
Space spectrum strategy

[Space spectrum strategy](#) – Welsh overview

STATEMENT:

Publication date: 10 November 2022

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The [annexes to this statement](#) have been published separately.

1. Overview

This document sets out Ofcom's refreshed strategy for managing radio spectrum used by the space sector.

The space sector delivers a wide and increasing range of benefits to people, businesses and public sector users in the UK. Satellite services include broadband, broadcast TV, global positioning, emergency communications, acquiring critical information about our climate, and gathering data to give us a greater understanding of the universe.

We've seen rapid changes in the sector over recent years, notably the launch and operation of large-scale constellations of non-geostationary orbit (NGSO) satellites providing broadband to homes and businesses, including in remote locations. Our updated space spectrum strategy takes account of this growth and other factors, such as the increased importance of data collected by Earth observation satellites for understanding climate change.

Our objectives and priorities

We want to make sufficient spectrum available to deliver even greater benefits in the future while ensuring spectrum is used efficiently. This includes finding the right balance between enabling new and innovative services while ensuring existing valuable services can continue.

To do this, we will focus our activities on three areas.

- **Communications** – We will have a strong focus on the opportunities and challenges raised by NGSO satellite systems. We have introduced a new NGSO licensing framework in the UK and will pursue improvements to international NGSO rules. We will consider providing access to more spectrum to enable the delivery of higher speed satellite broadband services to more businesses and people.
- **Earth observation and navigation** – In light of increased spectrum use by the space sector we will make sure there is appropriate protection from harmful interference for Earth observation satellites and the UK Earth stations that support them. We want them to continue benefitting sectors such as agriculture, emergency services, climate monitoring and weather forecasting while allowing other services to access spectrum.
- **Understanding and enabling access to space** – Given the rapidly rising numbers of satellites in orbit, we will play our role in supporting the bodies responsible for addressing issues such as space debris and safe access to space; for example, by considering spectrum access requirements for radars to track objects in space.

- 1.1 Our refreshed space spectrum strategy supports Ofcom's wider priorities to get everyone in the UK connected, enable wireless services in the wider economy and support investment in secure, strong networks. It also advances our spectrum management vision of innovative and efficient spectrum use.
- 1.2 Growth in the space sector has the potential to help promote innovation and growth in the UK economy as a whole. Achieving these benefits requires appropriate access to, and efficient use of, radio spectrum.

NGSO satellite communication systems will be a key focus of our work

- 1.3 The deployment of NGSO satellite communication systems is a key area of innovation in the space sector. It has driven rapid growth in the number of satellites in orbit around the Earth, with the number of active satellites in orbit trebling over the last 5 years, from 1,784 in 2017 to 5,465 in April 2022 (most of which are in non-geostationary orbits).¹ Operators have plans to deploy NGSO constellations with tens of thousands more satellites over the next few years.²
- 1.4 These constellations offer new and innovative satellite services to users, including consumers in hard-to-reach areas; passengers on aircraft and ships; and the public sector. We aim to enable as many NGSO systems as possible to provide services in the UK, in addition to continuing to enable geostationary orbit (GSO) satellite services. Our strategy seeks to enable this growth while recognising and mitigating potential challenges.
- 1.5 As NGSO operators deploy more satellites, pressure on the use of spectrum will increase and coordination to avoid interference between systems will become increasingly complex. In the future, this could have implications for competition. We have already introduced a new approach to NGSO authorisation in the UK to help us manage this complexity and we are investing in our monitoring capabilities. We are now helping to lead the development and reform of international rules governing the use of spectrum at a global level.
- 1.6 We will push for effective sharing of frequencies by different spectrum users wherever this is possible. We will also boost our ability to deal with coexistence between NGSO satellite systems and other UK spectrum users by developing our monitoring capabilities and taking enforcement action, when necessary.
- 1.7 Our strategy has been developed to complement the Government's National Space Strategy which also aims to drive growth and innovation in the UK space economy.

¹ <https://www.statista.com/statistics/897719/number-of-active-satellites-by-year/> and <https://www.ucsusa.org/resources/satellite-database>

² <https://www.cnbc.com/2021/11/05/space-companies-ask-fcc-to-approve-38000-broadband-satellites.html>

Next steps

- 1.8 This document sets out our plans for how we will move forward with implementing our strategy, both in relation to UK regulation and in helping to shape international rules and agreements.
- 1.9 In the UK we will consult on proposals for authorisation of Earth station gateways in the Q and V spectrum bands (and possibly the E band); proposals to give us added enforcement options to support protection of GSO satellite services and radio astronomy; and proposals to support improved NGSO maritime services.
- 1.10 Internationally, we will focus particularly on preparations for the next World Radiocommunication Conference (WRC-23), including the rules for NGSO satellite filings.
- 1.11 As the space industry is developing rapidly, it is likely there will be developments we cannot anticipate at this stage. We will therefore keep this strategy under review and may adjust our plans to take account of new information. We will update stakeholders on any significant changes to our strategy.

2. Introduction and background

- 2.1 This document sets out our updated strategy for managing radio spectrum used by the space sector.
- 2.2 The space sector is one of the biggest users of radio spectrum and delivers a wide range of benefits to people, businesses and the public sector in the UK. These benefits include the delivery of satellite broadband, broadcast TV, global positioning services, and emergency communications. Satellites are also increasingly important for Earth observation and the collection of data used to monitor weather and climate change.
- 2.3 Spectrum is a valuable and limited resource crucial for delivering wireless services for a range of other sectors as well as the space sector. Ofcom has the job of ensuring it is used in the best interests of all in the UK. We want to enable existing services to grow and innovate while allowing new services to emerge. To do this, we need to ensure spectrum is allocated efficiently.

Our proposals for an updated space spectrum strategy

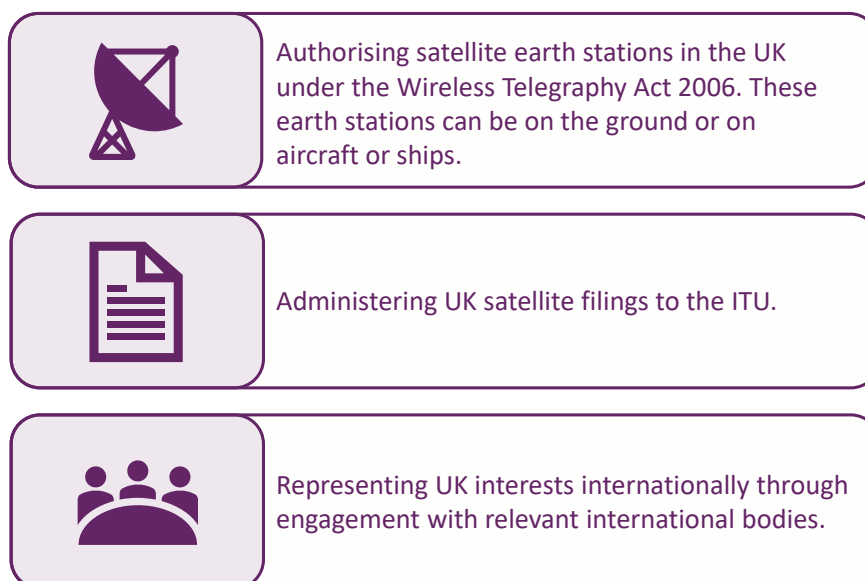
- 2.4 In January 2017 we published our [2017 space spectrum strategy](#). This focussed on enabling growth in satellite broadband and Earth observation and set out a workplan which we have now largely delivered. This earlier strategy continues to provide a strong foundation for our overall approach to spectrum access for the space sector.
- 2.5 However, in view of the significant changes and expansion in the space sector since 2017, we published a [consultation](#) on our proposals for a refreshed strategy on 15 March 2022. In general terms:
 - we noted that the cost of building and deploying satellites is now significantly cheaper than in the past, and that new satellites are much smaller and can be built much more quickly;
 - we noted that the capacity of **geostationary orbit (GSO)** satellites has increased alongside technological developments, allowing new uses and greater flexibility;
 - we said falling costs and faster production have also supported the mass deployment of **non-geostationary orbit (NGSO)** satellites, often based on large constellations in low Earth orbit;
 - we said NGSO systems in particular present both new opportunities and new challenges for space spectrum management, including around space launch, in-orbit servicing and tracking of space debris;
 - we emphasised the need to ensure satellites could continue to contribute to improved communications services in the UK and globally, while also meeting the important needs of weather forecasting and the monitoring of climate change;
 - we said the trends listed above had led to a general increase in space activity including the development of new launch platforms; in-orbit services to remove broken satellites from orbit and address the problem of space debris; renewed interest in manned space exploration; and investment in space weather monitoring capabilities.

