those bands have to coordinate their use of the spectrum on a first-come, first-served basis, based on the date of their ITU filings. Later systems will be expected to take into account earlier systems regardless of their type. The administration which holds the filing(s) for a specific NGSO system is ultimately responsible for ensuring such compliance.

3.35 We do not therefore think a statement to require "compliance with ITU Radio Regulations" is needed. Note 1 of the Earth Station Network licence says: "*This Licence does not remove any other obligations that the Licensee may have in relation to satellite filings made under the ITU Radio Regulations".* Accordingly, we do not think it is necessary for us to change the wording of the licence.

[4] Equivalent power-flux density (EPFD) limits are defined in the Radio Regulations and use to check whether NGSO systems meet their obligation to protect GSO networks in the relevant bands, that is, where Article 22.2 applies.

3.36 We agree with the points made by a respondent about self-declaration. Operators should provide a high-level explanation of how their systems will comply with the limits in Article 22 of the ITU Radio Regulations ahead of the granting of any further licences.

3.37 Applicants can also submit technical analysis, should they wish, and in practice this is how operators have responded to previous requests by Ofcom for additional information regarding the protection of GSO networks. In particular, during consultations on licence applications by SpaceX, Telesat and Mangata applications. For further information, please see our revised application form and guidance note for applicants (see also below under Additional matters).

3.38 We note that the points made by Viasat relate mainly to the licensing process and are very similar to comments made and considered by us in preparation of our December 2021 Statement on the Updates to NGSO licensing; our November 2022 Space Spectrum Strategy; and our November 2022 consideration of Starlink's application for NGSO gateway licences. In the absence of new evidence, we are not persuaded of any need to change our approach.

3.39 Satellites are global in nature and our overall approach is to reinforce international regulations. We note that the main driver for our proposals to include protection of GSO services as a specific condition in our NGSO network licence was to provide a speedier route to ensuring compliance in the event of interference than is currently the case through international processes. It was never our intention to increase the regulatory burden of compliance on NGSO operators.

Protection of radio astronomy from NGSO interference

3.40 The May 2023 consultation proposed new licence conditions on NGSO satellite downlinks to protect radio astronomy in the 10.6-10.7 GHz band. This is a band adjacent to the downlink bands used by Ku band satellites. We said that satellite services are already subject to international thresholds which protect radio astronomy in this band, but enforcement through international bodies can be a lengthy process.

3.41 We said a specific UK licence condition would provide us with the ability to take direct enforcement action in any cases of harmful interference from NGSO constellations, and remove interference more quickly than relying on international processes. We listed six UK radio astronomy sites to which this protection would apply (Jodrell Bank, Cambridge, Darnhall, Defford, Knockin and Pickmere).

3.42 We asked the following question:

> **Question 3:** Do you agree with our proposal to introduce a licence condition setting out requirements for the protection of radio astronomy from harmful interference in relation to NGSO downlinks? If you do not agree, please explain your reasons.

Consultation responses

3.43 There were no objections – or points raised – about our proposals for a licence condition to protect radio astronomy. We therefore intend to proceed as per our proposals.

Conditions to protect fixed links in 17.7-19.7 GHz from NGSO interference

3.44 There are roughly 3,700 fixed wireless links[5] currently operating in the 17.7-19.7 GHz frequencies in the UK, mainly supporting back haul for mobile operations.[6] The May 2023 consultation noted that Article 21 of the ITU Radio Regulations sets out PFD limits at the earth's surface to facilitate sharing with terrestrial services such as fixed wireless links.

3.45 We said that including this condition in the Earth Station Network Licence would ease enforcement and ensure consistency with all our existing co-frequency/adjacent band spectrum users. However, we noted that compliance with Article 21 PFD limits did not, on its own, guarantee there would be no interference to fixed links.

3.46 We therefore included a further clause (numbered 3.8r) stating that: "In any case, NGSO satellites operating in the space-to-Earth direction shall not cause undue (or harmful) interference to fixed links, and compliance with the relevant power flux-density limitations referred to in 3.8.q does not release licensees from this obligation".

3.47 We asked the following question:

> **Question 4:** Do you agree with our proposal to introduce licence conditions setting out requirements for the protection of fixed links from harmful interference in relation to NGSO downlinks? If you do not agree, please explain your reasons.

Consultation responses

3.48 There were no objections 'in principle' to the proposed licence conditions to protect fixed links, and the new clause based on ITU Article 21. However, three respondents (Amazon Kuiper, Rivada, and Mangata) objected to the proposed additional licence term 3.8r. They said Ofcom should limit any licence conditions to what appeared in Article 21.

3.49 Amazon Kuiper and Rivada said additionally that Ofcom needed to clarify what was meant by "undue (or harmful) interference" because it was not defined. Amazon Kuiper said there was no such term as "undue interference" in the Radio Regulations.

3.50 Rivada said there would be no need for protection conditions if FSS were allowed in the whole of Ka band and fixed links were relocated. Mangata said the 3.8r condition risked placing an unnecessary additional regulatory burden on operators and should be removed.

Ofcom assessment

3.51 Having carefully considered the consultation responses, we still assess that it is important to include both of our proposed clauses in the Earth Station Network licence to protect fixed links, because there may be cases where compliance with Article 21 of the ITU Radio Regulations does not necessarily protect fixed links from NGSO interference on its own.

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[5] Fixed wireless links are terrestrial based wireless systems that operate between two or more fixed points.

[6] As set out above, we also examined EESS, SRS, mobile and radiolocation services in Ku band (10.7-11.7 GHz and 12.5-12.75 GHz) and Ka and (17.3-19.7 GHz). These services can either be protected via the proposals we are already making or have secondary allocations.

