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General Notice of Final Decision on variation of radiocommunications licences to require compliance with international guidelines for limiting exposure to electromagnetic fields (EMF)

Publication Date: 18 May 2021

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Section

Annex

General Notice of Final Decision on Variation of radiocommunications licences

1.1 On 1 March 2021, we notified licensees of a proposal to vary radiocommunications licences to include a new licence condition. This new licence condition would require licensees to comply with international guidelines for limiting exposure to electromagnetic fields (EMF) for the protection of the general public. This document sets out our final decision relating to that proposal. **It contains important information and licensees should read it carefully.**

What we have decided – in brief

We have decided to proceed with our proposal and vary licences to include a new licence condition requiring licensees to comply with international guidelines for limiting exposure to EMF for the protection of the general public. We have also decided to require licensees to keep records demonstrating how they comply.

We have however listened to licensees' concerns and have decided to make some changes to the licence condition and our "Guidance on EMF Compliance and Enforcement". These changes provide further clarity and reduce the impact on licensees.

Alongside this decision, we have published on our website:

- an updated version of our "Guidance on EMF Compliance and Enforcement";
- an updated version of our EMF compliance flowchart; and
- a new shared site compliance flowchart.

We will also shortly publish on our website:

- an updated version of our online calculator tool;
- an updated version of our more simplified form of the guidance;
- an updated version of our additional guidance for ship radio licensees;
- an updated version of our additional guidance for amateur radio licensees; and
- new additional guidance for aeronautical radio licensees.

Licensees will need to comply with the new rules by:

- 18 November 2021 if they are using frequencies at or above 110 MHz;
- 18 May 2022 if they are using frequencies above 10 MHz but below 110 MHz;
- 18 November 2022 if they are using frequencies at or below 10 MHz.

1.2 This document is our final decision in relation to all the licence classes identified in Table 1 below and varies all licences[1] in those licence classes to include a new licence condition relating to EMF. We refer to the new licence condition as the "**EMF licence condition**".

1.3 We will shortly be writing to affected licensees to inform them of this final decision. We will include a replacement/update for their current licence, or explain where a replacement/update can be obtained.

1.4 This document sets out the background to our final decision; explains why we have made this decision; and describes what this means for affected licensees. This document also contains the following three annexes:

a) Annex A1 summaries the comments we received from licensees in response to our proposal and sets out our responses.

b) Annex A2 sets out the final version of the EMF licence condition showing the changes we have made to our proposed licence condition in 'tracked'.

c) Annex A3 summaries the comments we received in relation to the wording of the terms and conditions of the amateur licence that are unrelated to EMF and sets out our responses.

Background

1.5 In February and October last year, we issued two separate public consultations on our proposal to formally require licensees to comply with internationally agreed levels for limiting exposure to electromagnetic fields (**EMF**) for the protection of the general public. These internationally agreed levels are set out in Guidelines published by the International Commission on Non-Ionizing Radiation Protection (**ICNIRP**), a non-profit independent scientific organisation formally recognised by the World Health Organization and set up specifically to investigate possible adverse health effects from non-ionising radiation.

1.6 For simplicity, we refer to the internationally agreed levels in the ICNIRP Guidelines for limiting exposure to EMF for the protection of the general public as the **"general public EMF limits**".

1.7 In October 2020, we issued a Statement setting out our decision to require licensees to comply with the general public EMF limits (**October 2020 Statement**). This Statement explained the reasons for our decision. It explained that we intended to require licensees to comply with the general public EMF limits by varying licences to include a new licence condition relating to EMF. This Statement included draft "Guidance on EMF Compliance and Enforcement" to help licensees comply with the proposed new EMF licence condition.

[1] We refer to these licences as radiocommunications licensees, spectrum licences or Wireless Telegraphy Act licences.

Alongside this Statement, we also published a trial version of our EMF calculator to help licensees comply.

1.8 On 1 March 2021, we published an Update on our proposed new EMF licence condition (**March 2021 Update**). We also published an updated version of our "Guidance on EMF Compliance and Enforcement" and EMF calculator.

1.9 Alongside this update on 1 March 2021, we started the formal process of varying licences to include the new EMF licence condition. We did this by publishing a General Notice of our proposal to vary licences on our website (**March 2021 Notice**).

1.10 On 11 March 2021, we also published draft versions of simplified guidance as well as additional targeted guidance for (i) maritime (including ship) radio licensees and (ii) amateur radio licensees.

Proposal to Vary

1.11 Before we vary licences, we are required by law to first notify licensees of our proposal. We did this by publishing the March 2021 Notice on our website. We also contacted affected licensees to let them know we had published the March 2021 Notice.

1.12 The March 2021 Notice set out the relevant background and explained that we were proposing to vary the terms and conditions of all licence classes identified in the March 2021 Notice to include a new licence condition relating to EMF. The March 2021 Notice identified the proposed changes and explained that the proposed EMF licence condition will require licensees to (i) comply with the general public EMF limits; and (ii) keep records to demonstrate how they have complied.

1.13 We explained that the new EMF licence condition will only apply to licences that currently allow equipment to transmit at power levels in excess of 10 Watts EIRP (or 6.1 Watts ERP).

1.14 The March 2021 Notice also explained the licence variation process, including how licensees could make representations or provide comments to Ofcom in response to our proposal.

1.15 We also published on our website information on our EMF policy, EMF calculator and "Guidance on EMF Compliance and Enforcement" as well as various questions and answers to help licensees understand how our proposal would impact them.

1.16 Licensees had until 18 April 2021 to provide any representations to Ofcom.

Summary of representations

1.17 We received nearly 70 representations in response to our March 2021 Notice. The representations fell into the following broad categories:

a) Representations raising no objections to our proposal but commenting on specific drafting points relating to how we proposed varying licences to include the new EMF licence condition.

b) Representations that disagreed with our policy proposal to require licensees (or specific licence classes) to comply with the general public EMF limits.

c) Representations relating to how we expect licensees (or specific licence classes) to comply with the new EMF licence condition.

d) Representations relating to the process we have followed to vary licences to include the new EMF licence condition, in particular from aeronautical radio licensees.

1.18 We have summarised in more detail in Annex A1 to this document the representations we received and our responses. Whilst many representations provided valuable feedback on our proposed EMF licence condition, many raised issues that have previously been raised in response to the public consultation processes we carried out in February and October 2020. We have nonetheless considered all the representations we received in response to the March 2021 Notice. We have indicated in Annex A1 where we have addressed the relevant points previously.

Final Decision

1.19 We have concluded that no significant new argument or evidence has been presented that might result in us deciding not to vary any licences to include a new EMF licence condition.

1.20 The responses to our March 2021 Notice have confirmed to us that some licensees may not (i) be fully aware of the general public EMF limits and may not be fully taking EMF exposure levels into account when installing, using or modifying radio equipment; or (ii) have appropriate processes in place to monitor EMF exposure levels and ensure compliance with the EMF limits on an ongoing basis.

1.21 We continue to believe that the general public should be protected from EMF exposure from whatever radiocommunications source. We also continue to believe that requiring licensees that are allowed to transmit at power levels in excess of 10 Watts EIRP (or 6.1 Watts ERP) to comply with the general public EMF limits - and keep records demonstrating their compliance - is a necessary, justified and proportionate intervention that will ensure licensees operate services which will not adversely affect peoples' health.

1.22 We have therefore decided to proceed with our proposal and vary all radiocommunications licences in licence classes that allow equipment to transmit at power levels in excess of 10 Watts EIRP (or 6.1 Watts ERP) to include a new EMF licence condition.

1.23 We provide further reasons for our decision in paragraphs A1.8 – A1.21 below and the licence classes affected by this final decision are set out in Table 1 below.

1.24 Listening to licensees' concerns we have, however, decided to make some changes to our licence condition and our "Guidance on EMF Compliance and Enforcement". These changes provide further clarity to licensees and reduce the impact of our EMF licence condition. We have explained these changes in Annex A1 to this decision. The key changes are as follows:

a) We have confirmed that licensee's will not need to carry out an EMF assessment and comply with the general public EMF limits if they (i) do not transmit at an average power higher than 10 Watts EIRP or 6.1 Watts ERP; and (ii) do not transmit at a peak power higher than 100 Watts EIRP or 61 Watts ERP. Where licensees do need to carry out an EMF assessment, we have also confirmed that they can take into account the average power of their equipment. We have explained this change in more detail in paragraphs A.1.67 – A.1.74 below.

b) We have decided to allow licensees operating equipment at frequencies below 110 MHz an additional 6 months to comply with the new EMF licence condition. We explain this change in more detail in paragraphs 1.40 – 1.41 and A1.84 – A1.90 below.

1.25 In summary, our final decision is to proceed with the proposal set out in our March 2021 Notice but with a few amendments to the specific wording of the new EMF licence condition and our "Guidance on EMF Compliance and Enforcement".

The new EMF licence condition

1.26 We have included in Annex A2 a final version of the EMF licence condition ('tracked' against the March 2021 Notice version) that will be inserted into the terms and conditions of licences in the licence classes identified in Table 1 below.

1.27 In summary, the new EMF licence condition:

a) includes a new set of definitions relating to the EMF licence condition;

b) imposes a requirement on licensees to ensure their equipment complies with the general public EMF limits on (i) sites not shared with other licensees; and (ii) where applicable, sites shared with other licensees;

c) sets out an exemption where licensees are not required to comply with the general public EMF limits in emergency situations;

d) imposes a requirement to keep records demonstrating compliance with the EMF licence condition; and

e) imposes a requirement to take into account Ofcom's "Guidance on EMF Compliance and Enforcement".

Licence classes affected by this final decision

1.28 This final decision applies to all the licence classes identified below.

Table 1 – Licence classes affected by this final decision

Business Radio
Business Radio Technically Assigned
Area Defined
GSM-R

Police and Fire
Public Safety Radio (Emergency Services)
Suppliers light
Maritime
Ship Radio
Coastal Station Radio, International, UK and Marina
Coastal Station Radio UK and International Area Defined
Coastal Station Radio (Search and Rescue)
Automatic Identification Systems (AIS)
Differential Global Position System (DGPS)
Maritime Navigational Aids and Radar
Maritime Radio (Suppliers and Demonstration)
Amateur
Foundation
Intermediate
Full (including Club licences)
Fixed
Point to Point Fixed Links
Scanning Telemetry
Satellite
Satellite (Earth Station Network)
Satellite (Earth Station —Non-Fixed Satellite Service)
Satellite (Earth Station —Non-Geostationary)
Satellite Permanent and Transportable Earth Stations
Broadcasting
Sound broadcasting licences (local and national)
Isle of Man Sound broadcasting licences (local and national)
BBC Sound broadcasting licences (local and national)
Digital radio multiplex licences (local and national)
SSDAB multiplex licences (including trial licences)

Digital television multiplex licences (local, national and geographically interleaved)
Community radio licences
Long-term restricted service licences
Aeronautical
Aircraft – Tiers A, B, C & Transportable
All Aeronautical Station and Aeronautical Ground Station licences covering including A/G, AFIS and Tower, ACARS, Aerodrome Surface and Operational Control, Aeronautical Broadcast, Approach, Area Control, Fire and Emergency, Offshore, Recreational Aviation, General Aviation & VDL
Aeronautical Navigation Aid Stations
Aeronautical Radar

Variation of licences

1.29 In accordance with our final decision, this General Notice has varied all the licence classes identified in Table 1 above to include the new EMF licence condition. Licences have been varied in the manner set out below:

a) For **Amateur Radio Licences**, we have included the new EMF licence condition as a new Schedule in an updated version of the Amateur Radio Licence Terms & Conditions booklet which we have published here: https://www.ofcom.org.uk/__data/assets/pdf_file/0015/214116/emf-amateur-licence-terms-and-conditions.pdf

b) For **Ship Radio Licences**, we have included the new EMF licence condition as a new Schedule in an updated version of the Ship Radio Licence Terms & Conditions booklet which we have published here: https://www.ofcom.org.uk/__data/assets/pdf_file/0017/214118/emf-ship-licence-terms-and-conditions.pdf

c) For **Aircraft Radio Licences** (Tiers A, B, C & Transportable), we have included the new EMF licence condition as a new Schedule to the licence.

d) For **Aeronautical Ground Station Radio Licences**, we have included the new EMF licence condition as a new Schedule to the licence.

e) For **Broadcast Licences**, we have included the new EMF licence condition in the relevant licence conditions.

f) For all other licences identified in Table 1 above above (**Business Radio, Fixed, Maritime and Satellite**), we have included the new EMF licence condition as a new section in an updated version of the General Licence Conditions Booklet (version OfW597) which has replaced the current version (OfW195.1). We have varied licences

to include a reference to the updated version of the General Licence Conditions booklet which we have published here: https://www.ofcom.org.uk/__data/assets/pdf_file/0016/214117/emf-glc-licence-conditions-booklet.pdf

1.30 We have also made some minor edits to licences. These are administrative changes including updates to references to legislation and the removal of other out-of-date information. We have set out in Annex A3 our responses to representations we received on the terms and conditions amateur licence that are unrelated to EMF.

