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# **Spectrum access for Enhanced Long-Range Navigation (eLoran) systems at 90-110 kHz**

Supporting innovation for more resilient Positioning, Navigation and Timing

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**CONSULTATION:**

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# 1. Overview

- 1.1 This document sets out proposals to make radio spectrum in the 90-110 kHz frequency range available for Enhanced Long-Range Navigation (eLoran) systems. eLoran is the latest evolution of a positioning, navigation and timing (PNT) system first developed during World War II for use by ships and patrol aircraft.
- 1.2 Accurate PNT is important for people and businesses in the UK:
- It is used to provide precise **positioning** information, such as for the security-tracking and civil engineering sectors;
  - to help our **navigation** wherever we are in the world, such as for the maritime and aviation sectors; and
  - to provide highly accurate **timing**, which forms an essential part of modern communications networks, broadcasting and financial services.
- 1.3 Satellite-based PNT systems like the Global Positioning System (GPS) can be susceptible to interference and can be vulnerable to space weather events. The eLoran technology provides a terrestrial-based alternative to satellite-based services which could in future act as a supplementary or back-up system to GPS. As such, it has the potential to support innovation in the delivery of resilient PNT.
- 1.4 At present, there is no Ofcom licence product available to operators which is suitable for authorising the deployment of an eLoran system in the UK.

## What we are proposing – in brief

We propose to introduce a new ‘Spectrum Access eLoran licence’ product to authorise use of the 90-110 kHz spectrum band for eLoran systems.

- 1.5 We invite stakeholders to comment on our proposals. The consultation will remain open until 14 July 2023. Once the consultation is closed, we will review all the responses we receive. We will then publish a statement setting out our decision on whether to proceed with our proposals.

## 2. Proposal to authorise use of the 90-110 kHz spectrum band

- 2.1 The proposals set out in this consultation document would make radio spectrum in the 90-110 kHz frequency range available for new and resilient positioning, navigation and timing systems in the UK.
- 2.2 In this section of the document we describe the nature of the 90-110 kHz band and the potential for its innovative use to deliver PNT. We go on to outline our overall proposal to create a new licence product authorising use of the frequencies for high power services.
- 2.3 In the following sections we set out the non-technical (section 3) and technical (section 4) licence conditions we propose to apply to the licence.

### Introduction and background

- 2.4 Radio spectrum is a scarce and valuable resource on which all wireless communications depend. It is Ofcom's responsibility to authorise access to spectrum in the UK, and we have a statutory duty to ensure its optimal use.
- 2.5 We have been approached with a request to authorise use of the 90-110 kHz spectrum for the provision of a long-range navigation system, based on eLoran technology.
- 2.6 eLoran is a terrestrial-based PNT system that uses transmitters operating within the 90-110 kHz low frequency band. The technology can provide a ground-based complement and backup to satellite-based radio PNT such as the Global Positioning System (GPS). Its use of low frequency bands enables the transmission of signals capable of travelling long distances and into areas that satellite-based PNT systems cannot reach e.g. into buildings or underground areas.
- 2.7 At present, there is no Ofcom licence product available which would permit the introduction of an eLoran service in the UK. In view of the potential benefits of these systems, this consultation document sets out proposals for the introduction of a new licence product with the necessary technical and non-technical conditions to enable such a service.
- 2.8 The licence conditions we propose represent those we consider appropriate - in general - for the productive use of this spectrum by eLoran systems, noting the potential for multiple systems to be in operation at the same time, including overseas, and taking account of other users of this and adjacent bands.

### The 90-110 kHz band

- 2.9 The characteristics of the 90-110 kHz radio frequencies mean that signals can be carried across large distances close to the Earth's surface through ground wave propagation. The

band already has a primary allocation for radionavigation services in the international Radio Regulations, and in Ofcom's [UK Frequency Allocation Table \(UKFAT\)](#).

- 2.10 Footnote 1.1.2 of the UKFAT states that frequencies in this allocation are assigned for civilian use, except where permissions for military use are agreed with the Ministry of Defence (MOD). No protection can be claimed for any assignments in the band and undue interference must not be caused to other users.
- 2.11 In the past, the 90-110 kHz spectrum has been used by the General Lighthouse Authorities (GLA)<sup>1</sup> for trials of eLoran maritime positioning on a non-operational development basis. These trials were based on transmissions from five locations in Europe, including Anthorn in Cumbria. The other locations were Oth Ejde, Faroe Islands; Vaerlandet, Norway; Sylt, Germany and Lessay, France. The trials were discontinued in 2015.<sup>2</sup>
- 2.12 The 90-110 kHz band forms part of a wider series of bands that are also available on a licence exempt basis for Short Range Devices (SRDs). This means the spectrum may be accessed on the basis that users cause no interference to other users and can expect no protection from interference themselves.<sup>3</sup>
- 2.13 We understand that current licence-exempt uses in frequencies that include the 90-110 kHz range include a range of applications including metal detectors, inductive applications (such as for energy or power transfer), power cable detection systems, and active medical implants.<sup>4</sup> Minimum technical requirements for the operation of SRDs in the band are set out in Ofcom's [Interface Requirement IR2030](#) (see section 4 of this document).
- 2.14 Although the 90-110 kHz band is mainly allocated for civilian use, we are aware of some eLoran use by the Ministry of Defence (MOD), based on the Anthorn site. This use currently falls under a Crown licence exemption.<sup>5</sup> It is our understanding that the UK Government will maintain an eLoran capability.
- 2.15 We are not aware of other potential new technologies which might wish to make use of the 90-110 kHz band.

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<sup>1</sup> There are three general lighthouse authorities responsible for aids to navigation in the UK and Republic of Ireland: Trinity House (for England, Wales, the Channel Islands and Gibraltar); the Northern Lighthouse Board (for Scotland and the Isle of Man); and the Commissioners of Irish Lights (for the whole of Ireland).

<sup>2</sup> See <https://www.trinityhouse.co.uk/notice-to-mariners/27-15-enhanced-loran-discontinued>

<sup>3</sup> Ofcom has published a [Short Range Devices Information Sheet](#) on its website. It states: "SRDs cannot claim protection from other authorised services, SRD or, generally, from other spectrum users and must not cause harmful interference themselves".

<sup>4</sup> Licensing requirements for Short Range Devices are set out in the Interface requirements [IR2030](#) with specific uses defined in section 3 (e.g. IR2030/4/8 - Active Medical Implants and associated peripherals; IR2030/15/4 – Inductive devices (generic use) and IR2030/16/1 – Metal Detectors).

<sup>5</sup> The Communications Act 2003 makes Ofcom responsible for management of radio spectrum in the UK except for spectrum used by Crown bodies. The MOD manages spectrum designated primarily for military use. Other relevant Crown bodies include the Department for Transport, the Department for Business and Trade, Department for Science Innovation and Technology and the Home Office (for some emergency services). The Scottish Government is responsible for managing some spectrum for emergency services in Scotland.