3.52 One example is the protection of fixed links the band 17.7-19.3 GHz. Article 21 of the Radio Regulations contains limits to protect fixed links in this band (Article 21.16.6), but these limits have been identified as possibly incorrect for constellations with more than 1000 satellites.

3.53 Because of this possible problem, the World Radio Conference 2019 decided to allow administrations to have this provision waived. Therefore, at the moment, an NGSO constellation with more than 1000 satellites would need to meet the limits in Article 21 in all other relevant bands but not in 17.7-19.3 GHz if the administration responsible for the filing so requests.

3.54 We are aware that international discussions are underway to modify the formula in Article 21.16.6 to fix this issue. Should agreement be reached at WRC-23, we will adapt our approach as necessary to reflect any changes to international regulations on this point.

3.55 In the meantime, clause 3.8r in our updated Earth Station Network licence makes it clear that operators should not cause undue or harmful interference into fixed links, regardless of their status. We believe this allows us to take prompt action in the unlikely event that harmful interference is caused to fixed links, while not imposing unnecessary constraints to NGSO systems.

3.56 We note the comments about undue (or harmful) interference. As explained in the May 2023 consultation, we consider the terms “undue” and “harmful” to mean the same thing – recognising that the ITU Radio Regulation uses the term “harmful interference” and the UK WT Act uses the term “undue interference”.

3.57 Harmful interference is defined in the Radio Regulations as: “Interference which endangers the functioning of a radionavigation service or other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with the Radio Regulations”. For the avoidance of doubt, this seems to us to be an appropriate definition to use in determining undue or harmful interference. We address issues to do with the provision of information and on investigation and compliance in the next section of this document (Next steps).

Additional matters

3.58 The May 2023 consultation also included proposals on other aspects of Earth Station Network licensing. In particular we proposed changes to the definition of the geographical extent of the licence and to the information we would seek in future licence applications. We address these issues in turn below. We asked the following general question:

Question 5: Do you have any additional comments regarding any of our proposals?

Geographic boundaries of the licence

3.59 We said the growth of offshore industries and the rapid development of new ESIM services on ships and planes meant it was important to clarify where the licence applies, noting that UK ships and planes travel beyond UK territory into geographies governed by other administrations.

3.60 We therefore proposed changes to the wording of the licence to define clearly that the licence authorised use on land within the UK, Channel Islands and Isle of Man; on offshore installations in UK territorial sea or in other areas treated as part of the UK under section 120(2) of the Wireless Telegraphy Act 2006; and on any vessel or aircraft within or above the UK, its territorial waters, or the Channel Islands and Isle of Man.

Consultation responses

3.61 There was some confusion over our drafting of the new licence condition defining the extent of the licence.

3.62 One respondent [✂REDACTED] said the current drafting could be interpreted as requiring an operator to hold an Earth Station Network licence when any type of maritime ESIM operates outside UK territorial sea, but in waters which are to be treated as if it they were situated in such of the UK under section 120(2) of the Wireless Telegraphy Act. The response said this this provision should only apply for UK-flagged vessels that also have WT Ship Radio licences, and not for ESIM radio terminals on foreign-flagged vessels. It sought clarification.

3.63 It added that foreign flagged ships should not be required to obtain an Earth Station Network licence in order to provide ESIM services outside UK territorial seas. This would contravene ITU Radio Regulations.

3.64 SES also asked Ofcom to clarify that ESIM installed on non-UK flagged vessels/aircraft only need an Earth Station Network licence when operating within UK territorial waters (parts a and c of our draft licence condition); and that part b only refers to equipment and apparatus located on offshore installations to which UK jurisdiction has been extended (it quotes Section 11 of the Petroleum Act and Section 87 of the Energy Act).

3.65 GSOA made similar points in respect to offshore installations which are outside UK territorial sea but in waters treated as if they were situated in the UK. It said the drafting could be interpreted to apply to ESIM installed on non-UK flagged vessels sailing in waters around energy and oil platforms outside the UK territorial sea. It also sought clarification.

Ofcom assessment

3.66 We are grateful for the responses received on this issue and on the drafting of the licence. We acknowledge that the legislation in sections 119 to 121 of the Wireless Telegraphy Act 2006 is, legally speaking, quite technical in nature and can be tricky to apply.

3.67 Our policy intention when drafting these licence conditions is to authorise as much NGSO equipment use as we can, within the legislation, because of the benefits it can deliver for UK consumers and businesses.

3.68 We wish to ensure that places such as offshore oil installations are authorised, because we believe NGSO satellite uses are likely to be helpful in those locations. It follows that there are likely to be commercial opportunities for satellite operators in these situations. We note that most oil platforms to which UK law applies are beyond UK territorial waters but located in the UK Continental Shelf ("UKCS").

3.69 Our proposed licence text was intended to mirror the relevant sections of the Wireless Telegraphy Act. In summary, our authorisation is intended for stations:

- On land (within the UK, the Channel Islands or the Isle of Man);
- On offshore installations (which are inside UK territorial sea or outside UK territorial sea but in waters which are to be treated as if they were situated in such part of the United Kingdom under section 120(2) of the Wireless Telegraphy Act 2006); and
- On any vessel or aircraft (which is within or above the territory of the UK or within or above the territorial seas of the UK, the Channel Islands or the Isle of Man).

3.70 In a footnote in the draft licence, we added text explaining that UK, Channel Islands and Isle of Man registered ships or aircraft which are outside those places and their territorial seas may be licensed separately by ship or aircraft licences issued for the ship or aircraft concerned.

3.71 However, in light of the comments received in consultation responses, we have looked again at the drafting and the legislation.