1.31 These licence variations come into effect immediately i.e. on 18 May 2021.

Compliance with the new EMF licence condition

1.32 As noted above, all licensees holding a licence in one of the licence classes identified in Table 1 above have now had their licence varied to include the new EMF licence condition.

1.33 However, not all licensees will need to take action to ensure compliance with the new EMF licence condition. Licensees should take into account Ofcom's "Guidance on EMF Compliance and Enforcement" when assessing whether they need to take any action and, if so, what action they need to take.

1.34 Licensees do not need to take any action to comply with the new EMF licence condition in any of the following scenarios:

a) Their licence does not currently allow them to transmit at power levels in excess of 10 Watts EIRP or 6.1 Watts ERP.

b) They are no longer using their radio equipment.

c) They do not transmit at powers levels higher than 10 Watts EIRP or 6.1 Watts ERP. We explain how licensees can calculate the EIRP or ERP of their equipment in Section 6 of our "Guidance on EMF Compliance and Enforcement".

d) They only ever use their radio equipment in emergency situations. We explain what we mean by an emergency situation in Section 13 of our "Guidance on EMF Compliance and Enforcement".

1.35 In the following scenarios licensees will not need to carry out an EMF assessment but will need to hold appropriate EMF records demonstrating their compliance with the EMF condition:

a) The licensee has calculated that they (i) do not transmit at an average power higher than 10 Watts EIRP or 6.1 Watts ERP; and (ii) do not transmit at a peak power higher than 100 Watts EIRP or 61 Watts ERP. We explain how licensees can calculate their average power in Section 6 of our "Guidance on EMF Compliance and Enforcement" and they can use our EMF calculator to do this.

b) The licensee has previously carried out an EMF assessment and is satisfied their equipment already complies with the general public EMF limits.

1.36 In all other scenarios, licensees will need to carry out an EMF assessment and ensure they comply with the general public EMF limits. They will also need to keep appropriate records confirming they comply.

1.37 Section 6 our "Guidance on EMF Compliance and Enforcement" now includes further guidance on how to calculate EIRP/ERP and average power; the scenarios in which licensees do not need to carry out an EMF assessment; and the types of EMF assessments licensees can carry out in. Section 12 of our "Guidance on EMF Compliance and Enforcement" now contains a list of scenarios where an EMF record is not required as well as guidance on the types of records we would accept.

1.38 To help licensees comply with the new EMF licence condition, we have published on our website alongside this decision:

- an updated version of our "Guidance on EMF Compliance and Enforcement";
- an updated EMF compliance flowchart to help licensees work out if they need to carry out an EMF assessment (and if they do need to carry out an EMF assessment, to help them work out how to comply); and
- a new EMF shared site compliance flowchart to help licensees comply where they share a site with another licensee.

1.39 We will also shortly publish on our website:

- an updated version of our online calculator tool;
- an updated version of our simplified guidance;
- an updated version of our additional guidance for ship radio licensees (previously referred to as additional guidance for maritime radio users);
- an updated version of our additional guidance for amateur radio licensees; and
- new additional guidance for aeronautical radio licensees.

Time periods for compliance

1.40 We have decided to allow licensees operating equipment at frequencies below 110 MHz, an additional 6 months to ensure compliance. Licensees now have the following time periods to ensure that they have up-to-date records in place for which demonstrate how they comply with the new EMF licence condition:

a) Until 18 November 2021 for any equipment which operates on frequencies at or above 110 MHz.

b) Until 18 May 2022 for any equipment which operates on frequencies above 10 MHz but below 110 MHz.

c) Until 18 November 2022 for any equipment which operates on frequencies at or below 10 MHz.

1.41 During this time Ofcom may still carry out routine compliance checks and request access to a licensee's EMF compliance records. If the licensee does not currently have any records then, if requested, the licensee will need to provide evidence to Ofcom that the site is compliant with general public EMF limits within a period of 20 calendar days. We only expect to request records during this period if we discover radio installations that we consider are likely to be in breach of the general public EMF limits. Provided the licensee cooperates with Ofcom's request and takes any necessary steps to ensure the site is compliant, we are unlikely to take enforcement action and impose a financial penalty or other sanctions on a licensee during this time.

Next Steps

1.42 We will shortly be writing to affected licensees to inform them of this final decision. We will include a replacement/update for their current licence, or explain where a replacement/update can be obtained.

1.43 As explained in the March 2021 Notice, in future we intend to make greater use of General Notices published on our website and may not individually contact licensees to inform them of publication. We therefore urge all licensees to subscribe to email spectrum updates using the following link https://www.ofcom.org.uk/about-ofcom/latest/email-updates.

1.44 For all other affected licences where Ofcom is not permitted to vary a licence by issuing a General Notice, we will be contacting licensees directly setting out our final decision in relation to those other licences.

Legal Requirements

1.45 This document is a General Notice that gives notice of our final decision to all the licence classes identified in Table 1 above. It has been issued in accordance with paragraphs 6, 6A and 7 of Schedule 1 of the Wireless Telegraphy Act 2006 (the Act) and the terms and conditions applicable to all the licence classes identified in Table 1 above. In particular:

a) Paragraph 6(b) of Schedule 1 of the Act and the terms and conditions of all the licence classes identified above allow Ofcom to vary licences by publishing a General Notice on its website.

b) For the reasons set out in paragraphs 1.19 – 1.25 above, Annex A1 below (in particular paragraphs A1.8 - A1.21) and paragraphs 5.226 – 5.236 of our October 2020 Statement, we consider our EMF licence condition to be objectively justifiable and proportionate, non-discriminatory and transparent in accordance with the requirements in section 9(7) and paragraph 6A of Schedule 1 of the Act.

c) This General Notice constitutes our final decision in accordance with the requirements in paragraph 7(10) and (11) of Schedule 1 of the Act; it gives notice of our final decision to affected licensees, explains the reasons for our decision and varies all licences affected by this decision.

A1 Representations on EMF licence condition

General

Summary of representations

A1.1 Various licensees indicated that they were happy to comply with the proposed EMF licence condition and understood why Ofcom had proposed to require the vast majority of licensees to comply with the general public EMF limits. Some of these licensees made comments on the specific drafting of the licence condition but did not object to our proposals.

A1.2 However, some licensees – largely those from the amateur, maritime and aeronautical community – suggested our proposals were complex, disproportionate, unjustified and unnecessary. Some licensees suggested that we had not properly addressed previous concerns raised in relation to the impact of our EMF licence condition and that we should delay varying licences until those concerns had been addressed. It was suggested that compliance will impose an administrative and potentially costly burden on licensees, and some may not be able to afford to comply (for example, due to the cost of moving an antenna or instructing a radiocommunications industry expert).

A1.3 Some licensees noted that equipment is already checked by manufacturers and suggested that the only way to ensure compliance with the general public EMF limits is to set the limits at the manufacturing level; professional companies (who understand the technology) could then manufacture equipment to comply with the legal limits and offer guarantees to the end users.

A1.4 Some licensees suggested that it is inconsistent with good legislative practice to incorporate the limits in the ICNIRP Guidelines – which HSE interpreted as appropriate guidance – into formal licence guidance proposals. They said our proposals were in response to public concerns around 5G and mobile sites and should only apply to commercial licensees.

A1.5 It was suggested that many licensees have been operating without any evidence of harm or other issues for many years and queried what evidence of harm we have to justify intervening now. Some suggested we were creating extra work with no benefit. Others suggested any issues relating to EMF exposure may instead be caused by poorly made foreign electrical items, electrical cables and plasma TVs.

A1.6 Some licensees expressed concerns that they and other licensees (e.g. maritime, aeronautical and private mobile radio/PMR users) had no technical knowledge that would enable them to comply and that they did not understand the requirements or our guidance documents. It was suggested that our proposals were unclear and unworkable. Some suggested any changes should be more light touch.

A1.7 One licensee suggested that we should not be referring to electromagnetic fields (EMF) and should instead be referring to electro-magnetic radiation (non-ionising) or “EMrad”.

Our response

A1.8 We note that the vast majority of licensees either supported our proposed EMF licence condition or did not respond to our March 2021 Notice. We recognise the strong feelings of the small number of licensees who objected to our proposed EMF licence condition. Whilst we have considered all the comments we received, we note that many of the issues raised are the same or similar to those which we have previously considered and addressed in our October 2020 Statement and March 2021 Update.

A1.9 We have previously explained the reasons why we consider our EMF licence condition to be necessary, justified and proportionate, taking into account the risks we have identified and the gap in the current regulatory framework (see, for example, paragraphs 1.1 – 1.12, Section 4 and paragraphs 5.226 – 5.236 of our October 2020 Statement and paragraphs 2.1 – 2.11 and 4.41 – 4.54 of our March 2021 Update).

A1.10 In summary:

a) The ICNIRP Guidelines set internationally recognised limits on EMF exposure levels for the protection of the general public. These limits apply to all uses of radio equipment and it is an important principle that the general public should be protected from EMF exposure from whatever radiocommunications source.

b) All manufacturers, installers and users of the radio spectrum should already be aware of the ICNIRP Guidelines and be taking EMF exposure into account when using their equipment.

c) However, we identified a risk – and responses to our consultations have confirmed – that some spectrum users (licensees) may not be fully aware of the ICNIRP Guidelines and may not be fully taking EMF exposure levels into account when installing, using or modifying radio equipment. Some spectrum users may also not have appropriate processes in place to monitor EMF exposure levels and ensure compliance with the general public EMF limits on an ongoing basis.

d) Current regulatory regimes on EMF exposure – including current rules applicable to manufacturers, planning processes and workers – do not formally require spectrum users to comply with the general public EMF limits i.e. there is currently no legal requirement in the UK for spectrum users to comply with the general public EMF limits.

e) Neither Ofcom nor any other body is therefore currently in a position where it could take appropriate enforcement action in the event the general public EMF limits are breached.

f) As the organisation that authorises spectrum use, and has expertise in measuring EMF levels, we are well placed to help ensure spectrum users operate services which will not adversely affect peoples' health.

A1.11 We have concluded that no significant new argument or evidence has been presented that might result in us deciding to change our overall policy and not vary licences to include the new EMF licence condition. We continue to believe that our overall policy decision to vary

radiocommunications licences and require the vast majority of licensees to comply with the general public EMF limits is a necessary, justified and proportionate intervention that will ensure spectrum users operate services which will not adversely affect peoples' health.

A1.12 We acknowledge that we have seen no evidence that spectrum users are operating radio equipment in breach of general public EMF limits or causing harm to the general public. It does not however follow that our intervention is not justified. We believe the general public should be protected from the specific risk of EMF exposure.

A1.13 In the UK, Public Health England (PHE) takes the lead on public health matters associated with EMF and has a statutory duty to provide advice to Government on any health effects that may be caused by EMF exposure. PHE's main advice is that EMF exposure should comply with the Guidelines published by ICNIRP (i.e. the general public EMF limits).

A1.14 We do not agree that EMF risks can be appropriately addressed by only imposing obligations on manufacturers. Regardless of the steps a manufacturer takes to mitigate EMF risks, it is the user or operator of the equipment that is ultimately in control of how the equipment operates and any EMF levels that are produced by the equipment on an ongoing basis.

A1.15 We have therefore decided to proceed with our proposal and vary all radiocommunications licences in licence classes that authorise equipment to transmit at power levels in excess of 10 Watts EIRP (or 6.1 Watts ERP) to include a new EMF licence condition.

A1.16 Our focus is on ensuring that the specific requirements we are placing on licensees are proportionate to the risks we have identified. Throughout our consultation processes, we have considered how we can implement our EMF licence condition in a way that minimises any impact on licensees whilst ensuring licensees operate services which will not adversely affect peoples' health.

A1.17 In doing so, we have made various amendments, clarifications and refinements to our EMF licence condition and guidance documents[2] to reflect the comments received to date and minimise the potential impact on licensees (see, for example, paragraphs 5.6 – 5.28 and 5.221 – 5.225 of our October 2020 Statement and paragraphs 4.216 – 4.221 of our March 2021 Update). We discuss the various steps we have taken to reduce the impact on amateur, maritime and aeronautical radio licensees in paragraphs A.1.95 – A.109 (amateur), A.1.110 – A.129 (maritime) and A.1.130 – A.1.146 (aeronautical) below.