## Positioning, Navigation and Timing (PNT)

- 2.16 Accurate positioning, navigation, and timing (PNT) is necessary to support the functioning of many critical infrastructure sectors. Responsibility for managing UK PNT policy and resilience lies with the UK Government, and is managed via a dedicated cross-Government PNT office.
- 2.17 Ofcom has related spectrum management duties, including monitoring and taking compliance actions as needed: for example, against the use of illegal jammers affecting these services. Ofcom is also working with Government to understand any future potential PNT spectrum requirements.
- 2.18 Satellite-based PNT systems, like the Global Positioning System (GPS), are important for people and businesses in the UK to provide precise **positioning** information, such as for the security-tracking and civil engineering sectors; to help our **navigation** wherever we are in the world, such as for the maritime and aviation sectors; and to provide highly accurate **timing**, which forms an essential part of modern communications networks, broadcasting and financial services to enable the different systems to stay in synchronisation.
- 2.19 However, satellite-based PNT receivers can be susceptible to interference from out-of-band signals (signals from other uses outside the band in which they are operating) or in-band interference from jammers. In addition, satellites can be vulnerable to space weather events e.g. solar flares, where a sudden release of energy from the sun (electromagnetic radiation) can occur across the entire electromagnetic spectrum causing disruption/damage to electromagnetic devices.
- 2.20 In 2018, the [Blackett Report](#) into satellite-based PNT identified - and warned about - the potential risks associated with the UK's dependence on satellite-based services. It made recommendations on measures to make critical services more resilient to disruption or loss of these services, including by employing alternative back-up systems.
- 2.21 As a terrestrial-based alternative to satellite-based services, eLoran could in future act as a supplementary or back-up system to GPS or other PNT services.

## eLoran systems

- 2.22 Long Range Navigation (LORAN) systems were first developed during World War II for use with transatlantic shipping convoys. They were based on the use of low frequency spectrum to send signal pulses across large distances, enabling relatively accurate positioning and navigation.
- 2.23 Early versions of the technology, including the third generation of LORAN known as LORAN-C, used the difference in the time of arrival of two radio pulses (from two different radio transmitters) to produce a hyperbolic curve. This allowed a receiver to determine its position by listening to the low frequency radio signal pulses that were transmitted by the fixed land-based stations.

- 2.24 The transmitting stations were grouped in Loran 'chains', comprising a master transmitter station and several other secondary transmitter stations. Each secondary transmission was delayed by a different time duration for identification. All stations in the chain transmitted their pulse groups at the same repetition rate, called the Group Repetition Interval (GRI).<sup>6</sup> This allows for identification, and reduces the possibility of interference, since all transmissions operate on the same frequency.
- 2.25 Enhanced LORAN ('eLoran') is the latest evolution of the LORAN technology. It is a major technology upgrade of the Loran C version but uses a similar GRI pulse timing approach to reduce interference. eLoran also includes an additional data channel in the transmission signal. This data channel can convey a range of data, including application specific corrections, warnings and signal integrity information to the user receivers.
- 2.26 eLoran signals in the 90–110 kHz band can travel significant distances using ground wave propagation and can facilitate one-way data communication with an operational range of more than 1,200 miles.<sup>7</sup> The signals are also capable of penetrating buildings and tunnels.
- 2.27 The enhanced system uses the time of arrival of all eLoran transmitting stations to improve accuracy. Additional ground 'reference stations' at specific locations can also be used to further enhance the accuracy of location and timing synchronisation signals, giving a reported accuracy of 8-10 metres.<sup>8</sup>
- 2.28 This compares to an accuracy of approximately five metres for mobile phone GPS, but still makes eLoran a viable terrestrial complement/backup to existing satellite-based navigation systems.
- 2.29 Deployment of eLoran in the UK could complement existing PNT services, particularly in locations where there is poor GPS coverage or weak signals, like tunnels or deep inside buildings. eLoran could also provide resilience (i.e. back-up) for satellite-based systems against interference, jamming and spoofing, thereby aiding protection of key national infrastructure that is reliant on PNT services.
- 2.30 Further advances in receiver technology could also be envisaged to assist with improving resilience, such as combining eLoran and GPS or other Global Navigation Satellite Systems (GNSS) as one system. In those circumstances, the eLoran would still be available if GPS failed or was deliberately blocked.

## Ofcom's duties

- 2.31 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**").

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<sup>6</sup> The interval between the Loran master pulse groups is called the 'group repetition interval' (GRI) and the Loran system continuously emits pulse groups according to its own GRI.

<sup>7</sup> [Microcontroller Tips: Loran may be back, Why, How, Part 3, 5 August 2022](#)

<sup>8</sup> [GPS World: 10 answers about eLoran, 11 April 2022](#)

## Communications Act 2003

- 2.32 Our principal duties under the 2003 Act are to further the interests of citizens and consumers in respect to communications matters, 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.
- 2.33 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 electromagnetic 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

- 2.34 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.
- 2.35 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.
- 2.36 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.
- 2.37 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.

## Our proposal is to introduce a new spectrum licence which would authorise eLoran services in the 90-110 kHz band

- 2.38 In line with our statutory duties and our responsibility to ensure the optimal use of the radio spectrum, we are proposing to introduce a new 'Spectrum Access eLoran licence' product which would authorise use of the 90-110 kHz frequencies for eLoran services.
- 2.39 The proposed new licence product would set out technical and non-technical licence conditions that would make it appropriate for eLoran use by more than one entity in the UK. The proposed licence conditions are discussed in sections 3 and 4.
- 2.40 We consider the proposals set out in this consultation to be:
- **objectively justified** in that they are likely to help meet anticipated increased future demand for access to this spectrum, noting the propagation characteristics, international developments, potential demand for more resilient PNT solutions, and bandwidths available in this band;
  - **not unduly discriminatory** against particular persons or against a particular description of persons in that they apply to all potential new users of the spectrum wishing to deploy this kind of system;
  - **proportionate to what they are intended to achieve**, in that our proposed licence conditions aim to ensure that new users of the bands would not be likely to cause undue interference to others; and
  - **transparent in relation to what they are intended to achieve**, in that they are clearly described and explained in this consultation document.
- 2.41 We seek the views of stakeholders on the potential benefits or risks of enabling eLoran use of the 90-110 kHz band and/or whether there are alternative uses for these frequencies.

## Impact assessment

- 2.42 Impact assessments provide a valuable way of assessing different options for regulation. They form part of best practice policy making. This document as a whole represents an impact assessment as defined in section 7 of the Communications Act 2003.
- 2.43 In preparing this document, we have considered the citizen and consumer interests relating to authorising equipment. We have also considered the impact of granting the proposed licence on other users of the radio spectrum.

- 2.44 In summary, we consider there are potentially beneficial impacts for UK consumers and businesses that could arise from making eLoran services available. As noted earlier in this document, PNT services are important for people and businesses in the UK to provide precise positioning information for key industry sectors; to help navigation in cars, planes and ships; and to provide highly accurate timing for modern communications networks, broadcasting and financial services.
- 2.45 eLoran can help provide resilience and back-up to satellite-based PNT receivers, which are susceptible to interference, and vulnerable to space weather events. Resilience is particularly important for UK critical PNT infrastructure.
- 2.46 We do not believe there are likely to be any negative impacts, such as undue interference to other users of the 90-110 kHz band or in the adjacent bands, given the proposed technical and non-technical licence conditions.
- 2.47 Any comments about our assessment of the impact of our proposals should be sent to us by the closing date for this consultation. We will consider all comments before deciding whether to implement our proposals. For further information about our approach to impact assessments, see the guidelines '[Better policy making: Ofcom's approach to impact assessments](#)' on our website.

## Equality impact assessment

- 2.48 Ofcom is separately required by statute to assess the potential impact of all our functions, policies, projects and practices on the following equality groups: age, disability, gender, gender reassignment, pregnancy and maternity, race, religion or belief, and sexual orientation.
- 2.49 Equality impact assessments also assist us in making sure that we are meeting our principal duty of furthering the interests of citizens and consumers regardless of their background or identity.
- 2.50 We consider that our proposals would not be detrimental to any of these equality groups or impact any of these groups in any different way to others.
- 2.51 We have not carried out separate equality impact assessments in relation to the additional equality groups in Northern Ireland: religious belief, political opinion and dependants. This is because we anticipate that our proposals would not have a differential impact in Northern Ireland compared to consumers in general. We welcome any stakeholder views on this assessment.