3.72 In summary, the legal position is that the Wireless Telegraphy Act 2006 *does* apply to offshore oil and gas installations (or renewable energy installations) which are within the UKCS but outside UK territorial waters. We agree with the respondents who pointed out that it is the installation itself which is to be treated as being part of the UK, rather than the surrounding waters in which it is located.

3.73 The legal background for this position is that Section 120(2) of the Wireless Telegraphy Act refers to the possibility that there may be an 'Order in Council' under section 11 of the Petroleum Act 1998 which would apply civil and criminal law for the purposes of wireless telegraphy licensing to offshore installations. However, in reality there have no Orders directly made under s. 11 of the Petroleum Act 1998.

3.74 There is, however an Order - The Civil Jurisdiction (Offshore Activities) Order 1987 ("CJOA Order") - made under s. 23 of the Oil and Gas (Enterprise) Act 1982 which was the predecessor to s. 11 of the Petroleum Act 1998 (see www.legislation.gov.uk/uksi/1987/2197/made/data.pdf). Article 4 of the CJOA expressly refers to the application of the Wireless Telegraphy Act 1949 (the predecessor to the Wireless Telegraphy Act 2006).

3.75 There is also an Order, the Criminal Jurisdiction (Offshore Activities) Order 1987, which applies criminal law to the offshore installations, including the criminal law prohibition which applies to a person making radio transmissions which are not authorised by a Wireless Telegraphy Act licence (see https://www.legislation.gov.uk/uksi/1987/2198/made).

3.76 Section 49 and paragraph 1(2) of Part 1 of Schedule 3 of the Petroleum Act 1998 explains that these Orders take effect as if made under s. 11 of the Petroleum Act 1998.

3.77 There is similar legislation (civil and criminal jurisdiction) for offshore renewable installations (see https://www.legislation.gov.uk/uksi/2009/1739/contents/made and gttps://www.legislation.gov.uk/uksi/2009/1743/contents/made).

3.78 We appreciate the comments submitted to us, and we will now make slight drafting amendments to the proposed licence condition to more accurately deal with these points. We will ensure the wording of the licence authorises wireless telegraphy equipment on offshore energy installations which are inside UK territorial sea and also those which are outside the UK territorial sea (and the territorial seas of the Channel Islands and Isle of Man) but within the UK Continental Shelf (as set out in The Civil Jurisdiction (Offshore Activities) Order 1987).

3.79 In relation to vessels and aircraft, we note the comments made in particular about foreign registered vessels. We note that radio equipment on foreign vessels and aircraft which are *"for the time being within the limits of the British Islands and the territorial waters adjacent thereto"* are already exempt from wireless telegraphy licensing (see https://www.legislation.gov.uk/uksi/1998/2970/made).

3.80 We also note, as per our footnote, that UK registered (including Channel Islands registered and Isle of Man registered) ships and aircraft which are overseas are nevertheless also licensed under the individual ship or aircraft licence.

3.81 While the vessels and aircraft may have their own authorisation which would authorise their personnel's use of the ESIM on board, we wish to also authorise the network operator which has operational control over all of the ESIM radio equipment as part of its network operation.

3.82 We acknowledge that there will then, in certain situations and places, be more than one licence or licence exemption (for visiting ships and aircraft) which authorises the same piece of ESIM equipment. But these licences/exemptions are authorising different persons.

3.83 We consider that authorising the network operator is justified, in addition to the ship or aircraft itself, because that operator has a significant degree of control over the radio transmissions to and from the ESIM equipment. Licence conditions on network operators about coordination with other operators are necessary and justified in this case because of the risk of interference between services, which are inherent in the nature of NGSO system operation.

3.84 In summary, the updated Earth Station Network licence will now define the geographical extent of the licence as:

- On land (within the UK, the Channel Islands or the Isle of Man);
- On offshore energy installations which are within the UK territorial sea and also those which are outside the UK territorial seas (and the territorial seas of the Channel Islands and Isle of Man) but within the UK Continental Shelf (as set out in The Civil Jurisdiction (Offshore Activities) Order 1987); and
- On any vessel or aircraft (which is within or above the territory of the UK, the Channel Islands or the Isle of Man or within or above the territorial seas of the UK, the Channel Islands or the Isle of Man).

3.85 We will retain the footnote regarding ships but with additional wording to say "Radio equipment on foreign vessels and aircraft which are for the time being within the limits of these places (the UK, the Channel Islands or the Isle of Man) and their territorial seas may be exempt for wireless telegraphy licensing see *https://www.legislation.gov.uk/uksi/1998/2970/made*".

Applications for new NGSO systems

3.86 Recognising the new conditions in the Earth Station Network licence, we proposed to update the application form for the licence to include a new question:

> *"Please provide evidence that your service can protect other services operating in co-frequency or adjacent bands".*

Consultation responses

3.87 Amazon Kuiper sought clarification on what information Ofcom required from an applicant as evidence that it could protect other services in co- or adjacent bands. It said this should be addressed in the NGSO licensing guidance.

3.88 Rivada also commented on this and said evidence should be limited to demonstrating how an operator *intended* to handle coexistence. It was not possible to provide hard evidence at the application stage.

Ofcom assessment

3.89 It is not our intention to increase the regulatory burden for applicants. Our licensing process is light touch, but already requires applicants to provide a high-level explanation of the methodologies they will use to address coexistence with other NGSO services. We plan to take a similar approach here regarding coexistence with other co-frequency and adjacent band services.

3.90 We note the comments about the guidance note for applicants. We have updated the guidance in parallel with our changes to the Earth Station Network licence and made changes to the application form. The provision of technical information beyond a high-level indication of how an applicant will comply with coexistence requirements is welcome, but is not compulsory. If we consider the information provided in an application is insufficient, we will request further details.