A1.18 We have also published an EMF calculator and flowchart to help licensees comply as well as simplified guidance and additional guidance for amateur and maritime radio licensees. These documents are intended to provide clear and user-friendly guidance containing practical use examples tailored to specific licence classes. They are intended to assist

[2] For simplicity, we refer to our "Guidance on EMF Compliance and Enforcement" as well as our simplified guidance and additional targeted guidance for (i) amateur radio licensees; (ii) ship radio licensees; and (iii) aeronautical licensees collectively as our "**guidance documents**". Where we refer in this Annex to updating our guidance documents, we have updated one or more of our guidance documents as considered appropriate depending on the context.

licensees who may have less technical knowledge and provide simple and straightforward ways in which they can comply (for example, for licensees that do not transmit above 10 Watts EIRP or 6.1 Watts ERP).

A1.19 As explained throughout this Annex, we have now decided to make further changes to our EMF licence condition, guidance documents, calculator and flowchart which will further reduce the burden on licensees and provide additional clarity and guidance. For example:

a) We have added new sub-sections to Section 6 of our "Guidance on EMF Compliance and Enforcement" to explain how licensees can calculate their EIRP/ERP and average power.

b) We have added a new page on our website to help some licensees work out the maximum power allowed under their licence.

c) We have added the ability in our EMF calculator to enter the power in ERP (in addition to EIRP) and calculate average power.

d) We have amended Section 6 of our "Guidance on EMF Compliance and Enforcement" to identify circumstances when an EMF assessment is not required and published a revised flowchart to help licensees work out when they do not need to carry out an EMF assessment (and if they do, to help them work out how to comply).

e) We have added a new sub-section to Section 12 of our "Guidance on EMF Compliance and Enforcement" to identify circumstances when licensees are not required to hold an EMF record.

f) We have published a new flowchart to help licensees comply when they share a site with another licensee.

g) We will shortly publish updated versions of our additional guidance for (i) amateur radio licensees; and (ii) ship radio licensees.

h) We will shortly publish a new simplified guidance document targeted at aeronautical radio users.

A1.20 Taking into account all the comments we have received to date, as well as all the amendments, refinements and clarifications we have made to our EMF licence condition, guidance documents, calculator and flowcharts, we do not believe that our licence condition will impose an unreasonable or costly burden on licensees.

A1.21 In any event, we will continue to work with stakeholders over the coming months to ensure our guidance documents are and remain clear and user-friendly for different types of licensee. We may also provide an additional EMF calculator with extra functionality at a later date and will provide any updates on this on the EMF section of our website. If considered necessary, we may also publish additional simplified guidance documents targeted at other sectors in the future.

A1.22 We do not agree with the suggestion that we should refer to electro-magnetic radiation (non-ionising) or "EMrad" instead of EMF. We consider EMF to be a widely understood term and is used by numerous regulatory and industry bodies including PHE and ICNIRP.

A1.23 It is important to note that the EMF licence condition will apply to licences we issue under the Wireless Telegraphy Act 2006. These licences relate to the use of wireless telegraphy stations and apparatus (or radiocommunications equipment). We do not have powers to issue licences in relation to the use of non-radiocommunications electrical items and any EMF produced by such equipment is outside the scope of this project.

Scope of EMF licence condition

Summary of representations

A1.24 Some licensees objected to the variation of their licence on the basis the transmission power of their radio equipment is below 10 Watts EIRP (or 6.1 Watts ERP).

A1.25 One licensee suggested we should exempt licensees that are not actively using their equipment from the requirement to comply.

A1.26 Other licensees suggested the proposed scope of the EMF licence condition is discriminatory because it does not cover unlicensed, untraceable and unqualified users of amateur and commercial equipment for (i) Citizens' Band (CB) radio on 27 MHz (where users can deploy 12 Watts PEP SSB with an antenna gain of 2.15 dBi producing over 19 Watts EIRP); or (ii) PMR446.

A1.27 One licensee suggested our 10 Watt EIRP threshold was artificially low and that we should only include our EMF licence condition in licensees which allow transmit powers above 25 Watt EIRP.

A1.28 One licensee suggested our proposal should be rejected for all frequencies below 500 MHz. It was suggested that there was no evidence of harm, for such frequencies and that it is almost impossible to get high antenna gains large enough to produce ERPs with a high radiation density.

A1.29 Another individual queried our definition of the UK for compliance purposes, saying we had incorrectly proposed varying licences relating to the use of radio equipment in the Crown Dependencies.

Our response

A1.30 We have proposed to vary all licences in licence classes where the licence class allows transmit powers greater than 10 Watts EIRP (or 6.1 Watts ERP), even where the *individual* licence does not currently allow transmit powers above 10 Watts EIRP (or 6.1 Watts ERP). However, where the allowed transmit power currently specified in an individual licence is below this limit, the licensee **will not need to take any action** to comply with the new EMF licence condition.

A1.31 This approach will ensure that all licences in a given licence class will have a consistent set of terms and conditions. It will also mean that there will be no need to make further changes to the licence in future if, for example, the licensee requests (and is granted) an increase to the transmit power allowed under their licence which allows the licensee to transmit at powers in excess of 10 Watts EIRP (or 6.1 Watts ERP).

A1.32 We acknowledge the points made about CB radio and PMR446 use. Such use is currently exempt from the requirement to obtain a licence from Ofcom and was not therefore covered by our March 2021 Notice. As explained in paragraphs 6.26 – 6.30 our October 2020 Statement, we may include an EMF-related condition in licence exemption regulations in the future. We would consult separately on any proposals to amend licence exemption regulations on a case-by-case basis as considered appropriate.

A1.33 We determined what licences to vary to include the EMF licence condition based on which licence classes allow transmit powers in excess of 10 Watts EIRP (or 6.1 Watts ERP). We consulted on this 10 Watt EIRP threshold in our February 2020 consultation and explained our reasons for maintaining use of this threshold in our October 2020 Statement (see paragraphs 4.122 – 4.139) and our March 2021 Update (see paragraphs 4.125 – 4.131). We have not received any comments in response to our March 2021 Notice providing a sound justification for use of a different threshold.

A1.34 In our view, this threshold should be based on the permitted transmit power of equipment and not on what frequencies may be being used; it is still possible to use relatively high power equipment at lower frequencies and use of lower frequencies could result in the general public being exposed to EMF in breach of the general public EMF limits.

A1.35 We confirm that the use of spectrum in the Channel Islands and Isle of Man is governed by UK legislation that has been extended to Guernsey, Jersey and the Isle of Man. The licensing of spectrum in these Crown Dependencies, is carried out by Ofcom by virtue of the powers given to it by the Wireless Telegraphy Act 2006 and the Communications Act 2003, as and to the extent that these Acts are extended to the respective islands.[3]

Compliance with EMF licence condition

Version of the ICNIRP Guidelines

Summary of representations

A1.36 Some licensees raised concerns around the new requirements in the 2020 ICNIRP Guidelines for peak value limits at frequencies below 10MHz (Table 8) and limb currents (Table 9). It was suggested that the 2020 Guidelines appear to be significantly more restrictive in some situations than the equivalent limits in Tables 5 and 7 of the 1998 Guidelines and lack a sound foundation. It was also suggested that further guidance was needed on how licensees are expected to comply with Tables 8 and 9 of the 2020 Guidelines.

A1.37 As a result, it was suggested that Ofcom should in the future move to only requiring compliance with the 2020 Guidelines in two stages – first to require compliance with Tables 5 and 7 of the 2020 ICNIRP Guidelines and second to require compliance with Tables 8 and 9 of the 2020 ICNIRP Guidelines.

[3] Further information is available on our website (under the "Channel Islands and Isle of Man" tab).

A1.38 One licensee queried how we can allow compliance with the 1998 version of the ICNIRP Guidelines. He suggested that the 2020 version of the ICNIRP Guidelines supersedes the 1998 version and that the 1998 version is no longer valid. As a result, it was suggested the parameters in our calculator based on the 1998 ICNIRP Guidelines are also invalid.

Our response

A1.39 We note the points raised regarding Tables 8 and 9 in the 2020 ICNIRP Guidelines. We have raised these points with PHE and will discuss these issues further with interested parties and PHE.

A1.40 In the meantime, we will continue to allow licensees to comply with either the 1998 ICNIRP Guidelines or the 2020 ICNIRP Guidelines. We note that Tables 8 and 9 of the ICNIRP Guidelines do not apply to all frequencies and we continue to believe it is appropriate to allow licensees the flexibility of complying with either version of the Guidelines. For the avoidance of doubt, licensees that decide to comply with the 2020 Guidelines should take into account all relevant tables in those Guidelines. We have clarified this in a new paragraph 3.6 of our "Guidance on EMF Compliance and Enforcement".

A1.41 As explained in our EMF licence condition and "Guidance on EMF Compliance and Enforcement", once the relevant standards and methodologies are updated we will issue a public consultation on removing the option of complying with the 1998 Guidelines and requiring compliance only with the 2020 Guidelines. That consultation process will assess the impact on licensees of moving to requiring compliance only with the 2020 Guidelines.

A1.42 Regarding the validity of the 1998 Guidelines, we recognise that the 2020 Guidelines represent an updated version of the 1998 Guidelines. However, we are entitled to rely on either version as we deem appropriate; the fact the 1998 Guidelines have now been updated does not mean that the 1998 Guidelines are now irrelevant. As noted above, PHE takes the lead on public health matters associated with EMF and does not currently advise spectrum users to comply with the 2020 Guidelines only. Various legislation is also still based on the 1998 Guidelines including EC Recommendation 1999/519/EC and The Control of Electromagnetic Fields at Work Regulations 2016. In any event, as explained above we intend to in the future require compliance only with the 2020 Guidelines but consider it reasonable to provide some flexibility for licensees in the interim period.

Calculating EIRP and ERP

Summary of representations

A1.43 A number of licensees noted that our EMF licence condition and calculator requires licensees to calculate EIRP (or ERP). However, it was suggested most equipment specifications only quote total power output and do not refer to EIRP or ERP.

A1.44 For example, some noted that marine radio VHF and radar equipment specifications generally only quote total power and that aeronautical radio equipment often states power in peak envelope power (PEP). Licensees will therefore need to work out the EIRP or ERP, which means they also need to work out the antenna gain.

A1.45 However, it was suggested the antenna gain is also not provided in most equipment specifications. As a result, concerns were raised that working out the EIRP or ERP is likely to require technical expertise or equipment and be a costly and complex process.

A1.46 Some licensees were unclear if they were allowed to make assumptions about maximum output values and antenna gain properties and suggested if it is possible to make assumptions, then these should be included in the guidance documents.

A1.47 One licensee requested Ofcom clarify that:

a) when licensees are assessing whether their equipment ever transmits in excess of 10 Watts EIRP (in which case they would need to carry out an EMF assessment), the relevant power is the strongest power (EIRP or ERP) emitted in any direction; and

b) when licensees are carrying out an EMF assessment at a stated location, the relevant power is the EIRP/ERP in the relevant direction.

A1.48 In relation to this, it was noted that if EIRP means the maximum EIRP for the compliance assessment, then the figures in Table 1 of the additional guidance for amateur radio users represent "minimum heights" for an antenna based on forward gain. However, if EIRP means the EIRP in the assessed direction, then Table 1 should be interpreted differently and the reduced EIRP used to assess compliance distance in a given direction.

A1.49 It was also noted that the definition of EIRP in footnote 2 (now footnote 3) of our "Guidance on EMF Compliance and Enforcement" was inconsistent with the definition in the licence condition; the licensee said it should refer to "a measure of the strongest power emitted in *a given direction* from an antenna" and not to "a measure of the strongest power emitted in *any direction* from an antenna".

A1.50 Queries were also raised in relation to Ofcom's approach of applying a single ERP/EIRP power threshold across all the frequencies that licensees can use. One licensee thought this was unnecessarily restrictive as the impact of EMF and its effects varies significantly at different frequencies.

Our response

A1.51 Many licences define the maximum allowed transmit power in terms of ERP or EIRP. Many licensees should therefore already know the ERP/EIRP of their equipment in order to comply with the existing terms of their licence.

A1.52 Where licensees do not know the ERP/EIRP of their equipment, they can either:

a) use the maximum ERP/EIRP figure in their licence as the basis for their compliance calculation. We note that where the actual transmitted power is lower than the maximum allowed power, this will produce a conservative compliance distance; or

b) work out (or obtain) the actual ERP/EIRP of their equipment.

A1.53 The maximum ERP/EIRP is often identified either in the licence itself (including the schedules) or the licence will refer to other documents which identify the maximum allowed transmit power.