- 2.6 We received consultation responses from 38 respondents. Three of those respondents submitted confidential responses, with a further four respondents submitting responses which included some confidential material. One respondent submitted both a confidential and a non-confidential response. All [non-confidential responses](#) are published on our website. The issues raised in the responses are discussed in the annex to this document.
- 2.7 In developing the space spectrum strategy set out in this document we have considered all responses to the March 2022 consultation. Although covering a wide range of issues, the responses were all in one way or another related to the core of our strategy, that is, finding the right balance between enabling the new and innovative space services emerging while ensuring existing valuable services can continue to operate and grow.
- 2.8 This renewed space spectrum strategy sets out our objectives and priorities for space spectrum management and describes our plans for implementation of key actions over the next two to four years. In doing so, the strategy reflects Ofcom's broader [Spectrum Management Strategy](#), published in July 2021.

Ofcom's duties and functions

- 2.9 Ofcom's principal statutory duty is to further the interests of citizens in relation to communications matters, and consumers in relevant markets, where appropriate by promoting competition. In meeting this duty, we also have a number of specific duties, including to secure the optimal use of spectrum; ensure the availability throughout the UK of a wide range of electronic communication services; and to take account of the different needs and interests of all current or potential users of the spectrum frequencies.
- 2.10 We have three specific spectrum functions regarding the space sector as highlighted in Figure 1.

Figure 1: Ofcom's space functions



Authorising earth stations

- 2.11 We authorise use of the radio spectrum in the UK by granting wireless telegraphy licences under the Wireless Telegraphy Act 2006 (WT Act).³ We also make regulations exempting users of particular equipment from the requirement to hold such a licence.⁴
- 2.12 Ofcom licences cover the use of equipment to transmit signals. We also grant Recognised Spectrum Access ('RSA') to receive-only Earth stations (ROES) to protect their use in specific spectrum bands.

Satellite filings

- 2.13 Satellites can transmit across national borders over multiple individual states, so their use of spectrum needs to be managed globally. This management process, involving the processing of 'satellite filings', is administered and overseen by the International Telecommunication Union (ITU), a specialised agency of the United Nations.⁵ A satellite filing enables a satellite operator to gain internationally recognised spectrum and orbital resources prior to the deployment of a planned satellite system.
- 2.14 As the notifying body for the UK, Ofcom submits and manages all satellite filings to the ITU on behalf of organisations registered in the UK. Our processes are set out in our [Procedures for management of satellite filings](#). In order to keep our procedures up to date, we expect to consult on updates to them after WRC-23.

International engagement and representation

- 2.15 International spectrum rules are negotiated at the ITU and published in the Radio Regulations.⁶ Changes to the rules are made every four years at the World Radiocommunication Conference (WRC) held by the ITU. Ofcom exercises "international negotiation functions" representing UK interests⁷ at the ITU⁸, including by leading the UK delegation at WRC meetings. The next WRC is scheduled to take place in late 2023. Ofcom also represents UK interests at the European Conference of Postal and Telecommunications Administrations (CEPT).
- 2.16 We engage with our stakeholders (who come predominantly from government, industry and academic fields) to enable us to represent UK interests in these forums.

³ Examples of the licences we grant space operators include Permanent Earth Stations, NGSO Earth Stations, Transportable Earth Stations, Earth Station Network Licences and GNSS repeaters. See: [Apply for a satellite earth station licence - Ofcom](#).

⁴ A list of frequencies that can operate without a licence can be found in our Interface Requirement 2016: [ir2016.pdf \(ofcom.org.uk\)](#).

⁵ The rules governing the use of the electromagnetic spectrum by satellites are included in the 'Radio Regulations', an international treaty to which the UK is a signatory.

⁶ [Radio Regulations \(itu.int\)](#)

⁷ See Annex A to Memorandum of Understanding at: [mou_2004_international_rep.pdf \(ofcom.org.uk\)](#).

⁸ We also represent the Channel Islands, the Isle of Man and the British Overseas Territories at the ITU, see: [mou_ots_2007.pdf \(ofcom.org.uk\)](#).

Other on-going activities

- 2.17 In addition to the three functions noted above, we also carry out a number of on-going spectrum management activities to support the space sector, including:
- **Horizon scanning to help us respond to space sector developments:** we monitor developments in the space sector to help us track emerging trends and understand the potential impact of new technologies;
 - **Monitoring and taking enforcement action where needed:** we may monitor spectrum use, check compliance with authorisation terms, investigate and, when appropriate, take enforcement action if harmful interference occurs to other services. If a UK-filed satellite network causes harmful interference to other satellite networks, we can instruct satellite operators to cease transmission.

Our role alongside other UK public bodies

- 2.18 Ofcom collaborates with other regulators and the Government where our work and their work intersect on space related issues. We have had regard to the Government's [Statement of Strategic Priorities](#) for telecommunications, spectrum and postal services, published in July 2019.
- 2.19 The [National Space Strategy](#) outlines the Government's vision to "*build one of the most innovative and attractive space economies in the world*" and sets out an intention to work with Ofcom (among other organisations) to meet the needs of space users.
- 2.20 This refreshed space spectrum strategy aims to complement the Government's vision by supporting innovation and investment.
- 2.21 The Civil Aviation Authority is the UK regulator for spacecraft licensing and space launch licensing. We collaborate closely with the CAA in specific areas including:
- satellite filings/satellite licences;
 - Radio Frequency (RF) communications required for safe operation of satellites, e.g. frequencies for Telemetry, Tracking and Command (TT and C);
 - spectrum authorisations for space launch operations from the UK; and
 - international negotiations at the ITU pertaining to space launch and safe operations of satellites.
- 2.22 Ofcom also collaborates, as appropriate, with other Government departments and agencies including the Meteorological Office (Met Office), The UK Space Agency (UKSA), the Department for Business Energy Innovation and Science (BEIS), the Ministry of Defence (MOD), the Foreign Commonwealth and Development Office (FCDO), the Department for International Trade (DIT) and the Department for Digital, Culture, Media and Sport (DCMS).