NGSO to NGSO interference

3.91 Mangata said applicants for an NGSO Earth Station Network Licence needed to demonstrate coexistence between their own system and other NGSO systems, including both existing licensees and future systems. This assessment is based on the systems in operation or planned, as set out in ITU filings.

3.92 However, changing the parameters, or the number of satellites, affects the coexistence with other NGSO systems. It may therefore be necessary for the NGSO system to be defined clearly in Schedule 2 of the licence, not only identifying by the name of the satellites, but also the related satellite filing.

Ofcom assessment

3.93 We addressed this point in the 2021 consultation and statement on Updates to NGSO Licensing, which stressed the on-going nature of the requirements. “Licensed NGSO operators have an ongoing requirement to cooperate with others to ensure their services can coexist. Major modifications to a system might significantly change the interference environment for other operators. In such situations, operators will need to cooperate with other licensees ahead of the change in order to avoid causing harmful interference and impacting the services provided by other licensees. (para 3.42)

3.94 The same document set out our decision on the information we expect an applicant to provide in order to reassure that the quality of existing UK services will not be adversely affected by the new service. We said it was preferable for an agreement to already be in place with relevant licensees or, failing that, a detailed explanation of how coexistence would be possible.

3.95 The administration of NGSO systems is international in nature and is governed through the ITU filings system. As set out in the Space Spectrum Strategy, our role is not to prescribe how NGSO systems should share with each other, but to encourage regular communication between operators and to create the conditions for operators to reach cooperation agreements, ensuring both parties can provide reliable services in the UK.

3.96 Cooperation between operators is key to ensuring an efficient balance between the level of interference protection given to one system and the flexibility for others to transmit. However, we will act as a back stop, if necessary, should harmful interference arise, and work to resolve this through national and/or international activities as appropriate.

Access to the full 28 GHz band

3.97 Four respondents (Amazon Kuiper, [✂REDACTED] OneWeb and SES) raised an issue out of the scope of our current consultation – wider access to the 28 GHz band. They pointed out that the current licensing of frequencies to mobile operators means the band is fragmented and urged Ofcom to pursue a defragmentation approach following Arqiva's return of unused frequencies at some locations. More generally, they sought FSS access to the entire Ka band.

Ofcom assessment

3.98 As acknowledged, this matter is not within the scope of this consultation process. However, we note that our approach to 28 GHz spectrum is broadly in line with that used across Europe. We are also reviewing the use of the 28 GHz spectrum returned by Arqiva, and we have already proposed to extend the satellite gateway authorisation in this band.

Drafting of the licence

3.99 Mangata had some comments on the drafting of the proposed licence template. Firstly, it said the template should clearly identify the GSO or NGSO satellite network/system to which the earth stations are expected to operate and the frequency bands. This would allow the rest of the licence document to be read in proper context (for example "Clause 3 Limitations on use" should stipulate conditions that apply separately to GSO and NGSO systems, as well as collectively).

3.100 Second, it said the frequency bands listed in the Schedules should clearly state those applying to GSO networks and NGSO systems (or both). In its view the current representation was ambiguous.

3.101 It said it could not locate Schedule 1, Sections 2 i) and j) as referenced in Section A5 of the consultation document.

Ofcom assessment

3.102 We agree with Mangata on some of the points it raised on our drafting of the Earth Station Network licence template. We agree that the frequency bands listed in the table in Schedule 2 of the licence are ambiguous and not entirely consistent with the list of available frequency bands set out in Schedule 1, Section 3, "Limitations on use". We have therefore removed the list of frequency bands shown in the table in Schedule 2 of the licence.

3.103 As identified by Mangata, our proposed licence template did not contain Sections 2 i) and j) which are referenced in Schedule 3 of the licence. This was an error resulting from adding a new Section 2 to the licence. We have updated the text in Schedule 3 to refer to Sections 3 i) and j).

3.104 Regarding the identity of the GSO or NGSO satellite network to which the earth stations are authorised to operate, this is specified in the table in Schedule 2 of the licence, under "Satellite / Satellite Network Name".

4. Next Steps

4.1 Having considered the responses to our consultation and addressed the issues as described in section 3, we will now update the Earth Station Network licence in line with our decisions.

4.2 In summary, we will include clauses for:

- Authorisation of NGSO maritime earth stations, to clarify that these services are permitted in the territorial seas of the UK, Isle of Man and Channel Islands;
- New licence conditions to support the protection of GSO satellite services, radio astronomy and fixed links from harmful interference caused by NGSO systems;
- The addition of a definition of the geographical boundaries of the licence.

4.3 The new/updated licence is attached at Annex 2, with changes to the existing licence clearly highlighted. We will proceed as follows:

- The new licence will be issued to all future applicants who are granted an Earth Station Network licence.
- The updated terms will be issued to all existing licence holders in the form of a variation to their current licences.

4.4 We are also adding a new question to our application form asking applicants to provide high-level evidence that their service can protect other services operating in co-frequency or adjacent bands. Our accompanying guidance for applicants will be updated accordingly.

Provision of information on satellite interference

4.5 The Wireless Telegraphy Act gives us power to request information on interference and other data from licensees on a case-by-case basis. However, considering the new complex sharing environment we are seeing for satellites, it is clear that the real time and automated reporting of interference data could play a vital role in speedy resolution of satellite interference cases, and also benefit our understanding of sharing environment conditions.

4.6 While we are not adding specific conditions to the licence at this stage, we welcome and encourage engagement with operators willing to provide access to this information.

4.7 This approach is in line with our decision to progress with the development of a proof-of-concept interference reporting API (application programming interface) to allow spectrum users to log interference events automatically - in real time - as set out in our Spectrum Roadmap published in November 2022.