A1.54 We recognise that ship radio licences do not directly include maximum allowed transmit power levels in the licence document. To help these licensees, we will shortly publish on our website a table of the maximum allowed transmit powers in terms of ERP/EIRP for various equipment authorised under the ship radio licence.

A1.55 We also recognise that amateur licences are an exception as their licences define power in terms of PEP.

A1.56 Licensees who wish to work out the actual ERP/EIRP of the equipment will need to know the output power of their equipment and the gain of their antenna. This information may be available in equipment manuals or manufacturer's specifications (or could be obtained by contacting the manufacturer).

A1.57 To help licensees, we have included an additional sheet in our EMF calculator which will allow licensees to enter the output power and antenna gain and automatically calculate the EIRP. They can then enter the EIRP in the main calculator sheet.

A1.58 Licensees can also, if preferred, seek help from the installer of the radio equipment or other radiocommunications professional to help them work out the ERP/EIRP of their equipment.

A1.59 We recognise that some ships and aeronautical licensees may have older equipment and may struggle to obtain information on the output power and/or the antenna gain of their equipment. To help with this, Ofcom is working with a number of representative bodies for the aeronautical and maritime sectors to identify commonly used radio equipment and the typical antenna gain of such equipment. We will then include this information in our simplified guidance documents for these sectors. This may include assumptions about antenna gain that can be used where this is practicable and appropriate.

A1.60 In relation to amateur licences, as set out in paragraphs 5.3 – 5.6 of our March 2021 Update, we are aware that the Radio Society of Great Britain (RSGB) is developing pre-assessed equipment configurations which amateur licensees will be able to use and is likely to mean that licensees do not need to work out the ERP/EIRP of their equipment in some cases.

A1.61 Ofcom will continue to work with the RSGB and other interested parties to consider what additional guidance can be provided to amateur radio users to assist them in working out the ERP/EIRP of their equipment where needed. We may periodically update our additional guidance for amateur licensees to include this information.

A1.62 With regard to the requests for clarification, we can confirm that:

a) when licensees are assessing whether their equipment ever transmits in excess of 10 Watts EIRP (in which case they would need to carry out an EMF assessment), the relevant power is the strongest power (EIRP or ERP) emitted in any direction; and

b) when licensees are carrying out an EMF assessment at a stated location, the relevant power is the EIRP/ERP in the relevant direction.

A1.63 We have updated our guidance documents to clarify these points.

A1.64 With regard to the use of a single EIRP/ERP threshold across all frequencies, we note that we received a number of responses to our previous consultations on this topic and provided our response to these points in our March 2021 Update (see paragraph 4.137).

Transmission periods and duty cycles

Summary of representations

A1.65 Some licensees queried whether we require licensees to take into account peak power or average power. Others queried over what time period we expect power to be measured and how to calculate the duty cycle i.e. the percentage of time equipment transmits for within a 6 minute period. Some licensees suggested we had not properly taken into account how licensees typically operate and queried whether they would still need to comply if they only transmit for short periods at low duty cycles. For example:

a) On recreational boats, VHF equipment is only used occasionally for short conversations for safety reasons (e.g. a one-minute non-emergency transmission a couple of times a day).

b) On aircraft, equipment such as VHF radios and transponders often have a low duty cycle and do not on average transmit above 10 Watts EIRP over a 6 minute period. Some equipment may only transmit for a matter of microseconds.

c) Some amateurs do not generally use their equipment for long periods or continuously; amateur operation is completely different to a mobile phone or business transmission site.

A1.66 One licensee requested Ofcom provide all the risk assessments it has carried out where, for example, equipment is only being used 10% of the time. Other licensees suggested that we could significantly mitigate the impact of our proposal if we allow licensees to take into account the duty cycle of equipment and use the average EIRP/ERP over a 6 minute period when calculating the compliance distance (i.e. take into account the power output *after* factoring in the duty cycle). It was suggested that a lot of equipment does not on average transmit above 10 Watts EIRP over a 6 minute period and that even where equipment may on average transmit above 10 Watts EIRP over a 6 minute period, using the average EIRP would significantly reduce compliance distances.

Our response

A1.67 We had explained in our "Guidance on EMF Compliance and Enforcement" that when carrying out an EMF assessment, licensees could take into account whether their equipment was only transmitting for a certain amount of time during the relevant averaging period. We had also explained that one control measure licensees could use to ensure the general public are not exposed to EMF in breach of the general public EMF limits could be to ensure equipment was only used intermittently.

A1.68 Taking into account the comments received in response to our March 2021 Notice, we do however recognise that further clarity is needed in terms of how licensees should take into

account the fact equipment may only be transmitting for a short period of time over the relevant averaging period.

A1.69 Listening to licensees' concerns, we have decided to amend our guidance documents so that licensees that do not transmit at an *average power* higher than 10 Watts EIRP or 6.1 Watts ERP, do not need to carry out an EMF assessment (provided they do not transmit at a peak power higher than 100 Watts EIRP or 61 Watts ERP). Instead, they can comply with the EMF licence condition by calculating (and keeping a record of) their average power.

A1.70 We have also made a change to Ofcom's EMF calculator to help with this. Licensees can now enter the output power as well as the maximum length of time[4] that they will transmit for in any six minute period, and the calculator will then calculate the average power on behalf of the licensee. If the average power is not higher than 10 Watts EIRP or 6.1 Watts ERP (and as long as the peak power is not higher than 100 Watts EIRP or 61 Watts ERP), the calculator will indicate that no further action is required. Licensees can then print (or save a 'print screen' snapshot) of the output from Ofcom's EMF calculator and use this as their record of compliance.

A1.71 Recognising that licensees will not always need to carry out an EMF assessment, we have added a new sub-section to Section 6 of our "Guidance on EMF Compliance and Enforcement" to identify circumstances in which licensees will not need to carry out an EMF assessment. We have also amended clause 6 of our licence condition to confirm licensees need to hold appropriate records demonstrating their compliance with the EMF licence condition rather than with the general public EMF limits.

A1.72 We have also amended the definition of "Licensee's On-Site Radio Equipment" in the EMF licence condition to confirm that licensees only need to take into account EMF exposure levels from their equipment that transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP. We have added new wording to the footnote to this definition to note that our "Guidance on EMF Compliance and Enforcement" explains how licensees can work out if their equipment transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP. We have then updated Section 6 of our "Guidance on EMF Compliance and Enforcement" to explain that licensees can take into account the average power of their equipment when carrying out this assessment and how they can do that.

A1.73 In our view, this change is consistent with our rationale for setting the threshold for intervention at 10 Watts EIRP or 6.1 Watts ERP and does not expose the general public to any additional risk. We believe that this change is an objectively justified and proportionate response to ensure the general public are not exposed to EMF in breach of the general public EMF limits.

A1.74 Where licensees do transmit at either (i) an average power higher than 10 Watts EIRP or 6.1 Watts ERP; or (ii) a peak power higher than 100 Watts EIRP or 6.1 Watts ERP, they can

[4] In determining the maximum length of time, licensees may also take account of the manufacturer-defined duty cycle of their equipment where this is known. We will provide further guidance on how to do this in the simplified guidance documents.

still take into account the average power of their equipment when calculating the compliance distance. We have clarified this in our guidance documents.

Ofcom's EMF Calculator

Summary of representations

A1.75 Various licensees that responded to our March 2021 Notice welcomed our EMF calculator. Licensees also welcomed the possibility of Ofcom producing a new, more flexible calculator in the future. We also received various comments on the way in which the current version of the calculator operates including some of its limitations. We have summarised these comments and provided our responses in Table A1.1 below.

Table A1.1 – Summary of representations relating to our EMF calculator and our responses

Summary of representations	Our response
a) The calculator is largely based on commercial radio applications with very high duty cycles and continuous operation that has little correlation with the sporadic nature of other radio uses.	As noted in paragraph A1.70 above, we have made some changes to the calculator so that it allows licensees to enter the maximum length of time transmitting within any six minute period. In determining the maximum length of time, licensees may also take account of the manufacturer-defined duty cycle of their equipment where this is known. We will provide further guidance on how to do this in the simplified guidance documents.
b) The calculator assumes that the EMF exposure is to a fixed, static absorber (e.g. a neighbour), but makes no adjustment for the common situation where the general public are incidental to the transmitter location (e.g. a specific person passing transiently along a path/road).	We consider that it is appropriate to base our calculator on a fixed, static absorber scenario. While members of the general public may pass transiently, there may also be circumstances where they stop in the same location for a period of time. As explained in paragraph 5.3 of our "Guidance on EMF Compliance and Enforcement", where a licensee cannot be sure whether one or more members of the general public will be present when transmissions are taking place, they should take a *conservative* view and presume a member of the general public will be present in an area where the general public can be expected to be present (see also paragraphs 4.33 – 4.40 of our March 2021 Update).
c) The calculator makes no provision for EMF absorption by structures (e.g. a house)	As explained in our March 2021 Update, we think it is important to maintain a calculator

which would significantly reduce the separation compliance. It was also queried what impact the material a barrier (e.g. aluminium between an antenna and a member of the general public in an aircraft) is made of would have.	which is simple enough for all licensees to use. We recognise that there are many potential additions that would be helpful to some radio users but including these in our calculator would increase complexity and increase the risk of incorrect use by users without appropriate technical expertise. However, licensees are free to undertake a more detailed analysis taking into account other factors including, for example, the attenuation provided by surrounding materials.
d) The Ofcom calculator makes no mention of allowing for the considerable (many decades) of variation in EIRP with the beam pattern, of higher gain antennas, eg yagis and dishes. Ofcom should allow this to be taken into account and this should be mentioned in the guidance documents.	As set out in paragraph A1.62 above, we confirm that when licensees are carrying out an EMF assessment, the relevant power is the EIRP/ERP in the relevant direction. We have updated our guidance documents to reflect this point.
e) The calculator does not work for many of the important lower HF bands - 160m, 80M, 60M and 40M.	We explained in paragraphs 4.139 – 4.144 of our March 2021 Update that we had introduced a new lower cut-off frequency of 10 MHz. This is because it is not suitable for calculating compliance distances in the reactive near-field and, at these frequencies, it is likely that the separation distances calculated will fall within the reactive near-field and hence will be unreliable. We are considering what additional guidance and/or tools could be provided to assist with compliance assessments below 10 MHz. As set out in paragraphs A.1.87 – A.1.88 below, we have taken these issues into account in deciding to allow a longer period before licensees that use these frequencies must have appropriate EMF records in place.
f) The calculator only goes down to 10 MHz and it was queried how licensees are expected to calculate separation distances[5] at lower frequencies. Some licensees thought our calculator suggested there is no requirement to comply with the EMF licence condition in relation to use of frequencies below 10 MHz. One licensee suggested that the calculator would still be of some benefit in providing the reactive near-field clearance distance for frequencies below 10 MHz (e.g. for amateurs with large gardens or rural plots away from neighbours or when a temporary station is set up in a field).	
g) The calculator produces incorrect values, for example, there is no difference in	The reason that there appears to be no difference for certain power levels and frequencies at HF is because, as explained above, we have included an additional check in

[5] We also refer to the separation distance as the compliance distance.