## Consultation questions

**Question 1:** Do you agree in principle with our proposal to introduce a new licence product to enable authorisation of the use of the 90-110 kHz band for eLoran services?

**Question 2:** Are you aware of any alternative current or future uses for the 90-110 kHz band, including any which might preclude use of these frequencies for eLoran? If so, please provide details.

## 3. Proposed non-technical licence conditions

- 3.1 In this section of the consultation we set out our proposals for the 90-110 kHz eLoran licence **non-technical licence conditions**. In the following section (section 4) we set out our proposals on **technical conditions**. An indicative draft 'Spectrum Access eLoran licence', reflecting our proposals, can be found at annex 5.

### Introduction

- 3.2 Ofcom is responsible for authorising the use of radio spectrum in the UK, including through the issue of licences. However, the WT Act requires us to exempt stations and apparatus from the requirement to be licensed unless particular circumstances mean it is necessary<sup>9</sup>.
- 3.3 Such circumstances may include the need to ensure there is no undue interference with wireless telegraphy; ensure there is no adverse effect on the technical quality of services; and no inefficient use of the part of the electromagnetic spectrum available for wireless telegraphy.
- 3.4 In the case of eLoran services, we consider licensing to be necessary in order to apply appropriate conditions to allow a number of users to access the spectrum at the same time.
- 3.5 Licensing enables us to ensure that an operator is aware of the conditions and obligations placed on it regarding the use of radio equipment, and helps us manage the overall risk of interference to other users. This is especially important when we impose restrictions, such as power limits or other requirements, such as obligations to coordinate with other authorised spectrum users in the UK or overseas. Authorisation via licence makes such conditions clear, as well as what frequencies can be used and who is ultimately responsible for use of the spectrum.
- 3.6 Licensing also makes it more straightforward for us to take swift and direct enforcement action in the case of suspected non-compliance, or change authorisation terms if needed. Our powers of inspection, restriction and closedown are out in our [General Licence Conditions](#) booklet.

### Licensing for eLoran

- 3.7 We consider that commercial provision of eLoran services is likely to be a niche market at present. We do not therefore anticipate wide demand for licences. As a result, we do not currently propose to limit the number of licences we issue. If we decide to proceed with our proposals, after consideration of consultation responses, licences would become available on application and payment of the relevant licence fee.

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<sup>9</sup> Section 8(3) and 8(4) of the [WT Act](#).

- 3.8 In line with our statutory duties and the UKFAT<sup>10</sup> the licences we propose will authorise the deployment of services on the principle that licensees must not cause interference to other users and can expect no protection from interference themselves ('no interference no protection').
- 3.9 In addition to this, we propose to place the onus on licensees to cooperate and coordinate their operations with each other to avoid undue interference. Further, given the potential for eLoran signals to travel a significant distance, we also propose similar requirements in respect of coordination with other authorised operators overseas.
- 3.10 We propose to issue a single licence for each eLoran system to be deployed, rather than licences for each individual transmission site. Any licences we issue would be published on our website, with details of transmission locations, so that subsequent entrants can plan any future deployments accordingly. Any changes to transmission locations must be notified to Ofcom and the licence schedules updated accordingly. This will assist with managing the interference environment.
- 3.11 We address our proposed non-technical licence conditions in the following order:
- licence commencement and duration;
  - the territorial extent of licences;
  - the payment of licence fees;
  - the tradability of licences in secondary markets;
  - sharing of spectrum;
  - roll-out obligations ('use it or lose it');
  - access and inspection;
  - modification, restriction and closedown; and
  - provision of information to promote efficient use of spectrum.

### **Licence commencement and duration**

- 3.12 We propose that the licences should be issued for an indefinite duration, subject to standard revocation conditions. Once the licence has been issued, the licence would remain in force and continue to be held by the licensee, subject to payment of the appropriate licence fee and all other licence conditions continuing to be met.
- 3.13 While spectrum licences generally require Ofcom to give five years' notice of revocation, in this case we propose that a three-year revocation notice period for spectrum management reasons would be appropriate, (for example, if revocation were needed in order to achieve a more efficient use of the radio spectrum). We propose this shortened time frame due to

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<sup>10</sup> [UK Frequency Allocation Table \(UKFAT\) 2017](#) – UK Footnote 1.1.2

the uncertainty surrounding the future demand for eLoran services and how such systems might use the band in practice.

- 3.14 We consider that this would provide reasonable notice to licensees, but also enable us to respond promptly in the event that real world developments change our assessment of the most appropriate way to authorise access to these bands.
- 3.15 Under the usual terms of our licences granted under the WT Act, Ofcom may also revoke spectrum authorisations within a relatively short time period on certain limited grounds. These include at the request of, or with the consent of, the licensee; for non-payment or late payment of the relevant licence fee; for breach of any of licence terms; for breach of trading regulations; for national security or to comply with international agreements; or under direction of the Secretary of State.

### **Territorial extent of licences**

- 3.16 We propose to grant licences with the individual UK transmitter site locations identified and listed in a licence schedule. This will allow the eLoran transmitters to be located at positions throughout the UK to enable navigation and positioning services and to provide a clear record of where the transmitter sites will be/are located to aid co-ordination with other licensees.<sup>11</sup>

### **The payment of licence fees**

- 3.17 We propose that the new licence would be subject to a fee, payable every year, based on the cost of Ofcom's administration i.e. 'cost-based'.
- 3.18 As this would be a new licence, we do not have cost data for the licence on which to base a 'real-life' calculation. We have considered whether to conduct a detailed assessment of estimated costs. However, this would be a complex exercise and we consider this would not be proportionate or appropriate in this case.
- 3.19 Instead, we propose to use the actual per-licence costs associated with a similar licence product. We have looked at our existing licence products and we believe that the Earth Station Network licence represents the closest licensing regime to the one we are proposing for eLoran.
- 3.20 Like the proposed eLoran licence, the Earth Station Network licence is available for the deployment of transmitter stations on a UK-wide basis and places the responsibility for coordination of services on the operators rather than Ofcom. Given this similarity, we propose to use the costs associated with administration of the Earth Station Network licence to determine what our licence fee should be for the eLoran licence. This is currently £200 per year, based on a cost-recovery basis.

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<sup>11</sup> As set out from paragraph 4.27, given the potential for eLoran signals to travel a significant distance we are proposing a non-technical licence condition to require licensees to coordinate with authorised eLoran operators overseas as needed

- 3.21 Our approach to the annual fee may need to be reviewed in the future, depending on the take up of the licence product and our experience of how interference coordination is working in practice.
- 3.22 Prior to the introduction of any further fees, we would consult as appropriate and give notice of our specific proposals.

### The tradability of licences

- 3.23 We are not proposing to place limits on the number of licences available in the 90-110 kHz band. Further, we plan to set licence fees based on the cost of Ofcom's administration, meaning cost is unlikely to be a barrier to entry. For these reasons we propose that licences should not be tradable.

### Spectrum sharing

- 3.24 We note that licences issued by Ofcom do not guarantee exclusive use of the spectrum. In the future, we may grant additional authorisations to allow the use of all, or part, of the spectrum identified in this consultation. This is in line with our [framework on spectrum sharing](#).

### Non-technical restrictions on use

- 3.25 We do not propose to impose any non-technical conditions in the licences which limit the type of equipment that should be used, noting any equipment used would in any case need to comply with the [UK Radio Equipment Regulations](#).