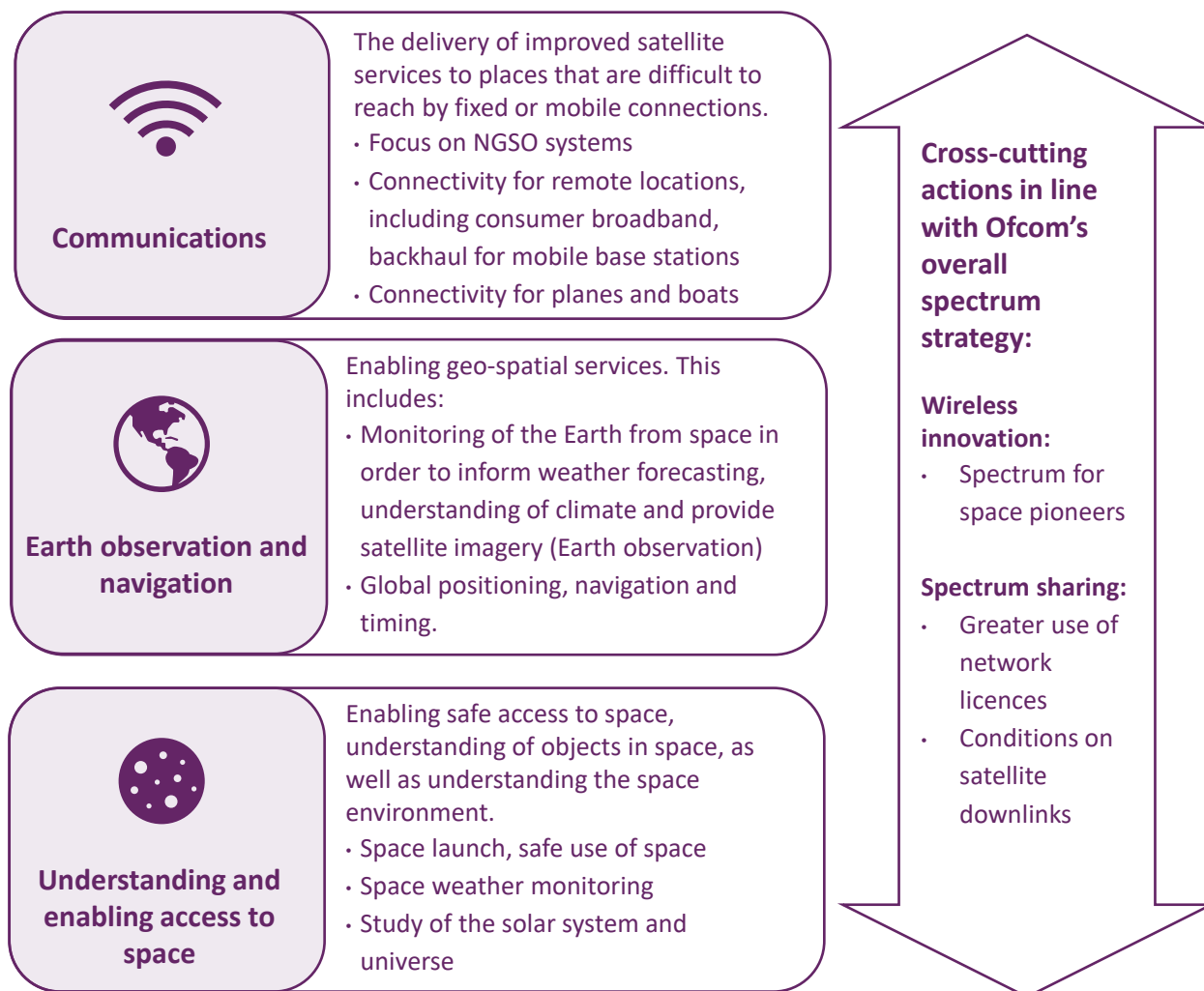
3. Overview of our space spectrum strategy

- 3.1 Recent trends in the space sector mean there will be growing and changing spectrum access needs over the next few years. We plan to broaden the scope of our activities to respond to these needs.
- 3.2 We have identified three key objectives for our space spectrum strategy:
- 1) **Providing access to spectrum to enable growth in the benefits that the space sector delivers** for people, businesses and the public sector in the UK.
 - 2) **Ensuring that spectrum is used efficiently by the space sector and does not create undue constraints on the growth of other spectrum users.** We place particular emphasis on promoting spectrum sharing – however, we will ensure there are appropriate assurances for continued use of spectrum (provided systems are appropriately resilient), both to support existing benefits from space services and to provide conditions for future investment. Our approach to sharing will apply the principles from our overall spectrum management strategy - which are relevant to all spectrum users - to the space sector:
 - Using better data and more sophisticated analysis when assessing the conditions for sharing among space spectrum users and with terrestrial users. We will - where possible - use information on the real performance of satellite equipment and services (rather than limits in standards or specifications).
 - Expecting space systems to be more resilient to interference from their neighbours: space users will need to ensure they are using equipment that offers appropriate resilience to interference and does not itself cause interference to other users. We do not generally expect to act on interference if it is caused by poor performance of receivers or wider systems.
 - Achieving an efficient balance between the level of interference protection given to one service and flexibility for others to transmit. We expect stakeholders to present evidence to support the level of protection they may be seeking.
 - 3) **Enabling as many NGSO satellite systems as possible to provide services in the UK** while promoting their efficient use and sharing of spectrum (in line with objective 2 above).

We will prioritise our work on three parts of the space sector

- 3.3 We aim to achieve our objectives for the entire space sector, but we are prioritising those parts of the sector where our actions can have the greatest benefit. We have identified three high-level priorities, as set out in the illustration below. These priority areas are undergoing the greatest level of change and development or are becoming increasingly important in the world or require the greatest level of regulatory intervention.

Figure 2: Priorities for our space spectrum strategy

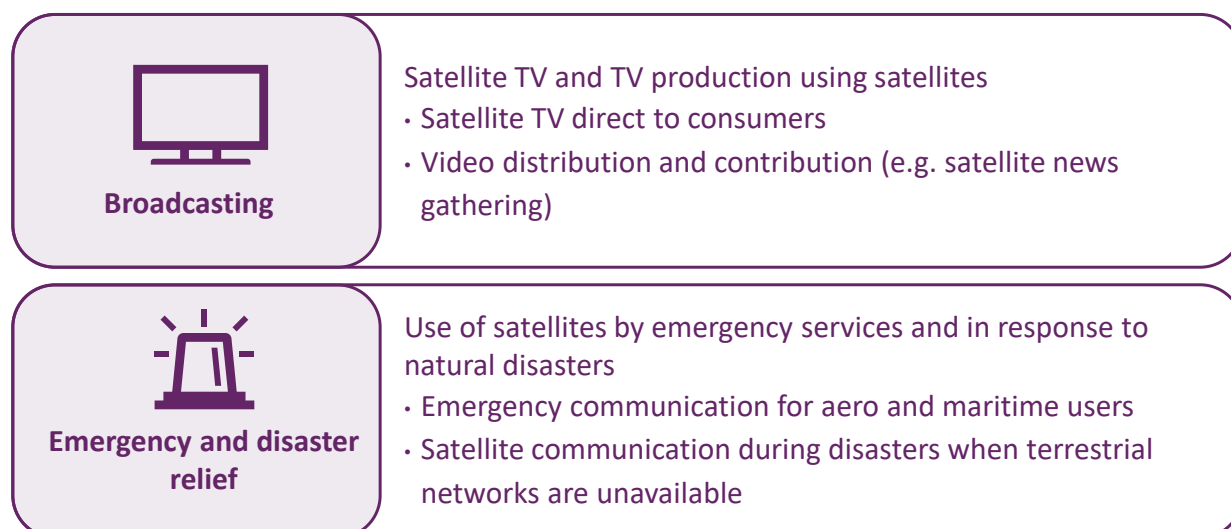


3.4 Our future work areas map to these priorities and will have a particular focus on NGSO satellite communication systems, given the major implications these systems have for the space sector and its use of spectrum. Although NGSOs present enormous new opportunities, they also present a range of challenges, including potential competition concerns and interference issues.

3.5 In addition, we will embed some cross-cutting actions, in line with our overall spectrum management strategy, specifically to support greater innovation across the space sector and improved spectrum sharing by space users.