4.8 We will consider the options for obtaining the information on real time interference data from satellite operators in the future, including potential further amendment of Earth Station Network licence conditions.

Investigations and compliance

4.9 We are planning further development of our ability to investigate and verify complaints of harmful interference to GSO stations.

4.10 For any suspected cases of interference arising from a single NGSO satellite, we will seek evidence of measurements conducted at the 'victim' earth stations (i.e. at the user or operator's site). For the investigation of any suspected cases of aggregate interference, we will use our satellite monitoring facility at Baldock in Hertfordshire.

4.11 We have also initiated work to promote a globally harmonised approach on the handling of NGSO to GSO and NGSO to NGSO interference through our engagement with the ISRMM (International Space Radio Monitoring Meeting) and relevant ITU groups.

4.12 We note that in cases of potentially harmful interference from NGSO Earth stations to GSO satellite receivers, measurements cannot be taken on the ground. We will therefore make use of evidence provided by the 'victim' satellite operator.

A1 Legal context

A1.1 Ofcom's statutory powers and duties in relation to spectrum management are set out primarily in the Communications Act 2003 (the "**2003 Act**") and the Wireless Telegraphy Act ("**WT Act**").

Communications Act 2003

A1.2 Our principal duties under the 2003 Act are to further the interests of citizens and consumers in respect to communications matter, where appropriate by promoting competition. In doing so, we are also required (among other things) to secure the optimal use of spectrum and the availability throughout the United Kingdom of a wide range of electronic communications services.

A1.3 Our spectrum management duties require us to have regard to:

i) the desirability of promoting competition in relevant markets;
ii) the desirability of encouraging investment and innovation in relevant markets;
iii) the different needs and interests, so far as the use of the electro-magnetic spectrum for wireless telegraphy is concerned, of all persons who may wish to make use of it; and
iv) the different interests of persons in the different parts of the United Kingdom, of the different ethnic communities within the United Kingdom and of persons living in rural and in urban areas.

Wireless Telegraphy Act

A1.4 We permit the use of the radio spectrum by granting wireless telegraphy licences under the WT Act. It is unlawful and an offence to install or use wireless telegraphy apparatus without holding a licence granted by Ofcom, unless the use of such equipment is exempted.

A1.5 In carrying out our spectrum functions we have a duty under section 3 of the Act to have regard in particular to:

i) the extent to which the spectrum is available for use, or further use, for wireless telegraphy;
ii) the demand for use of that spectrum for wireless telegraphy; and
iii) the demand that is likely to arise in future for such use.

A1.6 We also have a duty to have regard to the desirability of promoting:

i) the efficient management and use of the spectrum for wireless telegraphy;
ii) the economic and other benefits that may arise from the use of wireless telegraphy;
iii) the development of innovative services; and
iv) competition in the provision of electronic communications services.

A1.7 Section 8(3B) of the WT Act says the terms, provisions and limitations specified in the licences must be:

- objectively justifiable in relation to the wireless telegraphy stations or wireless telegraphy apparatus to which they relate;
- not such as to discriminate unduly against particular persons or against a particular description of persons;
- proportionate to what they are intended to achieve; and
- transparent in relation to what they are intended to achieve.

Impact Assessment

A1.8 Impact assessments provide a valuable way of assessing different options for regulation. They form part of best practice policy making. In preparing this document, we have considered the citizen and consumer interests relating to authorising equipment.

A1.9 As set out in the Space Spectrum Strategy, it is our objective to encourage as many NGSO communications systems as possible because they provide new and innovative broadband services to a variety of users, including consumers in hard-to-reach areas; passengers on aircraft and ships; and the public sector.

A1.10 As part of our considerations regarding these changes to the Earth Station Network Licence we carried out an impact and equality assessment and consider the changes to be:

- objectively justified in that they are likely to meet our aim of ensuring an effective, efficient and even-handed licensing regime for satellite earth stations, for the benefit of consumers and businesses;
- not unduly discriminatory against particular persons or against a particular description of persons in that the in that the new provisions apply to all potential NGSO operators, and the benefits apply to all potential users of the services;
- proportionate to what they are intended to achieve, in that our updated licence conditions aim to ensure the continuing coexistence of different services and align with already defined international obligations; and
- transparent in relation to what they are intended to achieve, in that they are clearly described and explained in the May 2023 consultation and in this statement document.

A1.11 We have also considered the impact of making the changes to the Earth Station Network licence on other users of the radio spectrum and on the licence holders themselves.

Impact on Consumers

A1.12 We consider there are beneficial impacts for UK consumers and businesses arising from enabling NGSO services in the territorial seas of the UK and Crown Dependencies through a combination of the Earth Station Network licence and Ship Radio licence.

A1.13 We also consider that UK consumers and businesses will benefit from our being able to take more direct and swift action in the event of suspected interference to other services from a NGSO system, as detailed below.

Impact on other users

A1.14 We set out in the Space Spectrum Strategy that we would examine the risk that NGSO systems might affect existing GSO services and radio astronomy in downlink frequencies. These issues were also raised by stakeholders in our consultation on NGSO Licensing Updates. We have examined these and other services operating co-frequency and in adjacent bands. We have assessed that it would be beneficial to also introduce protections for fixed wireless links in order to protect back haul for mobile services.

A1.15 Our Earth Station Network licence already contains protections for these services in the uplink frequencies. Our introduction of additional protections for GSO services, radio astronomy and fixed links are designed to mitigate potential interference from NGSO services in the down link frequencies and to improve speed of enforcement in the event of disruption to these services. They should therefore have a beneficial impact on these services.