calculated distance from 10 to 100 Watts for HF.	the calculator to ensure that the compliance distances it produces are never shorter than the outer boundary of the reactive near-field of the antenna. At lower frequencies, the reactive near-field is relatively large and reducing the power will not change the separation distance produced by the calculator. We have added a feature in the updated version of our calculator to flag where the calculated distance falls into the reactive near-field.
h) Whilst the calculator includes the use of a 'reflection factor' for ground-bounce, this is not applicable in every case and it was suggested we highlight this in our simplified guidance documents as well as in the excel calculator notes.	We explain the reflection factor that we have used in the Annex tab of the calculator. We have deliberately kept the simplified guidance documents as simple and user-friendly as possible and do not therefore consider it appropriate to include this point in those documents.
i) The calculator notes indicate it should be used for electrically short antennas. It is not therefore clear whether Ofcom will allow licensees to rely on the calculator in relation to longer antennas. This is particularly unhelpful for amateur licensees as they often use relatively long multi-band antennas. Ofcom should clarify whether the calculator can also be used for antenna longer than 0.5 lambda and if not, provide further guidance on how licensees using such antennas can comply. It was also suggested that it may not be obvious to the licensee whether the antenna they are using is electrically long (e.g. a multiband antenna containing traps where the active length may be indeterminate).	As indicated in the notes, our calculator may not, in certain situations, be suitable for electrically long antennas. This is because it calculates the outer boundary of the reactive near-field assuming the antenna is electrically short (i.e. the maximum linear dimension of the antenna is less than or equal to half a wavelength) using the equation $\lambda/2\pi$ (where λ is the wavelength). For electrically long antennas, the outer boundary of the reactive near-field is calculated using the equation $0{,}64\sqrt{D^3/\lambda}$, where D is the maximum linear dimension of the antenna. Our calculator may still provide valid separation distances for electrically long antenna where the separation distance calculated is greater than or equal to the outer boundary of the reactive near-field using the above equation (for electrically long antennas). Where our calculator produces separation distances shorter than this distance, licensees may wish to use the outer boundary of the reactive near-field for electrically long antennas as a

	conservative separation distance. Licensees are also free to use alternative methods in these circumstances providing that they produce sufficiently accurate results (i.e. do not result in a breach of the general public EMF limits). We have included additional guidance notes in our calculator to make this clear.
j) On multiple transmitter sites, the frequencies chosen for the first example, 450 MHz and 1800 MHz, are inappropriate, because they have different reference levels. In the second example the calculation is apparently wrong – the worst-case result of those two should be 2.13 m (for 450 MHz) not 2.26 m. Rather than taking the worst-case reference level and applying it to all the frequencies, a more accurate and less conservative method would be to calculate an exposure quotient for each frequency and sum those quotients, aiming for a total of less than or equal to 100%, where exposure quotient is the calculated power density, at a given distance, divided by the power density reference level.	We agree that the examples provided need to be amended and will do so in the updated version of the calculator. With regard to the alternative suggestion for dealing with multiple transmitters, we recognise that the proposed approach would be more accurate and less conservative than the method we have outlined in our calculator notes. We wish to keep the current version of our calculator as simple as possible and do not therefore consider it would be appropriate to include this method in the calculator. We will however consider whether to include this method in an additional, enhanced version of the calculator in future.
k) The calculator text says the result appears in cell D16 but they actually appear in cell D14.	We have resolved this issue in the version of the calculator currently available on our website.
l) The current format requires the user to calculate EIRP from ERP. Whilst this is a simple process, it would be far more desirable and easier to understand if the user could input ERP and the calculation was done automatically. ERP is a concept that will be easily understood and requiring users to calculate EIRP would seem an unnecessary technical step that will undoubtably generate a lot of calls from licensees.	We have made this change to the updated version of the calculator. Licensees are now able to choose to enter either EIRP or ERP in the calculator (but with the default option remaining as EIRP).

m) The description of how to work out the duty cycle in the EMF calculator is very confusing, especially for the average licensee. It refers to multiplying the maximum transmitter power of the equipment by the duty factor and then by the maximum time that the equipment will be operating within the averaging period. This conflicts with the description of how to perform the calculation in the guidance documents.	As explained in paragraph A1.70 above, we have made some changes to the calculator so that it allows licensees to enter the maximum transmission time within any six minute period. As the calculator works out the average power automatically, we no longer require the notes which describe how to enter the average power. We would however note that, in determining the maximum transmission time to enter in the calculator, licensees may take account of the manufacturer-defined duty cycle of their equipment where this is known.
n) If an online version of the calculator is made available it would be helpful to retain an offline version in case there are issues with broadband or mobile connections in a particular location.	We intend to also retain an offline version of our calculator and are considering the preferred format in which to make the offline version available.
o) Despite the stated caveats to the calculator, there remains a significant risk of non-technical site neighbours misusing the tool and being unnecessarily alarmed, for example by the apparent high calculated levels close to a site at steep elevation angles. A stronger and clearer message might therefore be appropriate, addressed to a wider group of readers than just the intended user group (the licensees).	We have reviewed the current caveats and consider t is clear that the calculator tool is designed for use by licensees and not the general public. We also note that non-technical site neighbours will be unlikely to know the correct parameters to enter in the calculator.

Summary of changes to EMF calculator

A1.76 Taking into account the comments received, we have decided to make the following key changes to our calculator:

a) We have added the ability to enter the power in ERP (in addition to EIRP).

b) We have added a new input field for licensees to enter the maximum transmission time within any six minute period. The calculator will then automatically take account of the average power in calculating the compliance distance.

c) We have added an additional sheet which allows licensees to enter their output power (or PEP) and antenna gain, and calculate the EIRP or ERP of their equipment.

d) We have added a feature to flag when the average power is below 10 Watts EIRP or 6.1 Watts ERP (when the peak power is also below 100 Watts EIRP or 61 Watts ERP).

e) We have added a feature to flag when the calculated compliance distance falls into the reactive near-field.

f) We have added guidance notes in relation to the use of electrically long antennas.

Methods of compliance and types of EMF assessment

Summary of representations

A1.77 We have summarised in Table A1.2 below various comments we received in relation to the EMF assessment licensees may be required to carry out and the types of EMF assessment (identified in our guidance documents) that may be appropriate:

Table A1.2 – Summary of representations relating to EMF assessments and our responses

Summary of representations	Our responses
a) A number of licensees suggested that Ofcom should consider producing some simple "Rule of thumb" guides on separation distances to help licenses comply with the EMF licence condition. For example, we could explain that if a licensee transmits on frequencies between 10MHz and 400MHz with 25W ERP (41W EIRP), the separation distance between the actual antenna and a member of the general public should be at least [X] metres. It was suggested that we publish recommended compliance distances for equipment on boats as well as equipment used in aviation.	We note that we have provided some tables in our simplified guidance documents showing illustrative separation distances for a number of frequency and power combinations. We are planning to provide additional worked examples and separation distances for some commonly used maritime and aeronautical equipment types. We are also aware that RSGB are working on preparing guidance on pre-assessed equipment configurations. We have updated Section 6 of our "Guidance on EMF Compliance and Enforcement" to explain that licensees can also comply with the general public EMF limits by ensuring their equipment is installed and operated in a way that is consistent with the compliance distance(s) calculated for a pre-assessed equipment configuration in the form of a practical example included in Ofcom's simplified guidance documents.
b) Ofcom has not provided any meaningful guidance on how licensees can comply with the EMF limits where they are using frequencies below 10 MHz. This is particularly important for amateurs that often need to use frequencies below 10	We acknowledge that our calculator is not suitable for frequencies below 10 MHz. We are considering what additional guidance and/or tools could be provided to assist with compliance assessments below 10 MHz.

	MHz. Ofcom seems to be suggesting that amateurs should comply by relying on any compliance model RSGB comes up with.	As set out in paragraphs A.1.87 – A.1.88 below, we have taken these issues into account in deciding to allow a longer period before licensees that use these frequencies must have appropriate EMF records in place.
c)	One licensee queried whether the EMF licence condition requires compliance in the near-field or the far-field.	The EMF licence condition requires compliance with the general public EMF limits in any area where members of the general public are or can be expected to be present, regardless of whether this is in the near-field or far-field of the antenna.
d)	Some licensees suggested that antenna modelling – as referred to in ITU Recommendations K.61 and K.52 – may be an appropriate way to ensure compliance. It was also suggested that modelling may help address the near-field issues in Ofcom's calculator as some software allows the user to deduce predicted near-fields. If Ofcom would accept modelling, including within the reactive near-field, as an alternative way to demonstrate compliance then Ofcom should refer to modelling in its guidance documents. It would also be helpful if Ofcom could identify any modelling methods that it believes may be unsuitable.	ITU-T Recommendations K.52[6] and K.61[7] allude to modelling techniques, such as method of moments (MOM) and the numeric electromagnetic code (NEC), that are useful in near-field assessments. However, these advanced computational methods are complex and difficult to use; they require adequate technical expertise and detailed information about the radio equipment and the exposure environment. Nevertheless, licensees are free to use such techniques if they feel they are competent to do so (or to use a third party who is). We have listed an up-to-date date set of recognised EMF standards on our website that licensees can use to comply with general public EMF limits.
e)	Where equipment can transmit above 10 Watts but where it is not currently connected to an antenna or used, Ofcom should clarify that licensees do not need to carry out an EMF assessment until that equipment is actually used. In such circumstances, it was suggested an appropriate EMF record could be the licensee certifying that they will carry out	We agree that licensees that are no longer using their equipment do need to carry out an EMF assessment. However, if a licensee plans to start using their equipment again, they will need to ensure they will comply with the EMF licence condition before they start transmitting. We have clarified this point in our guidance documents.

[6] See: https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-K.52-201801-I!!PDF-E&type=items#:~:text=Summary-,Recommendation%20ITU%2DT%20K.,to%20electromagnetic%20fields%20

[7] See: https://emfguide.itu.int/pdfs/T-REC-K.61-200802.pdf

	an EMF assessment when they next operate their equipment.	We have clarified this in Section 6 of our "Guidance on EMF Compliance and Enforcement". We have also updated Section 12 of our "Guidance on EMF Compliance and Enforcement" to confirm that licensees do not need to hold an EMF record when they are no longer using their equipment.
f)	It was noted that our "Guidance on EMF Compliance and Enforcement" referred to radio equipment not being capable of transmitting in excess of 10 Watts EIRP. It was suggested that this implies that EIRP is immutable and cannot be changed which is incorrect; Ofcom should instead refer to radio equipment that does not transmit in excess of 10 Watts EIRP.	We recognise that equipment can be reconfigured so that it may become capable of transmitting in excess of 10 Watts EIRP. We have amended our guidance documents in line with this comment and now refer throughout to equipment that does not transmit higher than 10 Watts EIRP.
g)	It was noted that our "Guidance on EMF Compliance and Enforcement" explains that one way of carrying out an EMF assessment is by using methods in recognised standards. However, it was queried what we mean by the term "recognised", for example, what body needs to have recognised the standard and in what way does it need to be recognised?	We confirm that we are referring to EMF standards that have been produced or ratified by the following bodies: British Standards Institute (BSI), European Committee for Electrotechnical Standardization (CENELEC), International Electrotechnical Commission (IEC), European Telecommunications Standards Institute (ETSI) and the International Telecommunications Union (ITU). We have listed the current set of standards that we would accept on our website and will keep this list up to date.
h)	It was noted that our "Guidance on EMF Compliance and Enforcement" explains that one way of carrying out an EMF assessment is by using a radiocommunications industry professional. However, it was queried what level of qualification they require for that method to be accepted.	We do not consider it necessary nor appropriate to identify all levels of qualification that may indicate an individual has expertise in ensuring radio equipment is installed in a way that ensures compliance with EMF limits. We have updated Section 6 of our "Guidance on EMF Compliance and Enforcement" to confirm that licensees can use any third party to help them comply. Licensees will however need to satisfy themselves (and demonstrate to Ofcom on request) that any third party they ask to install (or advise on how to install and operate) their radio equipment, has the

	technical expertise to ensure that equipment is installed and can be operated in a way which ensure compliance with the general public EMF limits.
i) It was noted that our "Guidance on EMF Compliance and Enforcement" explains that one way of carrying out an EMF assessment is by using other EMF calculators that produce accurate results. However, we do not say that other methods (such as carrying out measurements) also need to produce accurate results.	All EMF assessments should produce results which do not result in a breach of the general public EMF limits. We have updated our "Guidance on EMF Compliance and Enforcement" to clarify that measurements should be carried out using methodologies in recognised standards or that the licensee is confident will produce sufficiently accurate results (i.e. do not result in a breach of the general public EMF limits).
j) Ofcom explains that one control measure could be ensuring equipment is only used intermittently and for no longer than a specified period, for example, by introducing signs stating not to hold a button and use equipment for more than [x] seconds/minutes but Ofcom provides no guidance on how licensees are supposed to calculate the [x].	As explained in paragraph A1.70 above, Ofcom has amended the calculator so that licensees can enter the maximum length of time they are transmitting for within a six minute period. In cases where equipment may be used for a greater percentage of time than the licensee has assumed in their compliance calculation (resulting in possible non-compliance with the general public EMF limits), they may use a warning sign to control this risk. For example, where they have assumed they will be transmitting for 3 minutes in every 6 minutes, a licensee may decide to use a sign which warns users not to transmit for more than 3 minutes in every 6 minutes (or no more than 30 seconds in every minute). We have clarified this in our guidance documents.
k) One licensee noted that our "Guidance on EMF Compliance and Enforcement" provides no guidance on the number, type, location, size or wording and pictograms that should be included in any warning stickers. It was suggested that Ofcom should provide acceptable forms of wording where including a warning sign or notice on	We do not consider that it is necessary or appropriate to provide prescriptive guidance on the size, wording or other attributes of any warning signs used by licensees. Warnings signs should generally be designed to ensure equipment is not used for longer than a specified period or to ensure members of the general public do not sit or stand in certain areas either at all or at certain times when