3.6 We have identified a further two space spectrum management areas that require less significant regulatory attention at this time: broadcasting, and emergency and disaster relief. We have not identified additional spectrum management needs beyond our current arrangements for these areas. These areas remain important in our overall space spectrum strategy, and we will continue to support them fully via our ongoing activities.

Figure 3: Other important areas for space spectrum management



Our work areas and activities

- 3.7 The work areas and activities on which we will concentrate under our revised space spectrum strategy are driven by the objectives and priorities noted above. We have split the communications category into separate General and NGSO areas and have identified the need for a cross cutting area of work to embed our spectrum strategy.
- 3.8 For each work area we have identified one or more activities that support our overarching objectives. These activities fall into one of two categories:
- **Spectrum access:** Considering new/improved spectrum access for the space sector. Activities in this category aim to enable growth in the benefits that the space sector delivers for UK people and businesses; and
 - **Efficient use, sharing and assurance:** Promoting greater spectrum sharing by/within the space sector and assuring continued spectrum access for the space sector. Activities in this category aim for spectrum to be used efficiently by space users and not create undue constraints on the growth of other users (i.e. other space users and non-space spectrum users).
- 3.9 Not all these activities will necessarily lead to outputs (e.g. if they are monitoring developments or conditional on evidence of demand).
- 3.10 Section 6 of this document deals with how we plan to implement our strategy, including the outputs that we envisage in the shorter term. In some cases, the plan in section 6 groups activities together in a different way than the below summary, as it takes account of where grouping of activities can enable us to deliver them more efficiently.

Figure 4: Summary of work areas

	Spectrum access	Efficient use, sharing and assurance
Communications (general)	Access to 14.25-14.50 GHz for satellite terminals	Update international protection criteria for FSS
	Gateway Earth stations access to Q / V bands	
	Gateway Earth stations access to E band	
	Additional capacity for ESIMs (including those on aircraft and ships)	
	Access to guard bands in 28 GHz	
	Communications directly to/from mobile handsets and other terrestrial devices	
NGSO Communications	National authorisations for maritime and aeronautical use of NGSO satellite systems	NGSO-NGSO sharing: <ul style="list-style-type: none"> Improving the international framework for NGSO systems Developing our capabilities for handling NGSO-NGSO interference
	International work on extending spectrum access for 'Earth Stations in Motion'	NGSO-GSO sharing: <ul style="list-style-type: none"> Potential licence conditions to support enforcement of GSO protection requirements in cases of harmful interference to GSO Earth stations. Developing our capabilities for handling NGSO to GSO interference Improving international regulations on NGSO-GSO sharing
		NGSO-Radio Astronomy sharing: <ul style="list-style-type: none"> Potential licence conditions to support enforcement of NGSO downlinks sharing with Radio Astronomy Developing capabilities for handling NGSO interference to Radio Astronomy
		MSS NGSO communication systems: <ul style="list-style-type: none"> Move authorisation to a light licence basis Support reform of the CEPT framework for MSS systems < 1 GHz
		Spectrum pricing

	Spectrum access	Efficient use, sharing and assurance
Earth observation and navigation	Access to spectrum at downlink sites for Earth observation data	Ongoing protection of spectrum used for measurements
	Inter-satellite links	ITU Recommendation dealing with EESS sensors
	Climate change monitoring and weather forecasting capabilities	Efficient use of S-band for TT&C
	Spectrum requirements to support resilient positioning, navigation and timing	Resilience of existing positioning, navigation and timing systems
Understanding and enabling access to space	International regulatory framework for space weather	Protection of spectrum for radio astronomy measurements
	Spectrum authorisations for UK space launch	
	Sub-orbital vehicles	
	Input to safe and sustainable use of space	
Cross-cutting activities to embed our spectrum management strategy	Supporting wireless innovation: spectrum for space pioneers	Promoting spectrum sharing: Greater use of network licences
		Promoting spectrum sharing: Conditions on satellite downlinks

4. Strategy for satellite communications – general and NGSO-specific

- 4.1 This section details our strategy for satellite communications – covering issues which are generic to GSO and NGSO satellite systems, as well as the issues specific to NGSO satellite systems. **Section 5** details our strategy for all other issues beyond satellite communications. **Section 6** sets out how we intend to deliver our space spectrum strategy.

Satellite communications (general considerations for GSO & NGSO)

- 4.2 A key aim for our spectrum work relating to satellite communications is to enable the delivery of improved communication services to places that are difficult to reach by terrestrial fixed or mobile connections - particularly to enable better broadband options for residential consumers and businesses in those locations. We also aim to enable better broadband connectivity (e.g. Wi-Fi) for passengers on aircraft and on ships. The activities we have identified to address these aims are set out below.

Spectrum access for communications (general)

Access to 14.25-14.50 GHz for satellite terminals

- 4.3 We have published a [statement](#) confirming that we will extend access into the 14.25–14.5 GHz band for uncoordinated GSO and NGSO satellite user terminals (authorised under Earth Station Network licences). This doubles the existing spectrum available in the band, supporting improvements to broadband services for UK homes and businesses, and on aircraft, ships and other land-based vehicles.

Gateway Earth stations access to Q/V bands

- 4.4 To support new higher capacity satellite systems, we will consult on proposals to license gateway Earth stations (operating with both GSO and NGSO satellites) in key Q/V band frequencies 37.5- 40.5, 47.2-50.2, and 50.4-52.4 GHz.
- 4.5 Access to the 40.5-43.5 GHz band at present would be via a commercial arrangement with the existing Spectrum Access licensees.⁹ However, we have separately [consulted](#) on a number of different options for making 40.5-43.5 GHz available for new uses, including varying the existing Spectrum Access licences, or revoking some or all of the licences to make this spectrum available in 'high density areas' of the UK via auction.¹⁰ We will take the outcome of the consultation into account in developing any further licence proposals.

⁹ The current licensees in the 40 GHz band are: H3G 41.00-42.00 GHz and 42.50-43.50 GHz; MLL 40.75-41.00 GHz; and MBNL 40.50-40.75 GHz and 42.00-42.25 GHz

¹⁰ We expect that new uses of millimetre wave spectrum will be mostly concentrated in areas with high levels of data traffic, such as towns and cities (which we refer to as "high density areas").

Satellite stakeholders may therefore find it beneficial to focus on low density areas for future Q/V band gateways.

Gateway Earth stations access to E-band

- 4.6 We will consider options for the potential authorisation of E-band satellite gateways (80-86 GHz), alongside existing use of the band (i.e. fixed links). In principle this access could support future higher capacity satellite systems. However, compared to Q/V bands (above), there are fewer operators seeking access; the technology is less mature; and the international regulatory framework needs further development at these frequencies. Therefore, at present access is likely to be more uncertain and complex than access to Q/V bands.

Additional capacity for 'Earth Stations in Motion' (ESIMs)

- 4.7 We will consider whether updates to ship, aeronautical and network licences for ESIMs in Ka band would support higher capacity services on ships and aircraft. This includes extending our authorisations to a larger range of frequencies within 27.5-30 GHz – subject to coexistence alongside users of Spectrum Access licences.
- 4.8 Internationally, our engagement on the WRC-23 agenda item 1.15 studying ESIMs in 12.75-13.25 GHz will aim to ensure existing services are adequately protected.

Access to guard bands in 28 GHz

- 4.9 There are four 28 GHz guard bands located between 28 GHz and 29.5 GHz which are currently not authorised for satellite Earth station (or other) use. Access to these could provide a small increase in capacity for satellite systems operating across these bands. We will consider providing access to these guard bands, although this may be dependent on stakeholders securing commercial arrangements with 28 GHz licence holders in adjacent frequencies.