A1.16 Finally, our new approach to licensing NGSO maritime services, which no longer simply relies on individual Ship Radio licences, should ensure that all user terminals on ships are operated in a way that protects UK spectrum users while in UK territorial seas.

Impact on NGSO operators

A1.17 The new approach to authorising maritime services is similar to our approach to authorising GSO terminals. It will ensure that all NGSO satellite operators have similar licence obligations when providing connectivity in the territorial seas of the UK and the Crown Dependencies.

A1.18 We have already varied the licences of existing NGSO Earth Station Network licence holders in order to ensure that they are not held up in the deployment of their services. This is in line with our policy to encourage innovative new satellite services and seek to support competition through an equitable approach to authorisations and the efficient use of spectrum.

A1.19 In relation to the addition of specific licence conditions relating to NGSO downlinks, the measures we should already be followed by satellite operators in compliance with international regulations. Compliance with the additional protection measures should not place an additional burden on operators or have a negative impact on their operations.

A1.20 Overall, we assess that our changes should have a beneficial impact on NGSO operators.

Impact on other Earth Station Network licence holders

A1.21 We assess that there will be no negative impact from any of the changes to terminals operating to GSO services operating under the Earth Station Network licence as the conditions will not place additional obligations on them.

A1.22 At present, we are introducing new conditions relating to the downlink for NGSO systems only. This approach takes account of the fact that GSO services have been operating for decades without causing interference to radio astronomy and fixed wireless links in the UK, and that the nature of GSO services means there is a reduced likelihood of harmful interference arising.

A1.23 We have a duty to ensure our regulations are proportionate to the aim we are trying to achieve. This does not, of course, remove any obligation for GSO satellite operators to comply with the limits in ITU-R Recommendation RA.769 or in Article 21 of the ITU Radio Regulations where applicable.

A1.24 In addition, where GSO systems are being used for connectivity, Earth Station Network licences can be held by both GSO satellite operators and network operators (resellers using terminals operating to GSO networks) who do not control the GSO satellite.

A1.25 Finally, the conditions designed to protect GSO networks from potential interference from NGSO operators should give Earth Station Network licence holders operating terminals connecting to GSO networks greater certainty that their (existing) services will be protected in the frequencies where Article 22.2 of the ITU Radio Regulations applies. This will be a positive impact.

A2 Sample Earth Station Network Licence

A2.1 Our updated Earth Station Network licence is set out here, with the changes we have made to the wording of the current licence template marked in yellow.

Wireless Telegraphy Act 2006

Satellite (Earth Station Network)

Sector/class/product	**<Product>**
Licence number	**<Lic_No>**
Licensee	**<Lic_Name>**
Licensee address	**<Address>**
Licence first issue date	**<Issue_Date>**
Licence version date	**<Date>**
Payment interval	**<Year>**

1. This Licence is issued by the Office of Communications ("Ofcom") on **<Date>** and replaces any previous authority granted in respect of the service subject to this Licence by Ofcom or by the Secretary of State.

2. This Licence authorises <**Lic Name**> ("the Licensee") to establish, install and/or use radio transmitting and/or receiving stations and/or radio apparatus as described in the schedule(s) (hereinafter together called "the radio equipment") subject to the terms set out below and subject to the terms of the General Licence Conditions booklet (Version OfW597).

ISSUED BY OFCOM

Satellite (Earth Station Network) Licence SCHEDULE 1 TO LICENCE NUMBER <Lic_No> TERMS, PROVISIONS AND LIMITATIONS COVERED BY THIS LICENCE

This schedule forms part of Licence **<Lic_No>**, issued to **<Lic_Name>**, the Licensee on **<Issue_Date>**, and describes the terms and equipment specifications covered by this Licence.

1. The Licensee may establish and use:

1.1. Permanent, transportable or mobile sending and receiving network earth station(s) ("the station(s)") for the purpose of providing wireless telegraphy links between the station(s) and geostationary or non-geostationary satellite(s).

2. Geographical extent of the licence

2.1 This licence authorises earth stations:

a) on land (within the UK, Channel Islands or the Isle of Man);

b) on offshore energy installations which are within the UK territorial sea and also those which are outside UK territorial seas (and the territorial seas of the Channel Islands and Isle of Man) but within the UK Continental Shelf (as set out in The Civil Jurisdiction (Offshore Activities) Order 1987; and

c) on any vessel or aircraft (which is within or above the territory of the UK, the Channel Islands or the Isle of Man or within or above the territorial seas of the UK, the Channel Islands or the Isle of Man)[7].

3. Limitations on use

3.1. The station(s) operating with geostationary satellites shall:

a) transmit within one or more of the following frequency ranges: 14.0-14.5 GHz,

27.5-27.8185 GHz, 28.4545-28.8265 GHz, 29.4625-30 GHz;

b) for aeronautical stations, not transmit within the frequency range 14.47-14.5 GHz;

c) transmit only to the satellite and its associated orbital longitude specified in Schedule 2;

3.2. Land station(s) (including stations on vehicles and trains), station(s) on offshore installations and maritime station(s) operating with non-geostationary satellites shall:

d) transmit within one or more of the following frequency ranges: 14.0-14.5 GHz, 27.5-27.8185 GHz, 28.4545-28.8265 GHz, 29.5-30 GHz;

e) transmit only to the satellite network specified in Schedule 2;

3.3. Aeronautical station(s) operating with non-geostationary satellites shall:

f) transmit within the frequency range 14.0-14.47 GHz;

g) transmit only to the satellite network specified in Schedule 2;