	manually controlled equipment relating to duty cycle or power is essential for compliance. Another licensee suggested that use of appropriate warnings directing people where not to sit or stand when equipment is used should not be accepted as a suitable control measure for the general public; a location is either safe or it is not safe. Another licensee suggested it is impractical to put warning stickers on small boats to identify danger zones as this could mean putting warnings on the cabin, foredeck and most of the cockpit (i.e. most of the boat). A more sensible solution would be to put a warning sticker near the radio itself to alert people of the risks of using the radio before transmitting.	equipment may be transmitting. What is appropriate will depend on the individual circumstances but licensees should use common sense and ensure that any warning signs are clear and easy to understand. We have clarified this in our guidance documents. It is ultimately the licensee's responsibility to ensure compliance with the general public EMF limits and if members of the general public do not see or cannot understand a warning sign then that may be relevant to whether we decide to take enforcement action in a particular case and if so, what action we consider to be appropriate in the circumstances. We do not agree with the comment that a location is either safe or not safe. In many scenarios where equipment is not used continuously, there are likely to be areas where the general public EMF limits may only be breached when the equipment is transmitting. When the equipment is not transmitting, members of the general public may be able to sit or stand in that same area without any risk that the general public EMF limits may be breached.
l)	One licensee queried Ofcom's suggestion of possibly raising the height of an antenna in order to ensure no member of the general public can access areas within the compliance distance. It was suggested that attempts to raise the height of an aerial will require the licensee to seek costly and unnecessary planning permission. Another licensee suggested it may not be possible to comply in built-up areas if, for example, a neighbour builds a loft extension. It was suggested that the neighbour may then be able to access areas within the compliance distance but local planning rules may restrict what the	Raising the height of the antenna is just one option for licensees to consider (and licensees will need to ensure any change to antenna height complies with any applicable planning regulations). We recognise that neighbours may make changes to their property which could result in the licensee needing to re-evaluate compliance. Whilst planning rules may restrict what the licensee can do in terms of re-configuring their equipment, it does not follow that the neighbour can then be exposed to EMF in breach of the limits. In these cases, licensees have a number of options including moving the antenna or

licensee can do in terms of re-configuring their set-up.	reducing the transmit power. We provide further guidance on examples of control measures in our guidance documents.
m) It was suggested that another way of ensuring no member of the general public can access areas within the compliance distance would be by improving the antenna gain/pattern (which could reduce field levels below the antenna height) as advised in ITU-T K.61.	We recognise that there may be additional ways of ensuring compliance other than those included in our guidance documents. We have included this point in our guidance documents.
n) One licensee raised a concern that certain individuals may look up licensee details and target them with marketing to conduct site surveys and produce reports to help licensees comply.	Licensees should already be taking into account EMF exposure levels when operating their equipment. We do not publish the contact details of licensees on our website and are not making any changes to the type of licensing information we currently publish. In any event, on-site measurements is only one of a variety of ways in which licensees can ensure compliance; we expect that in most situations licensees will not need to conduct on-site measurements and can ensure compliance using one of the other EMF assessment methods identified in our guidance documents.
o) Ofcom should make clearer that references to “radio equipment” mean the antenna, so that people do not think we are referring to equipment in racks or on desks.	When we refer to radio equipment, we are referring to the set of equipment or apparatus used for transmitting, which includes the antenna. We use antenna when we are specifically talking about the proximity of equipment to members of the general public. We have included a note clarifying what we mean by the term ‘radio equipment’ in our guidance documents.

Time period for compliance and having appropriate EMF records

Summary of representations

A1.78 A number of licensees raised concerned about the time periods for compliance. Some suggested we should allow licensees using frequencies above 10 Watts EIRP longer than 6 months to ensure they have appropriate and up-to-date EMF records.

A1.79 Particular concerns were raised by amateur licensees who reiterated the point made in response to our public consultations that there are currently no adequate IEC, CENELEC or Ofcom standards that cover the scope of the amateur licence and would enable amateurs to assess compliance (in particular for those operating at frequencies below 100 MHz). The concern was not only around the 6 – 12 month grace period but also around the requirement within the grace period to provide Ofcom with appropriate records within 20 calendar days of a request.

A1.80 RSGB explained that they have set up a team to develop compliance standards and practices for amateur use but stressed that this is a significant exercise involving (i) establishing methods for assessing compliance against the relevant EMF limits; (ii) establishing a range of pre-assessed cases and guidance; (iii) establishing training requirements and preparing and delivering appropriate training for licensees; and (iv) completing an assessment of a sample of radio amateur licensees with a significant number of individual equipment configurations. RSGB also explained that they are assessing compliance with the 2020 ICNIRP Guidelines to avoid having to go through the same exercise in the future (and as noted in paragraph A1.36 above, guidance is needed on how to interpret Tables 8 and 9 of the 2020 ICNIRP Guidelines).

A1.81 It was suggested that (i) Ofcom should not require compliance before there is clarity on how licensees are expected to interpret the 2020 ICNIRP Guidelines; and (ii) Ofcom should not expect amateur licensees to perform an EMF assessment within the grace period; if required in a particular case, Ofcom should perform the assessment on behalf of the licensee and provide guidance on how to comply.

A1.82 It was also suggested that Ofcom should allow licensees that use frequencies below 10 MHz longer than 12 months to comply as there are currently no suitable ways in which they can demonstrate compliance (in particular for amateur licensees). Unless Ofcom allows licensees longer to comply, it is suggested there is likely to be a high level of non-compliance with many records based on inappropriate configurations, analyses and/or EMF 'measurements'.

A1.83 One licensee suggested our licence condition is retrospective and unfair.

Our response

A1.84 We acknowledge the concerns around the time periods for ensuring compliance, in particular from amateur licensees. Recognising some of the concerns around the use of frequencies below 10 MHz, we made the decision in our March 2021 Update to allow

licensees using frequencies below 10 MHz an additional 6 months to have appropriate EMF records in place.

A1.85 We also note the concerns in relation to Tables 8 and 9 of the 2020 ICNIRP Guidelines. We note that these concerns only apply to use of frequencies between 100 kHz and 110 MHz (and between 100 kHz and 10 MHz in the case of Table 8). We also note that they have arisen as a result of the additional flexibility we have provided by allowing licensees to initially comply with either the 1998 or 2020 version of the ICNIRP Guidelines. Licensees do still have the option of complying with the 1998 Guidelines. Whilst we sympathise with licensees preferring to move directly (and completely) to demonstrating compliance with the 2020 Guidelines, we do not consider that we currently have sufficient evidence to justify a decision to allow partial compliance with the 2020 Guidelines. We also do not believe it is appropriate to allow a longer period for compliance on the basis a licensee has chosen to take advantage of the additional flexibility we have provided.

A1.86 We also note that the changes we have made to our EMF licence condition and guidance documents to allow licensees to take into account their average power will mean many licensees will no longer be required to carry out any EMF assessment.

A1.87 We do however recognise that a number of licensees still have concerns around the period for compliance, particularly in relation to use of lower frequencies. We recognise that we have not currently provided a calculator that allows compliance calculations below 10 MHz, and that further guidance may be provided at a later date. We also note that in some lower frequency bands (below e.g. 110 MHz but above 10 MHz), the limitations on the calculator (i.e. whereby the compliance distance is limited to being no smaller than the boundary of the reactive near-field) may also mean that licensees need, in some cases, to conduct more detailed analysis to ascertain a less conservative compliance distance, and may also benefit from further guidance.

A1.88 Taking all of these points into account, we have decided to allow licensees using frequencies below 110 MHz an additional 6 months to ensure they have up-to-date records demonstrating compliance with the new EMF licence condition. The revised time periods for compliance are as follows:

a) Until 18 November 2021 for any equipment which operates at frequencies at or above 110 MHz.

b) Until 18 May 2022 for any equipment which operates at frequencies above 10 MHz but below 110 MHz.

c) Until 18 November 2022 for any equipment which operates at frequencies at or below 10 MHz.

A1.89 During this time Ofcom may still carry out routine compliance checks and request access to EMF compliance records for a specific site. If the licensee does not currently have any records then, if requested, they will need to provide evidence to Ofcom that the site is compliant with general public EMF limits within a period of 20 calendar days. We only expect to request records during this period if we discover radio installations that we

consider are likely to be in breach of the general public EMF limits. Provided the licensee cooperates with Ofcom's request and takes any necessary steps to ensure the site is compliant, we are unlikely to take enforcement action and impose a financial penalty or other sanctions on a licensee during this time.

A1.90 Our licence condition is not retrospective. As explained in paragraph 5.200 of our October 2020 Statement, for existing licences the new EMF licence condition is only effective and imposes obligations on licensees from 18 May 2021 (the date of this General Notice which notifies licensees that their licence has been varied to include the EMF licence condition). The EMF licence condition will however apply to all a licensee's radio equipment including equipment that was deployed before the licence condition comes into force as well as new deployments and any changes to existing or new radio equipment.

Appropriate EMF records and frequency of EMF assessments

Summary of representations

A1.91 Some licensees queried how frequently they would be required to carry out an EMF assessment. We first clarify what we mean by an appropriate EMF record. We have then summarised licensees' comments and provided our responses in Table A1.3 below.

A1.92 What we would accept as an appropriate record demonstrating compliance with the EMF licence condition will depend on the circumstances. We have added a new sub-section to Section 12 of our "Guidance on EMF Compliance and Enforcement" to identify various scenarios where we do not require a licensee to hold an EMF record. We have also refined the types of record we would accept.

A1.93 Licensees must hold an appropriate record for all equipment subject to the EMF licence condition no later than the date on which the licensee was required to have appropriate records in place (as identified in paragraph A1.88 above). This record must be updated or a new record created each time the licensee makes any change or addition to a site which is likely to increase the EMF exposure levels above the levels in their most recent EMF assessment in any area where the general public may be present when transmissions are taking place.[8]

A1.94 We recommend that licensees include the date on any EMF record they create. We also recommend licensees make a note of the version number of our calculator or guidance documents that they used to assess their compliance. We have amended our guidance documents to reflect these points.

[8] The EMF licence condition requires licensees to ensure the general public EMF limits are not breached in any area where a member of the general public is or can be expected to be present when transmissions are taking place. For simplicity, we refer to these areas as areas where members of the general public may be present.

Table A1.3 – Specific representations relating to frequency of EMF assessments and our responses

Summary of representations	Our responses
a) It was suggested that radio amateurs often use multiple bands and try new aerials and many will change their set up and aerials on a regular basis. As a result, it was suggested that it is unreasonable to require amateurs to run modelling and simulations to calculate compliance distances before they use a new aerial.	Licensees need to ensure that they are compliant with the EMF licence condition at all times. In most cases, undertaking a calculation in advance of using a new aerial should not be a time-consuming activity. It is also important to note that changing frequencies will not always require a new EMF assessment. This is because the power density limits in the general public reference levels in the ICNIRP Guidelines are the same across certain frequency ranges. For example, the power density limits across the frequency range 10-400 MHz is 2 W/m^2.[9] Therefore, if the licensee is using the same transmit power and same aerial and just changes the operating frequency, they may not need to carry out a new EMF assessment for each change of frequency.[10]
b) One licensee explained that they are currently licensed for about 60 frequency bands and queried whether an EMF assessment is required 60 times if the slightest item of transmit performance changes.	
c) Some licensees queried how compliance distances should be calculated in relation to portable equipment.	We explain how to demonstrate compliance for portable equipment in Section 10 of our "Guidance on EMF Compliance and Enforcement". We also discussed portable equipment in paragraphs 5.135 – 5.148 of our October 2020 Statement.

Licensee specific representations

Amateur Licensees

Summary of representations

A1.95 The key concerns raised that are specific to amateur radio licensees are summarised below. If you are an amateur licensee and we do not appear to have addressed your comment below then it is likely it has instead been addressed in one of the more general sections in this Annex.

[9] This is not the case for frequencies between 400 MHz and 2 GHz, where the power density limits vary across frequencies.
[10] Wideband antennas can exhibit different gain at different frequencies. Therefore, if licensees wish to perform one compliance assessment across the frequencies they use, they would need to use the worst-case antenna gain in their calculation.