### Use-it-or-lose-it

- 3.26 We have considered whether or not to apply licence conditions to authorised operators in the 90-110 kHz band requiring them to either use the frequencies in a timely manner or risk having the licence taken away (i.e. 'use-it-or-lose-it'). We do not currently propose to apply such conditions to the licence.
- 3.27 A 'use-it-or-lose-it' condition can be helpful as a deterrent against an operator seeking to 'stake a claim' on the spectrum, even if it has no immediate plans for use. However, there are practical reasons for not including such conditions:
- It can be difficult to define what constitutes 'use' and therefore what the trigger for an enforced trade or revocation would be;
  - There may be entirely legitimate reasons for spectrum remaining unused – a licensee may be holding back until it sees a suitable commercial opportunity or until the technology it wishes to use is ready;
  - Imposing such an obligation may have the potential to distort and/or chill the incentives to invest in the spectrum, and so reduce the benefits for consumers and citizens which authorisation would otherwise create.

- 3.28 Additionally, in this particular case, we do not propose to limit the number of licences we issue, so we do not think there is a strong incentive for an operator to hold a ‘paper’ licence with no intention of deploying services in order to prevent others from deploying services using this spectrum.
- 3.29 Further, as set out in paragraph 4.17 below, we propose to include a technical licence condition requiring the licensee to liaise, co-operate and co-ordinate with all eLoran licensees, so that eLoran services can be provided to end users from each eLoran system.
- 3.30 As a consequence, in the event that an eLoran licensee failed to co-operate and co-ordinate with other licensees, we would ultimately have the power to revoke licences as a consequence of non-compliance.

### **Access and inspection**

- 3.31 In accordance with our standard spectrum licence conditions, we propose that licensees should be required to permit any person authorised by Ofcom to have access to and to inspect the radio equipment specified in the licence at all reasonable times.

### **Modification, restriction and closedown**

- 3.32 In line with standard provisions, we propose a licence provision permitting Ofcom to require that the radio equipment (or any part of it) be modified, restricted in use or temporarily or permanently closed down if a licensee breaches the terms of its licence; the use of radio equipment is or may be causing or contributing interference to the operation of other authorised radio equipment; or it appears necessary or expedient in the event of a national or local state of emergency.

### **Provision of information to facilitate co-ordination and optimal spectrum use**

- 3.33 If we decide to proceed with our proposals, then any applicant for the licence would need to provide information about their planned operations as part of the licence application process.
- 3.34 This would include specific information relating to each planned transmitter site, as indicated in schedule 2 of the proposed licence. If the licence were granted, the schedule would be published on the Ofcom website to ensure transparency, and to help us secure optimal use of the spectrum. Provision of this information will help with the overall co-ordination of other eLoran systems within this band.
- 3.35 In line with our duty to manage the spectrum efficiently, we propose to include a condition in the licences requiring licensees to provide general information regarding the planned location of transmission equipment, and the use of frequencies (see technical licence conditions in the following section) if requested by Ofcom. Further, licensees would be required to ensure that any proposed changes to the information contained in the schedule to the licence were agreed with Ofcom in advance, and implemented only after the licence had been varied or reissued.



- 3.36 We note that we have powers under both the Communications Act 2003 (section 135 to 146) and the WT Act (sections 32 to 34) to require third parties to provide us with further information in certain circumstances.

### Consultation question

**Question 3:** Do you agree with the non-technical conditions we propose to include in the new 90-110 kHz licence? If not, please set out your reasons and provide any relevant evidence.

## 4. Proposed technical licence conditions

- 4.1 Having set out the non-technical licence conditions we propose for the 90-110 kHz band in section 3, we now move on to our proposed **technical licence conditions**. These take account of our statutory duties and international obligations.

### Principles for technical conditions

- 4.2 As noted in section 3, we propose to issue eLoran licences in the 90-110 kHz band on the basis of ‘no interference no protection’ and without any limit on the number of authorisations.
- 4.3 In those circumstances, we need to consider the potential coexistence environment if there were two or more eLoran operators in the band in future – even though we do not anticipate significant demand for licences.
- 4.4 The principle of ‘no interference no protection’ means operators must not cause harmful interference to other users of the band and cannot expect protection from harmful interference caused by others. This places the onus on the operators themselves to cooperate with each other, and coordinate their transmissions to avoid harmful interference.
- 4.5 The proposed technical licence conditions we set out in this section of the document - including a requirement that those applying for a licence must identify transmission sites - are intended to establish proportionate and appropriate conditions in order to make self-coordination easier amongst operators of eLoran services, and to ensure there are no licensing barriers for subsequent entry into the market.
- 4.6 Placing an obligation on operators to coordinate in good faith also helps to support competition among operators providing services.

### Coexistence of eLoran systems

- 4.7 At present, there are limited relevant international regulations and no harmonised radio equipment standards in place for the operation of an eLoran service in the 90-110 kHz band.
- 4.8 For example, the [ITU Radio Regulations](#) do not specify a maximum Effective Isotropic power level (EIRP), so there is no international limit at present on high power transmissions. There are also no mandatory coordination requirements specified within the regulations.
- 4.9 However, footnote 5.62 of the Radio Regulations states that: *“Administrations which operate stations in the radionavigation service in the band 90-110 kHz are urged to coordinate technical and operating characteristics in such a way as to avoid harmful interference to the services provided by these stations”*.

- 4.10 [ITU Radio Regulations Resolution 705](#) also encourages “*consultation, both nationally and internationally, between operators of radionavigation systems using the frequency band 90-110 kHz and of other systems using the frequency band 70-130 kHz*”.
- 4.11 Taking this into account, we propose that the maximum EIRP of each transmitter is initially limited to 400 kW (56 dBW). This takes into account the high transmission powers generally required and used by eLoran systems, but also the need to ensure that the overall interference environment (amongst different systems) can be managed and co-ordinated successfully.<sup>12</sup> We welcome stakeholder feedback on whether there might be specific benefits or risks associated with authorising higher power limits.
- 4.12 We recognise that licensing a single eLoran operator in this band would be relatively straightforward. However, we want to ensure that the technical licence conditions we apply make it possible for other operators to develop similar services in the UK alongside a ‘first mover’ if they choose.
- 4.13 We are also proposing a licence requirement that any new operator will need to take account of the on-going eLoran PNT transmissions from Anthorn, and not cause undue interference to the receiver equipment using this or any other eLoran system operated by or on behalf of the UK Government.
- 4.14 Different PNT ‘LORAN’ systems have coexisted in the past, but this has generally been with geographically separated transmissions and co-ordinated by the International Loran Association.<sup>13</sup> The existence of multiple systems with potentially more closely spaced transmitters covering a similar geographic region has not, as far as we are aware, been attempted so far. We will therefore require cooperation and co-ordination amongst operators, including with overseas international eLoran systems/operators.
- 4.15 Although all eLoran systems will operate on the same frequency and will generally operate at high power, we believe coexistence between multiple systems is possible if transmission pulses (i.e. Group Repetition Intervals or GRIs) are coordinated.
- 4.16 These pulses and their sequencing cannot be determined by Ofcom as they form part of the individual system designs and configuration. The capabilities of the user receiver devices are also a factor i.e. the ability of the receiver to correctly decode information in a given interference environment, and must similarly rely on cooperation between operators to ensure undue interference is not caused.
- 4.17 We therefore propose a licence condition as follows:

*“The Licensee must liaise, co-operate and co-ordinate with all eLoran Licensees (if necessary adjusting transmission power and other technical parameters of transmission such as the Group Repetition Interval), such that each eLoran system (comprising the*

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<sup>12</sup> An increased EIRP can directly impact the overall Interference signal strength ‘I’ received by a different eLoran system. This can potentially reduce the overall wanted signal to noise + interference (S/N+I) ratio at the ‘victim’ receiver, which can subsequently impact a receiver’s capability to operate successfully.