3.4. Additionally:

h) station(s) that transmit with e.i.r.p. greater than 55 dBW shall operate only with prior consent from Ofcom and registration of the station(s) against the Licence;

i) station(s) that transmit within the frequency range 14.0-14.5 GHz inclusive shall not operate at any location that is less than or equal to 5 km from the two geographical locations specified in

[7] Stations on an aircraft or vessel which is registered in the United Kingdom, Channel Islands and Isle of Man and which is outside those territories and outside their territorial seas are not authorised under this licence but may be separately authorised under wireless telegraphy licences for that individual vessel or aircraft. **Radio equipment on foreign vessels and aircraft which are for the time being within the limits of these places [the UK, the Channel Islands or the Isle of Man] and their territorial seas may be exempt for wireless telegraphy licensing see https://www.legislation.gov.uk/uksi/1998/2970/made**

Schedule 3 without prior consent from Ofcom and registration of the station(s) against the Licence;

j) station(s) that transmit with e.i.r.p. greater than 50 dBW and less than 55 dBW (50 dBW < e.i.r.p. < 55 dBW) in the frequency range 14.0-14.5 GHz inclusive shall not operate at any location that is greater than 5 km and less than or equal to 7 km from the two geographical locations specified in Schedule 3 without prior consent from Ofcom and registration of the station(s) against the Licence; and

k) station(s) shall not operate within the perimeter fence of any of the aerodromes specified in Schedule 4 without prior consent from the Civil Aviation Authority or stated Airport Authority.

3.5 Protection of radio astronomy and fixed links in the 14.25-14.5 GHz band

l) To protect radio astronomy ~~operating between 14.47-14.5 GHz~~, a land or maritime station shall not transmit ~~from a location~~ in the frequency range 14.47-14.5 GHz when located within a 175 km radius of either of the national grid references below[8]:

- Jodrell Bank – focus point of circle is NGR SJ5739392556;
- Cambridge – focus point of circle is NGR TL5439992385.

m) Licensees shall protect fixed links at 14.25-14.5 GHz in accordance with any Notice issued by Ofcom.

3.6 Protection of radio astronomy stations operating in the 10.6-10.7 GHz band

n) For protection of the following six UK radio astronomy stations:

- Jodrell Bank - NGR (Easting) 379817, (Northing) 370806
- Cambridge - NGR (Easting) 539423, (Northing) 254028
- Darnhall - NGR (Easting) 364278, (Northing) 362263
- Defford - NGR (Easting) 390201, (Northing) 244700
- Knockin - NGR (Easting) 332854, (Northing) 321877
- Pickmere - NGR (Easting) 370407, (Northing) 376953

o) Licensees shall manage interference by limiting unwanted emissions[9]. For non-geostationary orbit systems this includes the suppression of satellite transmissions in the channel immediately adjacent to 10.7 GHz or taking other measures.[10]

[8] Due to UK terrain, the interference areas are not symmetrical around each of the radio astronomy sites. By offsetting the centre of the interference area (away from the site) we can more closely match the interference area which has the overall result of reducing the size of the protection area.

[9] As stated in ITU-R Recommendation RA.1513, interference from any one network should not cause more than 2% data loss to radio astronomy measurements. Data loss occurs when the thresholds given in ITU-R Recommendation ITU-R RA.769 are exceeded.

[10] See ECC report 271

3.7 Protection of geostationary satellites and earth stations communicating with geostationary satellites

p) Non-geostationary satellites and earth stations communicating with non-geostationary satellite(s) shall ensure compliance with the relevant equivalent power flux-density limitations specified in Article 22 of the ITU Radio Regulations in both the Earth-to-space and space-to-Earth directions.

3.8 Protection of fixed links in the 17.7-19.7 GHz band

q) For non-geostationary systems, licensees shall ensure compliance with the relevant power flux-density limitations in Article 21 of the Radio Regulations in the space-to-Earth direction.

r) In any case, NGSO satellites operating in the space-to-Earth direction shall not cause undue (or harmful) interference to fixed links, and compliance with the relevant power flux-density limitations referred to in 3.8.q does not release licensees from this obligation.

4. Apparatus

4.1. The Licensee shall ensure that:

a) The wireless telegraphy apparatus comprised in the station(s) ("the apparatus") is so designed, constructed, maintained and operated, that its use does not cause any undue interference to other users of the spectrum;

b) The apparatus complies with (and is maintained in accordance with) the relevant performance specification(s) published by the operator(s) of the geostationary or non-geostationary satellite(s);

c) ~~The earth stations operating with non-geostationary satellite(s) shall ensure compliance with the equivalent power flux-density limitations specified in Article 22 of the ITU Radio Regulations~~; and

d) The apparatus used for transmission complies with the Radio Equipment Directive and UK Interface Requirement 2077.

5. Additional conditions for mobile operation

a) The radio equipment shall be established or installed so that transmissions from the radio equipment may only be made when the radio equipment's operation is enabled by the crew of the vehicle, aircraft, vessel or train upon which it is mounted, and under the operational control of the network control facility. The radio equipment shall provide the crew with a means to terminate transmissions immediately;

b) Where an aircraft or vessel is registered in the United Kingdom, Channel Islands or the Isle of Man, the Licensee shall ensure that all radio equipment on board that aircraft or vessel is endorsed by either a separate licence or exemption under the Wireless Telegraphy Act 2006;

c) Transmissions from the radio equipment shall automatically be terminated on loss or significant degradation of the downlink signal from the relevant satellite;

d) For operation with geostationary satellites, the radio equipment shall employ a stabilised platform with the ability to maintain a pointing accuracy +/-0.2 degrees towards relevant satellites throughout transmission; and

e) For operation with geostationary satellites, the maximum EIRP at angles greater than or equal to 2.5 degrees from the antenna main beam axis shall not exceed 20 dBW/40 kHz from any individual station.