A1.96 Amateur radio licensees made the following points:

a) The EMF licence condition will be extremely disruptive to and alienate the amateur community. It may deter young people from entering the hobby which is particularly troubling when amateur radio can improve peoples' wellbeing and some amateurs help prepare for national emergencies. The EMF licence condition may also have a disproportionate impact on disabled licensees.

b) There are currently no suitable methods for amateurs to assess compliance: Ofcom's calculator has significant limitations (e.g. it cannot be used for frequencies below 10 MHz); other calculators have similar limitations or do not take into account ground reflections; manufacturers' guidance for amateur radio equipment is unlikely to contain any appropriate instructions on EMF compliance; the pre-assessed equipment configurations do not currently exist, they may not cover all use cases and in any event RSGB may not make them available to non-members; and taking EMF measurements which produce accurate results requires licensees to invest in expensive equipment likely to cost at least £3,500.

c) RSGB's current exam syllabus does not cover the technical knowledge required to carry out an EMF assessment. However, amateur licences already prohibit licensees from causing harmful EMF exposure and RSGB's current exam syllabus does require licensees to pass a qualification which includes a section on EMF awareness and the relevance of the ICNIRP Guidelines. In any event, Ofcom cannot expect Foundation Licence holders to have the knowledge to calculate their EIRP, let alone work out how and where they can safely operate. A more appropriate solution would be improved education on EMF risks for amateur radio users.

d) For in-car installations, the calculated compliance distance will make it almost impossible to use a typical amateur radio mobile VHF or UHF. This is because, even for a modest 10 Watt UHF transceiver with a modest 5dB antenna at the centre of the vehicle's roof, the calculated minimum separation distance from the public is greater than the width of most vehicles. As there is no way for an amateur to stop passing traffic or pedestrians, this type of installation would become illegal to use on a highway. However, in reality the risk to the public is minute as any exposure would be fleeting as they pass by.

e) Radio Clubs are mostly, if not exclusively, used by licensed amateurs and EMF assessments should not be expected to allow for the worst-case scenario of an occasional visitor that is not an amateur licensee being present at any time.

f) Amateurs normally operate from private property, where the public has no right of access; as a result, it should be adequate for licensees to carry out a risk assessment relating to the probability of exposing the public to EMF in excess of the limits.

g) Ofcom should liaise with the International Amateur Radio Union rather than RSGB.

h) On frequency bands below 500 kHz, the amateur licence only permits transmit powers below 10 Watts EIRP. Ofcom should clarify that amateur licensees are not required to carry out any EMF assessment for these bands.

i) Ofcom should not refer to 142 MHz as that is not in the amateur allocation; it would be helpful if it instead referred to 144.3 or 145 MHz.

Our response

A1.97 We acknowledge the concerns of radio amateurs and note that their hobby has existed for many decades with few issues of concern. It is not our intention to impose on radio amateur licensees a significant regulatory burden over and above what licensees can already reasonably be expected to be doing to ensure they operate their equipment in a way which does not adversely affect peoples' health.

A1.98 Indeed, we note that radio amateurs should already be aware of the general public EMF limits (as demonstrated in the training they are required to undertake in order to be granted a licence). However we also note that some amateur licences allow transmission powers of up to 400 Watts and it is an important principle that the general public (including family, friends, visitors, neighbours and lodgers) should be protected from EMF exposure from whatever radiocommunications source.

A1.99 Our focus therefore is on ensuring our EMF licence condition is a proportionate response to the risk of members of the general public being exposed to EMF in breach of the limits.

A1.100 Throughout our consultation processes, we have carefully considered the potential impact of our EMF licence condition on amateur licensees. We discuss and assess the potential impact of our EMF licence condition on amateur licensees in various sections of our February 2020 Consultation (e.g. paragraphs 4.17 – 4.28), our October 2020 Statement (e.g. paragraphs 4.79 – 4.97, 4.122 – 4.150, 5.12 – 5.28, 5.221 – 5.236 and A1.19 – A1.28) and our March 2021 Update (e.g. paragraphs 4.3 – 4.16, 4.21 – 4.40, 4.125 – 4.162 and 4.192 – 4.202).

A1.101 We have received numerous comments on our proposals from amateur licensees and have had further engagement with RSGB. All these comments have been taken into account and we have made various amendments, clarifications and refinements to our EMF licence condition and guidance documents to reflect the comments received to date and the potential impact on amateur licensees. For example:

a) We have amended the EMF licence condition so that licensees do not need to comply with the general public EMF limits if they are sure no member of the general public will be present when transmissions are taking place.

b) We have confirmed that amateurs are not required to protect each other from EMF when they are visiting each other or working together.

c) We have expanded the types of EMF assessment we will accept as evidence of compliance including introducing an EMF calculator and allowing licensees to rely on pre-assessed equipment configurations provided by RSGB.

d) We have explained that we do not currently anticipate carrying out proactive enforcement related activities in relation to EMF exposure within an amateur's household.

A1.102 We have also produced additional targeted guidance for amateur radio licensees to help them comply.

A1.103 Many of the issues raised by amateur licensees in response to our March 2021 Notice have already been addressed in our October 2020 Statement and our March 2021 Update and by the various amendments, clarifications and refinements we have made to date.

A1.104 However, as explained in paragraphs A1.67 – A1.74 above, and taking into account the further comments received, we have decided to make an additional change to our EMF licence condition and guidance documents which we expect will further reduce the impact of our EMF licence condition on amateur licensees. This change confirms that licensees using equipment that does not transmit at an average power higher than 10 Watts EIRP or 6.1 Watts ERP (and does not transmit at a peak power higher than 100 Watts EIRP or 61 Watts ERP) do not need to carry out an EMF assessment for that equipment. Instead, they can comply with the EMF licence condition by simply calculating and keeping a record of their average power. Licensees can also use our EMF calculator to calculate their average power.

A1.105 We understand that many amateurs do not transmit at peak powers above 100 Watts EIRP or 61 Watts ERP and do not use their equipment continuously. As a result, this change is likely to significantly further reduce the burden of compliance on amateur licensees.

A1.106 We have also made various other improvements and clarifications to our calculator, guidance documents and flowchart to address comments received from amateur radio licensees. For example, we have:

a) Added new sub-sections to Section 6 of our "Guidance on EMF Compliance and Enforcement" to explain how licensees can calculate their EIRP/ERP and average power.

b) Added an additional sheet to our calculator which allows licensees to enter their output power (or PEP) and antenna gain, and calculate the EIRP or ERP of their equipment.

c) Amended Section 6 of our "Guidance on EMF Compliance and Enforcement" to identify circumstances when an EMF assessment is not required and published a revised flowchart to help licensees work out when they do not need to carry out an EMF assessment (and if they do, to help them work out how to comply).

d) Added a new sub-section to Section 12 of our "Guidance on EMF Compliance and Enforcement" to identify circumstances when licensees are not required to hold an EMF record.

e) Added a feature to our calculator to flag when the calculated compliance distance falls into the reactive near-field.

f) Added guidance notes to our calculator in relation to the use of electrically long antennas.

A1.107 We will reflect these changes in the additional guidance for amateur radio licensees and continue to work with stakeholders to ensure our guidance document is and remains clear and user-friendly for amateur radio licensees.

A1.108 Taking into account these further amendments, clarifications and refinements, we do not believe complying with the EMF licence condition will impose a disproportionate burden on amateur licensees. In many cases, we expect compliance to be relatively straightforward.

A1.109 In relation to the specific issues raised by amateur licensees that we have not addressed above or previously:

a) In relation to disabled licensees, Ofcom can provide information in a variety of formats on request, e.g. accessible PDF, large print, easy read, audio recording or braille. If a licensee can let us know what information it requires and in what format, we will consider the request and respond within 21 days. We recognise that the calculator spreadsheet is not currently fully accessible. We are planning to produce a web-based version of the calculator in the coming months and will consider how to make this as accessible as possible. We will publish this on our website when it is available.

b) On methods of compliance, we have identified a variety of EMF assessments amateurs can carry out to ensure compliance. For example, for frequencies above 10 MHz, they can use Ofcom's or RSGB's EMF calculator (which we note is also available to non-RSGB members on RSGB's website). We understand that the pre-assessed configurations produced by RSGB will also be available to non-RSGB members. We recognise that not all of these methods will be appropriate in all circumstances and that it will take further time to develop appropriate compliance methods for some amateur use (e.g. for use of frequencies below 10 MHz). As explained in paragraph A1.88 above, we have therefore decided to allow licensees using certain lower frequencies an additional 6 months to ensure they have appropriate records in place: licensees using frequencies between 10 and 110 MHz will now have 12 months to ensure compliance (i.e. until 18 May 2022) and licensees using frequencies at or below 10 MHz will have 18 months (i.e. until 18 November 2022).

c) We disagree with the suggestion that amateur licences already prohibit licensees from causing harmful EMF exposure. Prior to this licence variation, amateur licences simply noted that high intensities of radio frequency radiation may be harmful and safety precautions should be taken, but did not prohibit licensees from causing harmful EMF exposure. In contrast, the EMF licence condition that we have now included in amateur licences is a clear and enforceable condition which will require amateurs (and other licensees) to check that their equipment will not result in EMF levels in breach of the general public EMF limits.

d) On training, we recognise that RSGB's current training does include some awareness of the ICNIRP Guidelines. While this is useful, it is not in our view sufficient to ensure

licensees comply with the general public EMF limits. In our March 2021 Update (paragraph 4.14), we encouraged RSGB to update its training to include the most relevant and effective ways (identified in our "Guidance on EMF Compliance and Enforcement") in which amateurs can comply with the EMF licence condition as well as training on our additional guidance for amateur licensees. We also explained that such training should not be treated as a one-off tick-box exercise. We understand RSGB is establishing new training requirements and intends to prepare and deliver appropriate training for amateur licensees to ensure compliance with the EMF licence condition. We are grateful to RSGB for its cooperative approach and assistance in this area.

e) On in-car installations, our decision to allow licensees to use the average power of their equipment when calculating the compliance distance is likely to reduce the compliance distance in many cases. We recognise that if a car is moving, and there are no members of the general public inside the car, it is unlikely that members of the general public could be exposed to EMF from an in-car radio installation in breach of the limits. In this specific scenario, licensees will not need to comply with the general public EMF limits. However, where members of the general public may be present in the licensee's vehicle or outside the vehicle when it is stationary, the licensee will need to ensure they do not expose such individuals to EMF in breach of the limits. We have clarified this in Section 10 of our "Guidance on EMF Compliance and Enforcement".

f) On the use of equipment in Radio Clubs, licensees will not need to comply with the general public EMF limits in relation to their own or another licensee's exposure. They will also not need to comply if they are sure that no member of the general public is present in any area where the general public EMF limits may be breached when transmissions are taking place. However, if a member of the general public such as a visitor is present (of if the licensee cannot be sure if they are present) then they will need to ensure they comply with the general public EMF limits when they are transmitting. Whilst a Radio Club may only have occasional visitors that are members of the general public, this does not mean the licensee can expose those visitors to EMF in breach of the general public EMF limits on the occasions that they are present. Further information is available in paragraphs 4.27 – 4.40 of our March 2021 Update and Section 5 of our "Guidance on EMF Compliance and Enforcement".

g) We recognise that amateurs may normally operate from private property. However, from a private property an amateur could still expose family, friends, visitors, lodgers and neighbours to EMF. All of these individuals fall under our definition of the general public and should not be exposed to EMF in breach of the limits. Further information is available in paragraphs 4.2 – 4.16 of our March 2021 Update and Section 4 of our "Guidance on EMF Compliance and Enforcement".

h) On liaising with the International Amateur Radio Union, it is not possible (nor a requirement of any public consultation) to directly contact all stakeholder bodies whose members may be impacted by a proposal. We reached out to certain stakeholder and industry bodies that we have regular contact with or that expressed specific interest in our proposals. In any event, we have received a significant number

of comments (some of which may have been from members of the IARU) on our proposals from amateur licensees and have taken all these comments into account.

i) We will clarify in our additional guidance for amateur licensees that where amateurs are operating on frequency bands below 500 kHz, they will not be required to carry out an EMF assessment (on the basis the licence does not permit the amateur to transmit at powers above 10 Watts EIRP or 6.1 Watts ERP in those frequency bands).

j) We will amend our additional guidance for amateur licensees to refer to 144.3 MHz instead of 142 MHz.

Maritime Radio Licensees

Summary of representations

A1.110 The key concerns raised that are specific to maritime radio licensees are summarised below. If you are a maritime radio licensee and we do not appear to have addressed your comment below then it has likely been addressed in one of the more general sections in this Annex.