<sup>13</sup> The [International Loran Association](#) operated from 1972 until 2011 promoting the use of eLoran. However, there is currently no international organisation coordinating eLoran operations.

*transmitter stations and user terminals) can co-exist and operate without causing undue interference to each other, so that eLoran services can be provided to end users from each eLoran system”.*

- 4.18 As a consequence, in the event that an eLoran licensee failed to coordinate with other licensees, we could instruct the licensee to cease or change the use of particular equipment, including changing power levels (EIRP) in the event of undue interference. As already noted, we ultimately have the power to revoke licences in the event of non-compliance.

## Coexistence with Short Range Devices (SRDs)

- 4.19 As already noted, the use of SRDs is governed by Ofcom’s [IR2030](#) which sets out required technical conditions, including the broader frequency ranges under which SRD devices can operate. We do not anticipate coexistence issues with SRDs because of the nature of these types of devices.
- 4.20 For example, inductive devices are generally required to be closely coupled in order to operate, and medical devices generally need to be actually touching the body (or in contact through clothing).
- 4.21 In general, SRD devices are designed to operate within the wider radio frequency environment, which already includes high power transmitters in the low frequency spectrum, such as broadcast stations. We do not therefore propose any specific technical conditions to protect authorised SRD use of this band, beyond the general ‘no interference no protection’ provision.

## General conditions

- 4.22 We propose that the licence will enable transmission of eLoran signals in the UK with a centre frequency of 100 kHz and a bandwidth of 20 kHz. We propose that transmissions should be authorised from specific sites in the UK, and that these should be specified in the licence as part of a separate licence schedule.
- 4.23 We consider that having this information readily available as part of the licence, in addition to the core technical conditions (see below), will assist more broadly when co-ordinating with other licensees.
- 4.24 The eLoran user receivers (i.e. devices that receive signals but do not transmit) will operate under the [Wireless Telegraphy Apparatus \(Receivers\) \(Exemption\) Regulations 1989](#).
- 4.25 The general technical conditions we therefore propose include:

**ITU Emission Code:** 20K0V1X<sup>14</sup>;

**Maximum EIRP:** 400 kW (56 dBW);

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<sup>14</sup> See appendix 1 of ITU [Radio Regulations \(itu.int\)](#)

**Transmit signal emission profile:** 99% or more of the total radiated power must be contained within the 90-110 kHz band. i.e. The total power outside the 90-110 kHz band shall be 1% or less of the total radiated power; with the energy below 90 kHz no greater than 0.5% and the energy above 110 kHz no greater than 0.5% of the total radiated power;<sup>15</sup>

- 4.26 Our proposed licence schedule containing individual transmitter station information will include information on station locations to a 10-digit (1m resolution) National Grid Reference (NGR), as well as the operational details of each transmitter, including the transmitter power, antenna gain, antenna efficiency, EIRP, and the height of the transmit antenna above the ground/sea level.

## International coordination

- 4.27 eLoran signals are capable of travelling very significant distances. This means they are likely to extend beyond UK borders.
- 4.28 For this reason, we propose to include a condition requiring licensees to take responsibility for ensuring that radio equipment is co-ordinated with other international eLoran systems. Further, they must be operated in compliance with any cross-border coordination and sharing procedures, as may be notified to the licensee by Ofcom from time to time.

## Electromagnetic fields (EMF)

- 4.29 All uses of radio spectrum generate electromagnetic fields (EMF) and there are internationally recognised guidelines to help ensure services operate in a way that will not adversely affect health.
- 4.30 These guidelines are published by the [International Commission for Non-Ionizing Radiation Protection](#) (ICNIRP) and include limits on EMF exposure for the protection of the general public. We refer to these limits as the 'general public EMF limits'.
- 4.31 We propose to include a general condition, already included in most spectrum licences issued by Ofcom, requiring licensees to ensure compliance with the limits in the ICNIRP Guidelines on EMF exposure for the protection of the general public.
- 4.32 More detail is available in our [Guidance on EMF Compliance and Enforcement](#) and our general information on EMF.

## Consultation question

**Question 4:** Do you agree with the technical conditions we propose to include in the new 90-110 kHz licence? Please set out your reasons and provide any relevant evidence.

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<sup>15</sup> Standard 'Occupied Bandwidth' as defined in RR 1.153 of ITU [Radio Regulations \(itu.int\)](#)

## 5. Next steps

- 5.1 We now invite stakeholders to comment on our proposals to introduce a new licence product authorising eLoran services in the 90-110 kHz band. The consultation will remain open until **14 July 2023**.
- 5.2 Once the consultation is closed we will review all the responses we receive. We then plan to publish a statement setting out our decision on whether to proceed with our proposals.
- 5.3 If we decide to proceed with our proposals, we would set out in the statement how any parties wishing to establish eLoran systems transmitting in the UK in the 90-110 kHz spectrum band can apply for a Spectrum Access eLoran Licence.

# A1. Responding to this consultation

## How to respond

- A1.1 Ofcom would like to receive views and comments on the issues raised in this document, by 5pm on 14 July 2023.
- A1.2 You can download a response form from <https://www.ofcom.org.uk/consultations-and-statements/category-2/consultation-spectrum-access-for-eloran-systems-at-90-110-khz>. You can return this by email or post to the address provided in the response form.
- A1.3 If your response is a large file, or has supporting charts, tables or other data, please email it to [Eloranconsultation@ofcom.org.uk](mailto:Eloranconsultation@ofcom.org.uk) as an attachment in Microsoft Word format, together with the [cover sheet](#).
- A1.4 Responses may alternatively be posted to the address below, marked with the title of the consultation:
- eLoran Team  
Ofcom  
Riverside House  
2A Southwark Bridge Road  
London SE1 9HA
- A1.5 We welcome responses in formats other than print, for example an audio recording or a British Sign Language video. To respond in BSL:
- send us a recording of you signing your response. This should be no longer than 5 minutes. Suitable file formats are DVDs, wmv or QuickTime files; or
  - upload a video of you signing your response directly to YouTube (or another hosting site) and send us the link.
- A1.6 We will publish a transcript of any audio or video responses we receive (unless your response is confidential)
- A1.7 We do not need a paper copy of your response as well as an electronic version. We will acknowledge receipt of a response submitted to us by email.
- A1.8 You do not have to answer all the questions in the consultation if you do not have a view; a short response on just one point is fine. We also welcome joint responses.
- A1.9 It would be helpful if your response could include direct answers to the questions asked in the consultation document. The questions are listed at annex 4. It would also help if you could explain why you hold your views, and what you think the effect of Ofcom's proposals would be.
- A1.10 If you want to discuss the issues and questions raised in this consultation, please contact us at [Eloranconsultation@ofcom.org.uk](mailto:Eloranconsultation@ofcom.org.uk).

## Confidentiality

- A1.11 Consultations are more effective if we publish the responses before the consultation period closes. In particular, this can help people and organisations with limited resources or familiarity with the issues to respond in a more informed way. So, in the interests of transparency and good regulatory practice, and because we believe it is important that everyone who is interested in an issue can see other respondents' views, we usually publish responses on [the Ofcom website](#) at regular intervals during and after the consultation period.
- A1.12 If you think your response should be kept confidential, please specify which part(s) this applies to, and explain why. Please send any confidential sections as a separate annex. If you want your name, address, other contact details or job title to remain confidential, please provide them only in the cover sheet, so that we don't have to edit your response.
- A1.13 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and try to respect it. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.
- A1.14 To fulfil our pre-disclosure duty, we may share a copy of your response with the relevant government departments before we publish it on our website. These are the Department for Science, Innovation and Technology, and the Department for Digital, Culture, Media and Sport.
- A1.15 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's intellectual property rights are explained further in our [Terms of Use](#).