Communications directly to/from mobile handsets and other terrestrial devices

- 4.10 Satellite communications directly to/from mobile handsets and other terrestrial devices can enable services delivered by these devices to operate in very remote locations, for example supporting messaging in emergency situations or monitoring of remote infrastructure.
- 4.11 We are supportive of such innovations, although our preference is for satellite services to transmit in frequencies where international agreements are in place, to ensure new satellite services do not interfere with existing terrestrial services.
- 4.12 We will monitor developments in this area to understand the potential for spectrum sharing between satellite and mobile applications, and the potential benefit for UK users. We will consider whether any additional national or international regulatory measures are beneficial or necessary to enable their further development.

Efficient use, sharing, and assurance for communications (general)

Update international protection criteria for Fixed Satellite Services (FSS)

- 4.13 Our work within ITU Working Party 4A focusses on updating international recommendations on protection criteria for Fixed Satellite Services (FSS) and will consider implementing any changes. We will work towards protection criteria that ensure the continued provision of FSS without constraining unnecessarily the introduction of new services, for example fixed or mobile communication services, in the same bands.

NGSO satellite communications systems

- 4.14 We will focus on addressing the opportunities and challenges raised by NGSO satellite communications systems. The challenges include:
- **Interference challenges** – Growing deployment(s) of NGSO systems creates challenges to managing harmful interference among different NGSO systems, as well as with other spectrum users including GSO satellite systems, radio astronomy users and terrestrial spectrum users.
 - **Competition challenges.** We want to enable as many NGSO systems as possible, to provide services and increase choice for people and businesses in the UK. But if NGSO operators use their ITU regulatory status or early deployment as a means to create or raise barriers to entry to other operators, this might raise some competition concerns.
- 4.15 We will concentrate our efforts on issues related to the large-scale deployment of NGSO communication systems operating in low Earth orbit in bands allocated to FSS. These are usually above 3 GHz and typically offer wide bandwidths to deliver high-capacity services with low latency including broadband, enterprise services and mobile backhaul.

Spectrum access for NGSO communications

- 4.16 We do not believe there is a need to consider spectrum specifically for NGSO systems, but in the limited cases where spectrum access is currently available for GSO but not NGSO satellite systems, we will consider whether NGSO systems should be able to access the same spectrum in the same way as GSO systems.

National authorisations for maritime and aeronautical use of NGSO satellite systems

- 4.17 We will consider enabling the use of NGSO satellite terminals using Ku and Ka band on ships. In addition, WRC-23 is deliberating regulations for aero ESIMS in Ka band connecting to NGSO services. Pending the outcome of those deliberations, we may also consider enabling NGSO services using Ka band terminals on aircraft.
- 4.18 Taken together, these changes would allow all NGSO systems to access the same spectrum as GSO systems under a network licence, thereby giving more choice to aviation and maritime customers operating in UK airspace and UK waters.

- 4.19 We are not currently planning to extend NGSO authorisation to Transportable Earth Station licences as we have not yet seen evidence of demand for this.

International work on extending spectrum access for 'Earth Stations in Motion'

- 4.20 We remain supportive of work to extend access for NGSO ESIMs to bands where there is already access for GSO ESIMs – provided incumbent services (e.g. UK fixed links) remain adequately protected. We will seek to ensure appropriate measures are incorporated into the Radio Regulations to achieve this.

Efficient use, sharing and assurance for NGSO communications

- 4.21 We have identified several activities to support efficient sharing of spectrum and provide appropriate assurances over spectrum access.

NGSO systems sharing with other NGSO systems

- 4.22 Our role is not to prescribe how NGSO systems should share with each other, but to create the conditions for operators to reach agreements with each other that support efficient use of spectrum. 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.

Improving the international framework for NGSO systems

- 4.23 We will continue to support the principles of the current ITU framework for NGSO systems, including the need for later filed systems to seek agreement from earlier filed systems, and the obligation for operators to negotiate coordination in good faith.
- 4.24 Further, we will work within international bodies to promote improvements to the international framework for NGSO systems, particularly where these foster efficient sharing of spectrum between such systems and hence enable as many NGSO systems as possible. This includes reforms to make it easier for NGSO systems to complete coordination, and so facilitate further NGSO deployment; and to reduce the risk that operators partially ignore the ITU process to deploy more quickly.
- 4.25 We are taking a leading role in promoting several international reforms that support these aims. At present this includes:
- Creating guidance on how much interference NGSO systems should be prepared to accept from each other;
 - Increasing the certainty around the changes NGSO systems may need to undertake during their lifetime, including by:
 - quantifying how much an NGSO system can change its characteristics without affecting its coordination status and relative date of priority, and

- ensuring recorded satellite numbers remain up-to-date through the lifetime of an NGSO system, and that the associated rights to orbital resources match the actual satellites deployed;
 - Introducing orbital tolerances for NGSO systems. The current absence of tolerances in the Radio Regulations for NGSO systems creates a risk of inefficiencies if operators adopt overly wide tolerances, and so can reduce the ability of different NGSO systems to share spectrum and orbital resources. It also creates uncertainty over how those tolerances can change over the lifetime of the system.
- 4.26 We will consider promoting other improvements to the international framework where they can advance our aims.

Developing our capabilities for handling NGSO-NGSO interference

- 4.27 To ensure that harmful interference between NGSO-NGSO systems can be resolved as quickly and efficiently as possible, we will continue to develop our approach to investigating such interference and our understanding of the resilience of NGSO systems to interference. Since interference to and from new NGSO satellite systems is likely to be localised and transient. We expect that measurements should be conducted at or close to sites suffering interference rather than at a distant monitoring station. Investigation will rely on clear evidence from operators on the harmful impact of interference (especially if this is impacting the satellite receiver).
- 4.28 Once we have developed our approach to handling NGSO interference, we will share this with stakeholders, including providing guidance on the type of information we will need from operators to investigate interference. We will also continue to promote the development of a globally harmonised approach to handling NGSO-NGSO interference through the ITU, including through the ITU's International Space Radio Monitoring meeting programme (ISRMM).

Spectrum pricing

- 4.29 We will consider the introduction of 'Administered Incentive Pricing.' (AIP) licence fees¹¹ for NGSO satellite Earth stations, to reflect the opportunity cost of spectrum denied to other uses and users (rather than just the costs of managing the radio spectrum) when we next review the pricing of our satellite Earth station licences.

NGSO systems sharing with GSO satellites

- 4.30 We will aim to secure the continued assurance of GSO delivered services while avoiding inefficient constraints on the growth of NGSO systems. We will:

¹¹ Ofcom sets AIP spectrum fees where the demand for spectrum in a band exceeds supply, with the intention of providing long term signals of spectrum value to spectrum users.

- consider introducing a new NGSO licence condition to give us added enforcement options to support protection of GSO satellite services;
- develop our capability to verify and investigate cases of suspected harmful interference to GSO satellites (in any case where this is brought to our attention), as well as contributing to the development of a recognised international approach to investigating NGSO to GSO interference; and
- engage with international discussions on the evolution of regulations on NGSO-GSO sharing, to promote an appropriate balance between assurance of GSO benefits and efficient sharing with NGSO systems.

Potential licence conditions to support enforcement of GSO protection requirements in cases of harmful interference to GSO Earth stations

- 4.31 We already have conditions in our NGSO licences requiring Earth stations to comply with the equivalent power flux-density limitations specified in Article 22 of the ITU Radio Regulations, which are intended to protect GSO satellites. These conditions apply to the transmissions (uplinks) from Earth stations located in the UK.
- 4.32 Harmful interference occurring on the downlink, i.e. from a NGSO satellite transmitting into the UK, can at present be dealt with by contacting the administration responsible for the filing under which the satellite is operating (or for a UK filing, by us taking action under our satellite filing procedures).
- 4.33 We consider this approach to be sufficient at present. However, we will also consider whether introducing a new licence condition (into the Earth Station Network Licence) in relation to the downlink would enable us to enforce more quickly and directly against a UK NGSO licensee (under the new licence condition) if there was harmful interference to GSO receivers in the UK. This could give Ofcom added enforcement options beyond reaching out to the administration responsible for the interference.
- 4.34 This is one specific example of the general move to consider licence conditions relating to satellite downlinks that we discuss in the next section of this document (under cross cutting actions).