6. National and international obligations

a) The relevant satellite data shall have been submitted to ITU in accordance with established ITU procedures; and

b) All transmissions from the radio equipment must be terminated prior to any change of location; unless the apparatus used for transmission is designed for mobile operation and incorporates a stabilised platform or is operating under a specific exemption authorised by Ofcom.

7. Requirements specific to Satellite (Earth Station Network) Licences

a) The Licensee shall keep a record of the operational characteristics of all terminals in the network, including the locations of fixed installations or, for mobile operation, details of the vehicles, aircraft, vessels or trains on which the terminals are installed and the associated route or defined area of operation, which Ofcom may wish to have access to for enforcement purposes;

b) The radio equipment shall implement independent local control and monitoring functions at the terminal, and be authorised, supervised and administered by a network control and monitoring centre;

c) The Licensee shall have the facility to disable individual terminal transmission; and

d) For satellite networks in MESH configuration, the network operator must nominate and notify Ofcom of those earth station(s) located in the UK which have independent centralised control and monitoring functionality and possess the capability to suppress transmissions from any earth station within the network. Earth stations that are capable of dynamic assignment as point-to-multipoint and point-to-point configuration may only be licensed as permanent earth stations.

8. Additional conditions for operation with non-geostationary satellites

8.1. The radio frequencies authorised by this Licence must be used in common with other non-geostationary satellite systems authorised under wireless telegraphy licences granted by Ofcom. The names of these licensees shall be notified by Ofcom to the Licensee from time to time, and together with the Licensee are described as the “NGSO Licensees”.

8.2. The Licensee shall cooperate with all NGSO Licensees such that each satellite system (comprising the satellites, gateway earth stations and user terminals) can co-exist and operate within the United

Kingdom without causing harmful radio interference to each other, such that network services can be provided to end users.

8.3. In the event that -

a) one (or more than one) of the NGSO Licensees suffers a material and recurring (or ongoing) degradation of services to its users at a specific region or location in the United Kingdom; and

b) the degradation of services is resulting from radio transmissions from the earth stations, the satellite or any other part of the satellite system operated by any of the NGSO Licensees, including the Licensee;

Ofcom may by notice instruct the Licensee to cease or change the use of particular equipment or particular radio frequencies which are authorised under a wireless telegraphy licence (including but not limited to radio frequencies authorised under this Licence) and are used by any part of the satellite system.

8.4 Any such cessation or change must be for the purposes of ensuring that such interference is avoided and the degradation of services to users at the particular regions or locations is resolved.

8.5 Following receipt of such notice, for such period of time as may be specified in the notice, the Licensee may only operate in accordance with the terms and conditions of the notice.

9. Interpretation

9.1. In this and subsequent schedule(s):

a) “earth station” means a radio transmitter located on the surface of the earth or mounted on a vehicle, aircraft, vessel or train and intended for communication with one or more satellites;

b) “geostationary satellite” means a satellite in geostationary orbit which remains approximately in a fixed position relative to a position on the surface of the earth;

c) “non-geostationary satellite” means a satellite that does not remain fixed relative to a position on the surface of the earth; and

d) “IR” means the United Kingdom Radio Interface Requirement published by Ofcom in accordance with Article 8 of the Radio Equipment Directive (Directive 2014/53/EU of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available of radio equipment on the market (known as the Radio Equipment Directive)).

Notes

1. This Licence does not remove any other obligations that the Licensee may have in relation to satellite filings made under the ITU Radio Regulations.

2. This Licence does not affect the requirement, when necessary, to obtain licences or authorisations under other Acts, such as the Communications Act (2003).

3. Some terminal installations may require local authority planning approval.

4. The Licensee must apply for a variation of the Licence from Ofcom before making any changes which may contravene the conditions of the Licence.

5. Technical terms used in clause 2 shall have the meanings assigned to them in the ITU Radio Regulations.

6. For radio equipment installed on aircraft, licensees are advised that they must comply with Civil Aviation Authority (CAA) airworthiness requirements and regulations.

7. Further information, in respect of airworthiness requirements and certification requirements before installation, can be obtained by contacting the Civil Aviation Authority:

   Civil Aviation Authority
   Tel: 0330 022 1500
   http://www.caa.co.uk

SCHEDULE 2

Licence No	<Lic No>	**Licence version date**	<Date>	**Payment Interval**	<1 Year>

Earth Station Network Name	**Emergency Telephone Number (24 Hours)**
<Network_name>	<Emergency_telephone>

Network Type	**Satellite Type**	**Satellite / Satellite Network Name**	**Geostationary Orbital Longitude (degrees)**
<Network_type>	<Geostationary/NonGeostationary>	<Sat_name>	<Orbit_long>

~~**Frequency band**~~
~~14.0 – 14.5 GHz~~
~~27.5 – 27.8185 GHz~~
~~28.4545 – 28.8265 GHz~~
~~29.4625 – 30 GHz (GSO)~~
~~29.5 – 30 GHz (NGSO)~~

Operations are subject to the provision of Article 4.4 of the ITU Radio Regulations (non-interference basis to users of this spectrum) prior to international coordination.

SCHEDULE 3

Restrictions on equipment to be located within 7 km of the following National Grid References apply - see Schedule 1, Sections ~~2.~~3 i) and j) for further details.

SE 20900 56100
SS 20500 12600

SCHEDULE 4

Permission to operate equipment subject to this Licence from any location within the perimeter fence of the aerodromes listed below must be obtained from either the CAA or the Airport Authority.
CAA Contact: 0207 453 6531

[N.B. The CAA list of aerodromes is not reproduced here in this sample licence.]