## Next steps

- A1.16 Following this consultation period, Ofcom plans to publish a statement. If you wish, you can [register to receive mail updates](#) alerting you to new Ofcom publications.



## Ofcom's consultation processes

- A1.17 Ofcom aims to make responding to a consultation as easy as possible. For more information, please see our consultation principles in annex 2.
- A1.18 If you have any comments or suggestions on how we manage our consultations, please email us at [consult@ofcom.org.uk](mailto:consult@ofcom.org.uk). We particularly welcome ideas on how Ofcom could more effectively seek the views of groups or individuals, such as small businesses and residential consumers, who are less likely to give their opinions through a formal consultation.
- A1.19 If you would like to discuss these issues, or Ofcom's consultation processes more generally, please contact the corporation secretary:

Corporation Secretary  
Ofcom  
Riverside House  
2a Southwark Bridge Road  
London SE1 9HA  
Email: [corporationsecretary@ofcom.org.uk](mailto:corporationsecretary@ofcom.org.uk)

## A2. Ofcom's consultation principles

### Ofcom has seven principles that it follows for every public written consultation:

#### Before the consultation

- A2.1 Wherever possible, we will hold informal talks with people and organisations before announcing a big consultation, to find out whether we are thinking along the right lines. If we do not have enough time to do this, we will hold an open meeting to explain our proposals, shortly after announcing the consultation.

#### During the consultation

- A2.2 We will be clear about whom we are consulting, why, on what questions and for how long.
- A2.3 We will make the consultation document as short and simple as possible, with an overview of no more than two pages. We will try to make it as easy as possible for people to give us a written response.
- A2.4 We will consult for up to ten weeks, depending on the potential impact of our proposals.
- A2.5 A person within Ofcom will be in charge of making sure we follow our own guidelines and aim to reach the largest possible number of people and organisations who may be interested in the outcome of our decisions. Ofcom's Consultation Champion is the main person to contact if you have views on the way we run our consultations.
- A2.6 If we are not able to follow any of these seven principles, we will explain why.

#### After the consultation

- A2.7 We think it is important that everyone who is interested in an issue can see other people's views, so we usually publish the responses on our website at regular intervals during and after the consultation period. After the consultation we will make our decisions and publish a statement explaining what we are going to do, and why, showing how respondents' views helped to shape these decisions.

## A3. Consultation coversheet

### BASIC DETAILS

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

### CONFIDENTIALITY

Please tick below what part of your response you consider is confidential, giving your reasons why

Nothing

Name/contact details/job title

Whole response

Organisation

Part of the response

If there is no separate annex, which parts? \_\_\_\_\_

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If you want part of your response, your name or your organisation not to be published, can Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

### DECLARATION

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those which are marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

Ofcom aims to publish responses at regular intervals during and after the consultation period. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here.

Name

Signed (if hard copy)

## A4. Consultation questions

**Question 1:** Do you agree in principle with our proposal to introduce a new licence product to enable authorisation of the use of the 90-110 kHz band for eLoran services?

**Question 2:** Are you aware of any alternative current or future uses for the 90-110 kHz band, including any which might preclude use of these frequencies for eLoran? If so, please provide details.

**Question 3:** Do you agree with the non-technical conditions we propose to include in the new 90-110 kHz licence? Please set out your reasons and provide any relevant evidence.

**Question 4:** Do you agree with the technical conditions we propose to include in the new 90-110 kHz licence? Please set out your reasons and provide any relevant evidence.

## A5. Draft Spectrum Access eLoran Licence

A5.1 We set out below an indicative draft licence for the deployment of an eLoran system in the 90-110 kHz spectrum band, based on the proposals outlined in this document.

Office of Communications (Ofcom)



Wireless Telegraphy Act 2006

### SPECTRUM ACCESS eLoran LICENCE

Licence no: **xxxxxxx**  
Date of issue: **xx xxxx 20xx**  
Fee payment date **xx xxxx (annually)**

1. The Office of Communications (Ofcom) grants this wireless telegraphy licence ("the Licence") to **xxxxxxxxxx**  
(Company registration number xxxxxxxx)  
("the Licensee")  
**xxxxxxx**  
**xxxxxxx**  
**xxx xxx**

to establish, install and use wireless telegraphy stations and/or wireless telegraphy apparatus as described in the schedules to this Licence (together "the Radio Equipment") subject to the terms set out below.

### Licence Term

2. This Licence shall continue in force until revoked by Ofcom or surrendered by the Licensee.

### Licence Variation and Revocation

3. Pursuant to schedule 1 paragraph 8 of the Wireless Telegraphy Act 2006 ("the Act"), Ofcom may not revoke this Licence under schedule 1 paragraph 6 of the Act except:
  - (a) at the request, or with the consent, of the Licensee;

- (b) if there has been a breach of any of the conditions of this Licence;
  - (c) if, in connection with the transfer or proposed transfer of rights and obligations arising by virtue of the Licence, there has been a breach of any provision of regulations made by Ofcom under the powers conferred by section 30(1) and (3) of the Act<sup>16</sup>;
  - (d) in accordance with schedule 1 paragraph 8(5) of the Act;
  - (e) if it appears to Ofcom to be necessary or expedient to revoke the Licence for the purposes of complying with a direction by the Secretary of State given to Ofcom under section 5 of the Act or section 5 of the Communications Act 2003;
  - (f) for reasons related to the management of the radio spectrum, provided that in such a case the power to revoke may only be exercised after at least three years' notice is given in writing.
4. Where Ofcom exercises its power to revoke or vary the Licence in accordance with schedule 1 paragraph 6 of the Act, the Licensee shall be notified in writing or by a general notice. Any general notices will be posted on the Ofcom website.

### Transfer

5. The Licence may not be transferred. The transfer of rights and obligations arising by virtue of this Licence may however be authorised in accordance with regulations made by Ofcom under powers conferred by section 30 of the Act<sup>17</sup>.

### Changes to Licensee details

6. The Licensee must give immediate notice to Ofcom in writing of any change to the Licensee's name and address from that recorded on the Licence.

### Fees

7. The Licensee shall pay to Ofcom the relevant sums as provided in section 12 of the Act and the regulations made thereunder:
- i) on or before the date of issue of this Licence; and
  - ii) on or before the payment date shown on this Licence for subsequent payments or such other date or dates as shall be notified in writing to the

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<sup>16</sup> These are regulations on spectrum trading.

<sup>17</sup> See Ofcom's website for the latest position on spectrum trading and the types of trade which are permitted.

Licensee, in accordance with those regulations and any relevant terms, provisions and limitations of this Licence.

8. If the Licence is surrendered, revoked or varied, no refund, whether in whole or in part, of any amount which is due under the terms of this Licence, payable in accordance with the Regulations, or provided for in any regulations made by Ofcom under sections 12 and 13(2) of the Act will be made, except at the absolute discretion of Ofcom.

### **Radio Equipment Use**

9. The Licensee shall ensure that the Radio Equipment is established, installed and used only in accordance with the provisions specified in the schedules to this Licence. Any proposal to amend any detail specified in any of the schedules to this Licence must be agreed with Ofcom in advance and implemented only after this Licence has been varied or reissued accordingly.
10. The Licensee shall ensure that the Radio Equipment is operated in compliance with the terms of this Licence and is used only by persons who have been authorised in writing by the Licensee to do so and that such persons are made aware of, and of the requirement to comply with, the terms of this Licence.
11. The Licensee must ensure that all Radio Equipment is established, installed, modified and used only in accordance with the provisions specified in schedule 3 (EMF Licence Condition) of this Licence.