Developing our capabilities for handling NGSO interference to GSO receiving Earth stations

- 4.35 We will develop our ability to investigate and verify any complaints of harmful interference to GSO receiving Earth stations from transmissions of NGSO systems, whether caused by a single satellite or by the aggregate effect of multiple satellites of a single NGSO system.
- 4.36 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.¹²

¹² It should be noted that in potential cases of harmful interference from NGSO Earth stations to GSO satellite receivers, monitoring stations on the ground cannot measure interference to the satellite receiver and so we will rely on evidence of harmful interference from victim satellite operator

- 4.37 We also plan to promote a globally harmonised approach to handling NGSO to GSO interference (similar to that for NGSO-NGSO interference) through our engagement with the ITU and ISRMM.

Improving international regulations on NGSO-GSO sharing

- 4.38 We will support improvements to the way NGSO systems are modelled when assessing their interference potential towards GSO systems. We consider the methodology contained in Recommendation ITU-R S.1503 may currently result in unnecessary constraints to NGSO systems in some cases, while potentially underestimating the interference they create in some locations in other cases.

NGSO downlinks sharing with Radio Astronomy

- 4.39 We will seek to ensure appropriate protections for radio astronomy from potential interference caused by space to Earth downlinks of NGSO (as well as GSO) systems operating in frequencies adjacent to those allocated for radio astronomy use. It is possible that large NGSO constellations visible to radio astronomy sites present an increased risk of interference compared to GSO. We will examine whether additional protections are necessary.

Potential licence conditions to support enforcement of NGSO downlinks sharing with Radio Astronomy

- 4.40 We will consider updates to NGSO licences to include a requirement that satellite systems must comply with the relevant ITU thresholds to protect the bands allocated to radio astronomy at radio astronomy sites.
- 4.41 Although these systems are already subject to these international thresholds, a UK licence condition will provide us with the ability to take direct enforcement action in any cases of harmful interference, and remove interference more quickly than relying on international processes. This is a further specific example of the general move to consider licence conditions relating to satellite downlinks that we discuss in the next section (under cross cutting activities).

Developing capabilities for handling of NGSO interference to Radio Astronomy

- 4.42 We will work closely with the radio astronomy community on the development of a new approach for investigating potentially harmful interference to radio astronomy. Since NGSO operators are expected to implement site specific solutions for the protection of radio astronomy sites, future interference measurements will need to be made at or close to those sites.

MSS NGSO communication systems

- 4.43 Several satellite operators have planned to deploy NGSO constellations, particularly using bands allocated to MSS below 1 GHz, to provide IoT/M2M services which may benefit some users in remote locations in the UK. While we are not seeking additional

international allocations for these systems at present, we have identified two activities that will support the sharing of spectrum by these systems in the future.

Move authorisation to a light licence basis

4.44 Satellite terminals operating to MSS systems (under UK Interface Requirements 2016) are currently exempt from licensing. We will consider moving their authorisation to a light licence basis¹³ to provide greater options for managing the sharing environment between these systems in the future. This is a further specific example of the general move to light licensing that we discuss in the next section (under cross cutting activities). We will also consider whether to authorise additional bands under these light licences if we think this could be beneficial.

Support reform of the CEPT framework for MSS systems below 1 GHz

4.45 We will support planned work within CEPT to review the framework under ERC Decision (99)06 for MSS systems operating below 1GHz. We will aim to streamline the processes to enable speedy access to spectrum for new MSS systems.

¹³ A single licence would be held by each operator that provides a blanket authorisation of all of their terminals in the UK without the need for individual licensing of each terminal.

5. Our strategy beyond satellite communications

- 5.1 This section covers the following work areas beyond our work on satellite communications:
- Earth observation and navigation
 - Understanding and enabling access to space
 - Cross cutting activities to embed our spectrum strategy

Earth observation and navigation

- 5.2 Earth observation systems and space-based position, navigation and timing (PNT) systems (such as GPS) are used every day by consumers and businesses.
- 5.3 We will ensure that our spectrum management policies support Earth observation (EO) as a priority because we recognise its importance for applications such as weather forecasting, understanding climate change, supporting public services, and providing data for commercial applications. We also recognise the importance of PNT services, because of their role in helping us to navigate wherever we are in the world and providing highly accurate timing for some critical services.
- 5.4 At the same time, we will take a balanced approach, applying the principles for promoting spectrum sharing in our [spectrum management strategy](#) to ensure critical applications can be protected without unnecessarily constraining the introduction of new services. This could mean the adoption of requirements for receivers that are more resilient to interference.

Spectrum access for Earth observation and navigation

Access to spectrum at downlink sites for Earth observation data

- 5.5 We already offer protection via Recognised Spectrum Access for Earth station sites using the 26 GHz band to downlink Earth observation data. While there is potential to expand RSA protections to other bands, in particular to 26.5-27 GHz or to the 8 GHz band, we have not yet received firm evidence on the need for these. We will however keep both of these under review, subject to evidence on stakeholder needs and the benefits arising from them.

Consideration of inter-satellite links

- 5.6 Inter-satellite links are used among other things to transfer data between NGSO Earth observation satellites and GSO relay satellites that are then able to transmit the data to the required point on Earth. Their use means that EO data can be made available to users much more quickly as there is no need to wait until the EO satellite is visible from the required point on Earth.

- 5.7 We will engage with international work, initially under WRC-23 agenda Item 1.17, to consider operation of inter-satellite links in bands additional to 24.45-27.5 GHz. This could make connectivity easier for small satellites and NGSOs in general. In engaging internationally, we will seek to ensure appropriate protection of existing UK services. We will also monitor developments on the adoption of optical communications for inter-satellite links.

Climate change monitoring and weather forecasting

- 5.8 We will consider spectrum access for climate change monitoring and weather forecasting, initially through support for WRC-23 agenda Item 1.12 regarding active EESS around 45 MHz and agenda Item 1.14 on a review of existing EESS (passive) allocations and possible new allocations in the band 231.5–252 GHz. We will engage with international work on these WRC-23 agenda items with the aim of achieving appropriate spectrum access for Earth observation without placing undue constraints on other users. We also welcome thoughts on proposals for future WRC agenda items, related to climate change monitoring, where it is agreed that international regulatory changes, are necessary.

Spectrum requirements to support resilient positioning, navigation and timing

- 5.9 We will provide support as appropriate for the UK's work on resilient PNT and will work with Government to understand the potential spectrum requirements.

Efficient use, sharing and assurance for Earth observation and navigation

Ongoing protection of spectrum used for Earth observation measurements

- 5.10 We will balance the needs of Earth observation with the needs of communication services by applying the principles for promoting spectrum sharing, as set out in our [spectrum management strategy](#). This will include considering the real performance of systems rather than the theoretical worst cases when assessing the risk of interference. We recognise the importance of ensuring long-term predictability of access to spectrum bands used for sensing. We will consider Earth observation uses of spectrum when introducing new services and will engage internationally to promote a balanced approach.

Updates to the ITU Recommendation dealing with Earth observation sensors

- 5.11 We will propose updates to the relevant ITU-R Recommendation dealing with EESS system characteristics during the next review of that Recommendation. This will help ensure that sharing studies consider the real performance of such systems. We plan to use this work to highlight that the Radio Regulations do not protect these receivers from emissions outside their allocated bands.