### **Access and Inspection**

12. The Licensee shall permit any person authorised by Ofcom:
  - (a) to have access to the Radio Equipment; and
  - (b) to inspect the Licence and Radio Equipment, at any and all reasonable times or, when in the opinion of that person an urgent situation exists, at any time, to ensure that the Radio Equipment is being used in accordance with the terms of this Licence.

### **Modification, Restriction and Closedown**

13. Any person authorised by Ofcom may require the Radio Equipment or any part thereof, to be modified or restricted in use, or temporarily or permanently closed down immediately if in the opinion of the person authorised by Ofcom:
  - (a) a breach of a term of this Licence has occurred; and/or

- (b) the use of the Radio Equipment is, or may be, causing or contributing to undue interference to the use of other authorised radio equipment.
14. Ofcom may require any of the Radio Equipment to be modified or restricted in use, or temporarily closed down either immediately or on the expiry of such period as may be specified in the event of a national or local state of emergency being declared. Ofcom may only exercise this power after a written notice has been served on the Licensee or a general notice applicable to holders of a named class of licence has been published.

### **Geographical Boundaries**

15. Subject to the requirements of any coordination procedures notified to the Licensee, the Licensee is authorised to establish, install and use the Radio Equipment at the locations listed in, and in accordance with, the schedule(s) to this Licence.

### **Interpretation**

16. In this Licence:
- (a) the establishment, installation and use of the Radio Equipment shall be interpreted as establishment and use of wireless telegraphy stations and installation and use of wireless telegraphy apparatus for wireless telegraphy as specified in section 8(1) of the Act;
  - (b) the expression “undue interference” shall have the meaning given by section 115 of the Act;
  - (c) the expressions “wireless telegraphy station” and “wireless telegraphy apparatus” shall have the meanings given by section 117 of the Act;
  - (d) the schedule(s) form part of this Licence together with any subsequent schedule(s) which Ofcom may issue as a variation to this Licence; and
  - (e) the Interpretation Act 1978 shall apply to the Licence as it applies to an Act of Parliament.

### **Issued by Ofcom**

### **Office of Communications**



**SCHEDULE 1 TO LICENCE NUMBER: xxxxxxxx**

**Licence category: Spectrum Access eLoran Licence**

**Description of Radio Equipment**

1. References in this schedule to the Radio Equipment are references to any wireless telegraphy station or wireless telegraphy apparatus that is established, installed and/or used under this schedule.

**Special conditions relating to the Radio Equipment**

2.
  - (a) The Radio Equipment will operate on a non-interference and non-protected basis. For the avoidance of doubt, this means that the Licensee may not claim protection from and must not cause undue interference to other authorised uses of radio spectrum.
  - (b) The Licensee must ensure that eLoran transmission signal pulses, including the duration between pulses, are designed and operated in a way which will not cause undue interference to eLoran services operated by or on behalf of the UK Government.
  - (c) The radio frequency band authorised by this Licence is shared and must be used in common with other eLoran systems authorised under wireless telegraphy licences granted by Ofcom and together with the Licensee are described as the “eLoran Licensees”.
  - (d) The Licensee must liaise, co-operate and co-ordinate with all eLoran Licensees (if necessary adjusting transmission power and other technical parameters of transmission such as the Group Repetition Interval), such that each eLoran system (comprising the transmitter stations and user terminals) can co-exist and operate without causing undue interference to each other, so that eLoran services can be provided to end users from each eLoran system.
  - (e) The Licensee shall submit to Ofcom in such manner and within such period as specified by Ofcom, any information in relation to the Radio Equipment, or any wireless telegraphy station or wireless telegraphy apparatus which the Licensee is planning to use, as Ofcom may from time-to-time request. Such information may include, but is not limited to, information in relation to the radio frequency, transmitted power and date of first use for wireless telegraphy stations or wireless telegraphy apparatus to be established, installed or used within such timeframe and in such areas as Ofcom may reasonably request.

## Technical conditions

Transmitter(s)	
Permitted Frequency Block	90 – 110 kHz
Centre Frequency	100 kHz
Bandwidth	20 kHz
Class of emission	20K0V1X
Maximum Peak Radiated Power (EIRP):	400 kW (56 dBW)
Transmit signal emission profile	<p>99% or more of the total radiated power must be contained within the 90 - 110 kHz band.</p> <p>The total power outside the 90-110 kHz band shall be 1% or less of the total radiated power. The power below 90 kHz shall be no greater than 0.5% and the power above 110 kHz shall be no greater than 0.5% of the total radiated power.</p>
Transmitter locations	As listed in schedule 2

## Co-ordination at frequency and geographical boundaries

3. The Licensee shall ensure that the Radio Equipment is operated in compliance with the co-operation and co-ordination conditions set out in this schedule and any other co-ordination procedures as may be notified to the Licensee by Ofcom from time to time.

## International cross-border coordination

4. The Licensee shall ensure that the Radio Equipment is co-ordinated with other international eLoran systems to ensure undue interference is not caused and operated in compliance with such cross-border co-ordination and sharing procedures as may be notified to the Licensee by Ofcom from time to time.

## Interpretation of terms in this schedule

5. In this schedule:
  - (a) “non-interference, non-protected” means that no harmful interference may be caused to any radiocommunication services that are entitled to protection and

that no claim may be made for protection of the Radio Equipment against harmful interference originating from authorised uses of radio;

- (b) "Classification of emission" shall have the meaning given in Appendix 1 of the ITU Radio Regulations;
- (c) "dBW" means the power level in decibels (logarithmic scale) referenced against 1 watt (i.e. a value of 0 dBW is 1 Watt);
- (d) "EIRP" means the equivalent isotropically radiated power. This is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain), measured during the "on" part of the transmission;
- (e) "Permitted Frequency Block" means the occupied bandwidth of the eLoran transmission signal within which 99% or more of the total transmitted power must be contained.

**Ofcom**

**SCHEDULE 2 TO LICENCE NUMBER: xxxxxxxx**

**Licence category: Spectrum Access eLoran Licence**

**Base station locations**

6. The Licensee may establish, install and use transmitters in accordance with the following site details:

<b>Station 1</b>	
Name / Address of Transmitter Station Site	
Transmitter Station Location (NGR)	
Antenna Type	
Antenna Gain (dBi)	
Peak Transmitter Power (dBW)	
Antenna Efficiency	
Peak Radiated Power, EIRP (dBW)	
Antenna height above ground level (or mean sea level if offshore) (m)	
Ground height (amsl)	

[Repeat table for subsequent sites etc]

**SCHEDULE 3 TO LICENCE NUMBER: xxxxxxxx**

**EMF Licence Condition**

**Schedule Date:** **xx xxxx 202x**

**Licence category:** **Spectrum Access eLoran Licence**

**Sites which are not shared with another Licensee**

1. The Licensee shall only establish, install, modify or use Relevant Radio Equipment if the total electromagnetic field exposure levels produced by the Licensee's On-Site Radio Equipment do not exceed the basic restrictions<sup>18</sup> in the relevant tables for general public exposure identified in the ICNIRP Guidelines<sup>19</sup> in any area where a member of the general public is or can be expected to be present when transmissions are taking place.

**Sites which are shared with another Licensee**

2. In the case of a shared site where the Shared Site Exemption applies to the Licensee, the Licensee shall comply with paragraph 1 above.
3. In the case of a shared site where the Shared Site Exemption does not apply to the Licensee, the Licensee shall only establish, install, modify or use the Relevant Radio Equipment if:
  - a) the total electromagnetic field exposure levels produced by the Licensee's On-Site Radio Equipment, together with
  - b) the total electromagnetic field exposure levels produced by all other wireless telegraphy stations and wireless telegraphy apparatus operated by another Licensee on the same site for which the Licensee can reasonably assume that a Shared Site Exemption does not apply,

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<sup>18</sup> Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.

<sup>19</sup> The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".

do not exceed the basic restrictions<sup>20</sup> in the relevant tables for general public exposure identified in the ICNIRP Guidelines<sup>21</sup> in any area where a member of the general public is or can be expected to be present when transmissions are taking place.

### Emergency Situations

4. The obligations in paragraphs 1, 2 and 3 above will not apply if the Relevant Radio Equipment is being used for the purpose of seeking emergency assistance or reporting and responding to an emergency situation (in the vicinity of that situation) including for search and rescue activities and maritime emergency communications<sup>22</sup>.

### Relationship with authorised transmission levels

5. The Licensee shall comply with paragraphs 1, 2 and 3 above notwithstanding the maximum transmission levels authorised in the Licence.

### Records

6. The Licensee shall keep, or shall procure that a third party shall keep, and shall make available to Ofcom on request, records (including the type of records identified in Ofcom's "Guidance on EMF Compliance and Enforcement") that demonstrate how it has complied with paragraphs 1, 2 and 3 above when Relevant Radio Equipment is established, installed, modified or used.

### Ofcom's "Guidance on EMF Compliance and Enforcement"

7. When evaluating its compliance with paragraphs 1, 2 and 3 above, the Licensee shall take into account Ofcom's "Guidance on EMF Compliance and Enforcement" that is in force at the relevant time.

### Interpretation

8. In this schedule:
  - (a) "dBi" means the ratio in dB (decibel) when comparing the gain of the antenna to the gain of an isotropic antenna. An isotropic antenna is a theoretical antenna which radiates power uniformly in all directions;
  - (b) "EIRP" means equivalent isotropically radiated power which is the product of the power supplied to an antenna and the absolute or isotropic antenna gain in a given direction relative to an isotropic antenna;

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<sup>20</sup> Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.

<sup>21</sup> The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".

<sup>22</sup> Further information on emergency situations is set out in Ofcom's "Guidance on EMF Compliance and Enforcement".

- (c) “**ERP**” means effective radiated power which is the product of the power supplied to an antenna and its gain in a given direction relative to a half-wave dipole;
- (d) “**general public**” means any person who is not: (a) the Licensee, owner, operator or installer of the Relevant Radio Equipment; or (b) acting under a contract of employment or otherwise acting for purposes connected with their trade, business or profession or the performance by them of a public function;<sup>23</sup>
- (e) “**ICNIRP Guidelines**” means the version of the Guidelines published by the International Commission on Non-Ionizing Radiation Protection for limiting exposure to electromagnetic fields which are identified in Ofcom’s “Guidance on EMF Compliance and Enforcement” that is in force at the relevant time.<sup>24</sup>
- (f) “**Licensee’s On-Site Radio Equipment**” means the Relevant Radio Equipment and any other wireless telegraphy station(s) and wireless telegraphy apparatus on the same site which transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP.<sup>25</sup>
- (g) “**Relevant Radio Equipment**” means all the Radio Equipment that is authorised by this Licence to transmit at powers higher than 10 Watts EIRP or 6.1 Watts ERP.
- (h) “**Shared Site Exemption**” means any of the following three situations apply on a shared site in relation to the Licensee’s or another Licensee’s wireless telegraphy station(s) or wireless telegraphy apparatus that is authorised to transmit at powers higher than 10 Watts EIRP or 6.1 Watts ERP:

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<sup>23</sup> There is pre-existing health and safety legislation which already requires employers to protect workers from exposure to electromagnetic fields (“EMF”) including the following legislation specifically relating to EMF (as amended from time to time): [The Control of Electromagnetic Fields at Work Regulations 2016](#), [The Control of Electromagnetic Fields at Work Regulations \(Northern Ireland\) 2016](#) and [The Merchant Shipping and Fishing Vessels \(Health and Safety at Work\) \(Electromagnetic Fields\) Regulations 2016](#).

<sup>24</sup> Ofcom’s “Guidance on EMF Compliance and Enforcement” will initially require the Licensee to comply with the ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz), published in: Health Physics 74(4):494-522, dated April 1998 and available at: <https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf> (“1998 Guidelines”) or the ICNIRP Guidelines for limiting exposure to electromagnetic fields (100 kHz to 300 GHz), published in: Health Physics 118(5): 483–524; 2020 and available at: <https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf> (“2020 Guidelines”). However, once work on the relevant standards explaining the methodology for assessing compliance with the 2020 Guidelines has progressed sufficiently, Ofcom will publish a public consultation on updating its “Guidance on EMF Compliance and Enforcement” to explain that going forward Ofcom will be requiring the Licensee to comply with the 2020 Guidelines only. Following this public consultation, Ofcom will publish an updated version of Ofcom’s “Guidance on EMF Compliance and Enforcement” on its website. Ofcom will follow the same process for any subsequent versions of the ICNIRP Guidelines.

<sup>25</sup> 10 Watts EIRP is equivalent to 6.1 Watts ERP. In linear units  $EIRP (W) = 1.64 \times ERP (W)$ ; in decibels  $EIRP (dB) = ERP (dB) + 2.15$ . Ofcom’s “Guidance on EMF Compliance and Enforcement” explains how the Licensee can determine if wireless telegraphy station(s) or wireless telegraphy apparatus “transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP”.

- The first situation is that all of the Licensee’s wireless telegraphy station(s) or wireless telegraphy apparatus on a shared site do not transmit at a combined total radiated power in any particular direction<sup>26</sup> that is higher than 100 Watts EIRP or 61 Watts ERP;<sup>27</sup>
  - The second situation is that the total electromagnetic field exposure levels produced by the Licensee’s wireless telegraphy station(s) or wireless telegraphy apparatus in any area where a member of the general public is or can be expected to be present when transmissions are taking place is no more than 5% of the basic restrictions or 5% of the reference levels in the relevant tables for general public exposure identified in the ICNIRP Guidelines;<sup>28</sup>
  - The third situation is where the Licensee’s wireless telegraphy station or wireless telegraphy apparatus has an antenna gain that is equal to or higher than 29 dBi and has a fixed beam;
- (i) “**shared site**” means a site that is shared by the Licensee and at least one other Licensee for the purposes of establishing, installing, modifying or using wireless telegraphy stations or wireless telegraphy apparatus;
- (j) “**site**” means a physical structure, building, vehicle or moving platform;
- (k) “**wireless telegraphy apparatus**” has the meaning given to it in section 117 of the Wireless Telegraphy Act 2006; and
- (l) “**wireless telegraphy station**” has the meaning given to it in section 117 of the Wireless Telegraphy Act 2006.

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<sup>26</sup> For the purpose of this situation, the combined total radiated power is a simple sum of the radiated powers (in EIRP or ERP) of all of the licensee’s wireless telegraphy station(s) or wireless telegraphy apparatus on the shared site that transmits signals covering the same or overlapping areas.

<sup>27</sup> 100 Watts EIRP is equivalent to 61 Watts ERP.

<sup>28</sup> The relevant tables for general public exposure are identified in Ofcom’s “Guidance on EMF Compliance and Enforcement”.