Efficient use of S-band for Telemetry, Tracking and Command (TT&C)

- 5.12 We will engage in ITU-R work to develop a new Recommendation on the optimal use of the S-band (2205-2210 MHz uplink and 2200-2290 MHz downlink), noting the need for its protection for TT&C.

Resilience of existing positioning, navigation and timing systems

- 5.13 We will monitor and take compliance action against jammers causing illegal in-band interference to PNT services. We will not generally expect to act on interference if receivers are impacted by signals outside the band in which they are receiving. We will therefore continue to encourage manufacturers to use more robust PNT receivers where available, and note that standards work could make future receivers more robust.

Understanding and enabling access to space

- 5.14 We will consider spectrum access for activities which enable space launch and the maintenance of 'safe space', such as in-orbit servicing, debris tracking and removal. We will also consider spectrum access for activities that add to our understanding of space, the universe, and space weather; and which support the development of lunar communications and space exploration.

Spectrum access for understanding and enabling access to space

International regulatory framework for space weather

- 5.15 We will work with international partners to provide regulatory certainty for space weather monitoring, which currently has no recognition in the Radio Regulations for its spectrum use. Space weather events, such as solar flares, can have potentially significant impacts on the UK's critical national infrastructures, such as the national power grid, communication systems, and transport.
- 5.16 To achieve this, we will continue to jointly lead with Germany, on the development of CEPT policy on WRC-23 agenda item 9.1.A, which aims to make first changes to the Radio Regulations to create an international regulatory framework for space weather. The work on development of international regulatory framework for space weather will span over two WRCs (WRC-23 and WRC-27) and will involve modifications to a number of articles of the Radio Regulations.¹⁴

Input to safe and sustainable use of space

- 5.17 Within the UK, the CAA is the regulator with responsibility for issues concerning the safety of space, including space launch and space debris. The UK's policy on safe and sustainable use of space is determined by the UK Space Agency and BEIS.

¹⁴ Articles 1 and 4 at WRC-23 and changes to Article 5, dealing with allocations, at WRC-27

- 5.18 However, we recognise the role spectrum will play in enabling safe and sustainable use of space. For example, we plan to consider appropriate access to spectrum for radars to track the movements of objects in space. Appropriate spectrum access to enable in orbit servicing also has a role, although we currently believe this can be supported within existing international spectrum allocations without requiring changes to the international regime. We also remain ready to assist UK based in-orbit servicing operators with satellite filings to support their systems.
- 5.19 We will continue to discuss with our counterparts in the CAA and the UK Space Agency how we can work together on this issue.

Spectrum authorisations for UK space launch

- 5.20 We will continue to support the UK's Spaceflight Programme providing spectrum authorisations for commercial vertical and horizontal small satellite launchers, range operations and UK spaceports. Operators are encouraged to engage with us at an early stage to ensure we can provide the relevant spectrum authorisations in a timely manner.

Sub-orbital vehicles

- 5.21 We will work with interested UK parties, such as the UK Space Agency and the CAA, to support the creation of an international framework for communications to and from sub-orbital vehicles, beginning with agenda Item 1.6 of WRC-23¹⁵. We will monitor the use of sub-orbital vehicles for research and space tourism purposes and their impact on airlines, which must reroute around segregated airspace during sub-orbital missions.

Lunar communications and space exploration

- 5.22 We will work alongside the UK Space Agency and other agencies to support the Government's commitment to future exploration of space, and of the Moon and Mars in particular. We encourage early engagement from all stakeholders as we seek to understand the potential spectrum requirements involved. We will engage with the work of WP7B within ITU on the issue of lunar communications.

Efficient use, sharing, and assurance for understanding and enabling access to space

Protection of spectrum for radio astronomy measurements

- 5.23 We note that radio astronomy depends on being able to take measurements, at extremely low signal levels, of phenomena across the universe, and so operates in bands which are allocated for that specific use to avoid any radio interference from other users. For example, in developing proposals for authorising access to the 26 GHz band (24.25–27.5 GHz) for new uses we have proposed appropriate protection of radio astronomy sites using

¹⁵ [WRC-23 Agenda Item 1.6 "Consideration of regulatory provisions to facilitate the introduction of sub-orbital vehicles"](#)

the adjacent 24 GHz band in the UK. We have introduced appropriate protections for 14.47-14.50 GHz as part of our recent decision on access to 14.25-14.50 GHz.

- 5.24 We will consider a new NGSO licence condition to provide us the ability to take direct enforcement action in any cases of harmful interference to radio astronomy (see above under 'Activities for NGSO satellite communications systems'). We will also engage in CEPT and ITU work on the development of appropriate solutions for protection of radio astronomy sites in the UK and abroad.

Cross cutting activities to embed our spectrum strategy

- 5.25 We will implement cross-cutting activities to embed our overall spectrum management strategy, ensuring that we support wireless innovation and promote spectrum sharing.

Supporting wireless innovation: spectrum for space pioneers

- 5.26 We already deal with a wide range of innovative players and projects in the space sector whose authorisation requirements do not always fall neatly within one of our existing licence products. For example, TT&C for small satellites or 'cubesats', often developed by UK-based universities or small satellite manufacturers, tends to use lower frequencies and bands that are not as well-established as those used by traditional (larger) satellites
- 5.27 To further support these innovators, we will identify frequency and authorisation options that may be relevant for new cubesat/smallsat applications, particularly for TT&C, but potentially for innovative uses such as space-generated solar power or in-space manufacturing. We will aim to clarify the regulatory constraints associated with these options and communicate this as clearly as possible to a wide audience through our website and our stakeholder engagement activities, including with universities and start-ups. We will provide further information about the process for applying for authorisations for such bands and, where possible, will streamline our processes for assessing and granting such licences.

Promoting spectrum sharing: Greater use of network licences

- 5.28 At present, there are certain types of equipment that can be used in the UK to communicate with a satellite without the need for a licence, i.e. because it has been exempted from licensing. This includes MSS terminals and some FSS terminals.
- 5.29 However, we believe resolution of harmful interference may be expedited where the use of equipment is authorised under the terms of a network licence, where details of the licence-holder are known (in contrast to exempt devices). We will therefore consider greater use of network licences in the space sector, including the removal of existing licence exemption of terminals and transition to an alternative 'light network licensing' regime.
- 5.30 A light licensing regime could also provide greater flexibility in introducing new enhanced schemes for sharing spectrum, as the affected parties can be more readily identified. A

single network licence would be held by a satellite operator and would authorise an unlimited number of terminals. We have already introduced this new approach in relation to NGSO FSS terminals, and in the previous section signal our intention to consider this approach for MSS terminals. We will consult on any specific proposals to make such changes.

Promoting spectrum sharing: conditions on satellite downlinks

- 5.31 Harmful interference to spectrum users in the UK arising from downlinks from satellites can be dealt with by contacting the administration responsible for the filing under which the satellite is (or, for a UK filing, by us acting under our satellite filing procedures).
- 5.32 However, an alternative approach which we will consider in the future, is to apply conditions on UK authorised equipment to address the potential for harmful interference from associated satellite downlinks. This approach gives us another tool for resolving harmful interference, enabling us to act quickly and directly to resolve problems affecting UK users, by taking action under such a licence condition rather than needing to liaise with an overseas administration.
- 5.33 We have already applied this approach in relation to interference between NGSO systems¹⁶. This strategy has identified two further areas where we will consider applying this approach, specifically in relation to GSO satellite receivers (see from paragraph 4.35 above) and radio astronomy sites (see from paragraph 4.40 above). We may consider its application in relation to other downlinks in the future where relevant and appropriate.

¹⁶ https://www.ofcom.org.uk/data/assets/pdf_file/0018/229311/statement-ngso-licensing.pdf

6. Delivering our space spectrum strategy

- 6.1 This section sets out our current thinking on how our work to implement the strategy can be best phased over coming years.
- 6.2 The work programme covers both our nationally focused work, including where we look to update licensing arrangements for satellite gateway Earth stations and terminals, and our international engagement work. It sets out our initial prioritisation and planned phasing of work covering:
- **Near term work**, on which we will concentrate during financial year 2023-2024. We will continue our work to enable future satellite systems and will develop our capabilities to ensure users are protected from harmful interference.
 - **Medium term work**, including future work which is dependent on the outcomes of WRC-23.
 - **Longer term work**, which we will consider over a longer period dependent on evidence of demand and/or benefits.
 - **Ongoing activities**. In some cases, our strategy identifies established activities which we will continue, and issues which we will monitor and be prepared to take appropriate action where necessary.
- 6.3 In developing the space spectrum work programme, we have taken account of the timelines of international processes and prospective deployments of new satellite systems, as well as our own workload. Nonetheless, this roadmap represents our current view based on the information we have at the time of writing. We will keep it under review and update as appropriate.
- 6.4 In the paragraphs below we provide information on our planned national and international activities for 2023-2024. The overall implementation work programme is set out in full in Figure 5 (national activities) and Figure 6 (international activities).

Near term work

National activities for 2023-2024

- 6.5 We plan to prioritise a subset of the activities that **enable new and improved satellite services while developing our capabilities to deal with any cases of harmful interference arising from the growing deployment of NGSO systems**. Plans include:
- Bringing forward proposals in 2023-2024 to **enable the use of satellite communications systems** which could bring higher speed services to users on aircraft, ships, and remote locations in the UK, specifically through:
 - Proposals to authorise **satellite gateways in Q/V bands**. We will consider access to 37.5 -40.5 GHz (FSS downlink), 47.2 - 50.2 GHz, 50.4 - 52.4 GHz (FSS uplink).¹⁷

¹⁷ Implementation of decisions to expand the bands available for satellite gateways is likely to be in 2024-2025.

- Considering options for the **future potential authorisation of E-band satellite gateways** (71-76 GHz/81-86 GHz) alongside the existing use of the band. It is too early to say whether this will lead to proposals in 2023-2024, as this use will need to be supported by updates to the international regulatory framework.
- Proposals to update the **authorisation of maritime satellite terminals** (in Earth Station Network licences) to enable maritime users to benefit from use of NGSO satellite systems (including the additional capacity we have made available at 14.25-14.5 GHz).
- **Managing risks to other users.** We plan to focus on two aspects to provide us with additional levers and capabilities for dealing with the risk of harmful interference from NGSO satellite systems to other UK spectrum users including:
 - Proposals for potential new conditions (in Earth Station Network licences) on **NGSO satellite downlinks to protect GSO receivers** and **radio astronomy** sites in the UK, to support enforcement of GSO protection requirements in cases of harmful interference to GSO Earth stations. This would give us added enforcement options beyond reaching out to the administration responsible for the interference.
 - Development of our **NGSO satellite monitoring** capabilities, enabling us to effectively investigate cases of possible harmful interference to UK spectrum users (other NGSO services, GSO services or radio astronomy users), and development of our communications to stakeholders about our approach to investigation and enforcement.
- **Considering the implications of satellite communications directly with mobile handsets and 'short range' devices,** including whether any additional national or international regulatory measures are beneficial or necessary to enable further development.

International activities for 2023-2024

- 6.6 Our immediate international work is largely determined by the timing of international meetings, particularly preparation for and attendance at WRC-23. Our overall prioritisation of issues for WRC-23 was set out in our [call for inputs](#) published in June 2022.
- 6.7 As discussed in section 4 our highest priority international issues involving the space sector relate to the **development and reform of rules which govern use of spectrum by NGSO systems**. Such rules will enable multiple NGSO systems to serve the UK while protecting the benefits delivered from GSO satellites.
- 6.8 Our other top space priority for WRC-23 is our wish to establish a more robust **regulatory framework for the operation of systems that monitor space weather**. Severe space weather events need to be monitored given the potential for significant impacts on satellite systems and the UK's critical national infrastructures i.e. national power grid and critical communication systems, as well as air/rail/road travel.

Space spectrum work programme

Figure 5: Space spectrum work programme – national activities

	Gateway authorisation updates	Terminal authorisation updates	Other work
Near term work (FY 2023-2024)	Consult on proposals for authorisation of Q/V band Earth station gateways and potentially for E band	Consult on proposals to give us added enforcement options - consider conditions on NGSO downlinks re harmful interference to GSO and radio astronomy Consult on proposals to support improved NGSO maritime services	Development of NGSO satellite monitoring capabilities and communicate our approach to investigation and enforcement. Consider the implications of satellite communications connecting directly with mobile handsets and 'short range' devices.
Medium term work	Implementation of Q/V band (and possible E band) licence updates dependent on earlier consultation Spectrum for space pioneers – publish guidance for non-standard bands Consider access to 28 GHz guard bands	Consider access to 28 GHz guard bands	
Medium term (post WRC-23) activities		Expanding capacity for aero services – scope to be determined after WRC23 (AI 1.15,1.16) outcome	Update satellite filing procedures after WRC-23
Longer term activities		Consider transition of MSS bands from exemption to light licences	Extending Recognised Spectrum Access to support EO dependent on demand (8 GHz / 26 GHz)
On-going activities	<ul style="list-style-type: none"> • Satellite Earth station licensing (GSO & NGSO) • Manage satellite filings • Protection of spectrum used for Earth Observation & Radio Astronomy • Provide support as appropriate for UK work on resilient position, navigation and timing (PNT), take compliance action against PNT jammers • Authorise spectrum use for UK space launches • Monitor spectrum needs to support safe use of space • Implement our satellite monitoring capabilities 		

Figure 6: Space spectrum work programme – international activities

	International WRC work	Ongoing international work
Highest priority international activities	<p>Improving international rules for NGSO satellite filings, including:</p> <ul style="list-style-type: none"> • NGSO orbital tolerances (AI 7A) • NGSO Post milestone reporting (AI 7B) • Aggregate non-GSO interference to GSO (AI 7J) <p>Space weather international framework (WRC-23 AI 9.1.A)</p>	<p>Improving international rules for NGSO satellite filings:</p> <ul style="list-style-type: none"> • Guidance on acceptable level of interference between NGSO systems • How much NGSO systems can change without affecting its status & priority • Improved modelling of potential NGSO to GSO interference (Rec S.1503)
Medium priority international activities	<p>Medium priority WRC23 AIs:</p> <ul style="list-style-type: none"> • ESIM in 12.75-13.25 GHz (AI 1.15); NGSO ESIM (AI1.16) • Sub-orbital vehicles (AI 1.6). • Intersatellite links (AI 1.17) • Climate change monitoring and weather forecasting capabilities (AI 1.12 and 1.14) <ul style="list-style-type: none"> • Consider future AIs for WRC27 	<p>Ongoing ITU work:</p> <ul style="list-style-type: none"> • Review FSS protection criteria recommendations • Updates to recommendation on EESS sensors • Recommendation on optimal use of S-band for TT&C. <p>Ongoing CEPT work:</p> <ul style="list-style-type: none"> • Develop solutions for protection of radio astronomy sites • Support reform of CEPT framework for MSS systems below 1GHz
Other international activities	WRC27 priorities to be determined following WRC23	

Next steps

6.9 We will take forward our spectrum management work in the space sector in line with this strategy. In addition, we will:

- Keep this strategy under review and may adjust our plans to take account of new information as appropriate; and
- Periodically update stakeholders on our progress and on any significant changes to our plans.