A1.111 Maritime radio licensees made the following points:

a) Ofcom has produced no evidence that EMF from a recreational ship's radio equipment has caused physical harm or raises a significant risk. A lot of equipment on boats has a low duty cycle and there is unlikely to be any risk associated with marine VHF operating at 25 Watts with the antenna at the top of a mast on a sail boat or with a whip antenna mounted relatively low down on a motor boat.

b) Many recreational boaters will not understand the requirements and will not be able to comply. Most equipment manuals do not refer to EMF and Ofcom's assumptions about the availability of information were not reasonable. Licensees are not equipped to assess EMF exposure levels and the repeated references to ERP in the additional guidance for maritime radio licensees indicates it is primarily aimed at radio technicians.

c) Most equipment on boats is there for safety reasons and there may be safety consequences if people decide not to use their radios or turn the power down in order to comply (for example, cutting transmission power to 10 Watts EIRP could mean the difference between life and death). Ofcom should make clear that licensees should not remove or make structural alternations to a radio or restrict its output without professional advice unless they can demonstrate that the lower setting will still enable then to seek shore-based help if required. Licensees should also be advised against replacing fixed VHF with portable equipment with a shorter range to avoid any issues with compliance with the new EMF licence condition.

d) The EMF licence condition is impractical and draconian for small boats (e.g. boats less than 50 foot) because (i) separation distances can be impossible due to limited space; (ii) small boats often come with fixed radio sets e.g. those used by main sailing clubs

and schools; and (iii) VHF equipment is only used occasionally for short conversations for safety reasons.

e) The additional guidance for ship radio licensees should be made clearer for the average person and reduce the burden on licensees, in particular where technical information is not readily available. In addition to taking into account the above points raised by ship radio licensees, the guidance should:

   i) Identify minimum compliance distances and safe rules of thumb for the different types of equipment used on boats.

   ii) Identify which equipment (including transmitters used for distress and safety communications) requires the licensee to hold appropriate EMF records demonstrating compliance.

   iii) Confirm whether licensees are really required to hold records to demonstrate certain equipment such as Emergency Position Indicating Radio Beacons (EPIRB) is only used in emergencies, and whether licensees need to comply with the EMF licence condition when such equipment is tested.

   iv) Confirm whether AIS transmissions (which are milliseconds in length) can be ignored.

   v) Have separate sections for ship stations, coast stations and mobile shore operations (and does not need to contain non-ship related information as almost all licences are for ship radio).

   vi) Identify the frequencies at which different equipment generally operates (for example, so licensees know what the relevant time period is for them to ensure compliance).

   vii) Confirm how to carry out an EMF assessment for radar which exhibits high ERP over a very narrow beam which is being continuously swept and confirm whether carrying out an EMF assessment in relation to modern broadband radar is the same for older, fixed frequency, pulsed radar.

f) Ofcom should confirm whether the EMF licence condition would permit a licensee to transmit at 1 Watt inside a harbour where there are members of the general public present on the quayside, or whether a new lower output radio would be required.

Our response

A1.112 We acknowledge the concerns of maritime radio licensees. It is not our intention to impose on maritime radio licensees a significant regulatory burden over and above what licensees can already reasonably be expected to be doing to ensure they operate their equipment in a way which does not adversely affect peoples' health.

A1.113 It is an important principle that the general public should be protected from EMF exposure from whatever radiocommunications source. Whilst some ship radio equipment does not transmit at very high powers and may be used on small boats, it does not follow that use of

that equipment can never result in the general public being exposed to EMF in breach of the limits. We also note that some ship radio equipment can have high transmit powers (for example, marine band MF/HF radio with Digital Selective Calling can transmit at up to 400 Watts EIRP).

A1.114 We continue to believe that all members of the general public should be protected from EMF on the basis they may have no knowledge of their exposure to EMF and in any event are not in a position to fully understand, control and/or mitigate the risk of exposure to EMF. This includes family, friends, visitors and paying customers that may be present on a boat or other vessel or nearby e.g. in a quayside area, harbour, marina, port or dock.

A1.115 Our focus therefore is on ensuring our EMF licence condition is a proportionate response to the risk of members of the general public being exposed to EMF in breach of the limits.

A1.116 Throughout our consultation processes, we have carefully considered the potential impact of our EMF licence condition on maritime radio licensees. We discuss and assess the potential impact of our EMF licence condition on maritime radio licensees in various sections of our February 2020 Consultation (e.g. paragraphs 4.17 – 4.28), our October 2020 Statement (e.g. paragraphs 4.98 – 4.116, 4.122 – 4.150, 5.12 – 5.28, 5.221 – 5.236 and A1.19 – A1.28) and our March 2021 Update (e.g. paragraphs 4.3 – 4.10, 4.17 – 4.20, 4.27 – 4.40, 4.82 – 4.101 and 4.163 – 4.164).

A1.117 We have received numerous comments on our proposals from maritime radio licensees and have had further engagement with the Maritime and Coastguard Agency and the Royal Yachting Association. All these comments have been taken into account and we have made various amendments, clarifications and refinements to our EMF licence condition and guidance documents to reflect the comments received to date and the potential impact on maritime radio licensees. For example:

a) We have confirmed that licensees do not need to carry out an EMF assessment if they do not transmit at powers higher than 10 Watts EIRP or 6.1 Watts ERP.

b) We have refined our emergency exemption and removed the previous requirement which limited the exemption to situations where compliance was "*likely to result in or create an immediate and serious threat to the safety of the public or public health*".

c) We have expanded the types of EMF assessment we will accept as evidence of compliance including using our EMF calculator or asking a third party expert to install their equipment.

d) We have explained that licensees can implement various control measures to ensure compliance and take into account the fact some equipment transmits intermittently.

e) When deciding whether a licensee needs to assess the aggregate EMF exposure produced by different transmitters on a boat, we have explained that: (i) licensees do not need to take into account the aggregate EMF exposure produced by radar or satellite equipment and can instead assess compliance on an individual basis (provided the radar or satellite equipment has been installed and maintained in line with

manufacturers' instructions); and (ii) licensees can take into account the fact that different pieces of equipment may not transmit at the same time.

A1.118 The additional guidance for maritime radio licensees is intended to assist licensees that may have less technical knowledge and provide simple and straightforward ways in which they can comply with the use of practical examples. We will shortly publish a revised version of this additional guidance which will take account of the feedback provided. This will include amending it to focus solely on ship radio users. In view of this, we will amend the name of this guidance to "What you need to know as a Ship Radio licensee".

A1.119 The updated version will include, for example, clearer guidance on which types of ship radio equipment do or do not require an EMF assessment and additional practical examples for equipment that does require an EMF assessment. We have also updated our guidance documents to explain that an acceptable method of compliance is ensuring equipment is installed and operated in a way that is consistent with the compliance distance(s) calculated in accordance with one of Ofcom's practical examples.

A1.120 It is not our intention for our EMF licence condition to compromise safety on board any boat. We do not believe that our EMF licence condition should result in licensees needing to remove any equipment that is used for safety purposes (in particular equipment that may be required in an emergency). We consider that the additional guidance we shortly publish will help to reassure licensees that this is the case and will help even those with very limited technical knowledge to quickly and easily check compliance.

A1.121 Many of the issues raised by maritime radio licensees in response to our March 2021 Notice have already been addressed in our October 2020 Statement and our March 2021 Update and by the various amendments, clarifications and refinements we have made to date.

A1.122 However, as explained in paragraphs A1.67 – A1.74 above, and taking into account the further comments received, we have decided to make an additional change to our EMF licence condition and guidance documents which we expect will further reduce the impact of our EMF licence condition on maritime radio licensees. This change confirms that licensees using equipment that does not transmit at an average power higher than 10 Watts EIRP or 6.1 Watts ERP (and does not transmit at a peak power higher than 100 Watts EIRP or 61 Watts ERP) do not need to carry out an EMF assessment for that equipment. Instead, they can comply with the EMF licence condition by simply calculating and keeping a record of their average power. Licensees can also use our EMF calculator to calculate their average power.

A1.123 We recognise that various radio equipment on a boat may only be used intermittently for safety purposes and expect this change to significantly further reduce the burden of compliance for ship radio licensees (for example, it is likely to mean licensees to not need to carry out an EMF assessment in relation to AIS transmissions). We expect this change to be particularly helpful for licensees that have equipment on small boats and who may have otherwise struggled to find a place to install their equipment while maintaining the relevant compliance distance. We also expect this change to mitigate the risk that any

licensee may take steps to comply with our EMF licence condition which may compromise safety.

A1.124 Even in cases where, having taken account of the average power, licensees consider that members of the general public could get closer to the antenna than the compliance distance, they should still be able to ensure compliance by implementing simple and appropriate control measures, for example, by:

a) Introducing barriers or locks to limit access to the antenna.

b) Installing clear and easy to understand warning signs directing people where not to sit/stand when equipment is being used and setting out simple explanations of risks.

c) Ensuring equipment never transmits when a member of the general public may be present in an area in which the general public EMF limits may be breached.

d) Ensuring equipment is only used intermittently and for no longer than a specified period, for example, by introducing signs stating not to hold a button and use equipment for more than [x] seconds/minutes.

A1.125 Use of equipment in an emergency situation also continues to be exempt from the requirement to comply with the general public EMF limits.

A1.126 We have also made various other improvements and clarifications to our calculator, guidance documents and flowchart to address comments received from maritime radio licensees. For example, we have:

a) Added new sub-sections to Section 6 of our "Guidance on EMF Compliance and Enforcement" to explain how licensees can calculate their ERP and average power.

b) Added a new page on our website to help licensees work out the maximum power allowed under their licence.

c) Added the ability in our EMF calculator to enter the power in ERP (in addition to EIRP) and calculate average power.

d) Amended Section 6 of our "Guidance on EMF Compliance and Enforcement" to identify circumstances when an EMF assessment is not required and published a revised flowchart to help licensees work out when they do not need to carry out an EMF assessment (and if they do, to help them work out how to comply).

e) Included additional information on control measures in Section 6 of our "Guidance on EMF Compliance and Enforcement" and explained how licensees can use signs on or next to radio equipment to ensure equipment is not used for longer than the licensee assumed in their compliance calculation.

f) Added a new sub-section to Section 12 of our "Guidance on EMF Compliance and Enforcement" to identify circumstances when licensees are not required to hold an EMF record. For example, we have removed the requirement for licensees to keep a record of how it was determined radio equipment (such as EPIRBs) is only ever used in an emergency situation.

A1.127 We will reflect these changes in the additional guidance for ship radio licensees and continue to work with stakeholders to ensure our guidance document is and remains clear and user-friendly for ship radio licensees.

A1.128 Taking into account these further amendments, clarifications and refinements, we do not believe complying with the licence condition will impose a disproportionate or costly burden on maritime radio licensees. In many cases, we expect compliance to be relatively straightforward.

A1.129 In relation to the other specific issues raised by maritime radio licensees that we have not addressed above or previously:

a) We recognise that equipment that is required for an emergency situation will require routine/periodic testing to ensure it will work as required in the event of an emergency situation. In many cases, we expect that the testing of such equipment is unlikely to involve transmitting at an average power in excess of 10 Watts EIRP or 6.1 Watts ERP. We have in any event clarified in Section 13 of our "Guidance on EMF Compliance and Enforcement" that licensees are not required to comply with the general public EMF limits when they carry out such testing.

b) We will consider what additional information and guidance can be provided in relation to radar in our additional guidance for ship radio licensees.

c) We will identify the key frequencies at which different equipment generally operates in our additional guidance for ship radio licensees.

d) We confirm that our EMF licence condition permits licensees to transmit at 1 Watt inside a harbour where there are members of the general public present on the quayside; licensees are permitted to transmit at an average power up to 10 Watts EIRP or 6.1 Watts ERP (provided their equipment does not transmit at a peak power above 100 Watts EIRP or 61 Watts ERP) without needing to carry out an EMF assessment.

Aeronautical Radio Licensees

Summary of representations

A1.130 The key concerns raised that are specific to aeronautical radio licensees are summarised below. If you are an aeronautical radio licensee and we do not appear to have addressed your comment below then it has likely been addressed in one of the more general sections in this Annex.

A1.131 Aeronautical radio licensees made the following points:

a) We did not contact any stakeholders in the aviation or sports flying industry prior to March 2021 including the Civil Aviation Authority (CAA), the General Aviation Alliance, the Light Aircraft Association, the British Gliding Association and the British Microlight Aircraft Association. We have not therefore assessed the impact of our proposals on such licensees. Our licence condition should not be implemented until we have adequately consulted with the relevant bodies to assess the risks and impact of our

proposals and implemented appropriate mitigation. The EMF limits in the ICNIRP Guidelines are guidance and recommendations and we can therefore exercise our discretion as appropriate for different categories of licensee.

b) Any licence condition that may require licensees to make any changes to their equipment could be expensive and burdensome as licensees may be required to obtain an airworthiness assessment and seek approval of any changes from the CAA.

c) Pilots are unlikely to have any technical EMF knowledge and the EMF licence condition may result in some licensees deciding to remove or not to install equipment so that they do not have to concern themselves with compliance (particularly lower-level airspace users including light aircraft, microlights and gliders). Changes to equipment could also result in sub-optimal performance. The EMF licence condition should not compromise established aircraft safety mechanisms and should not run counter to recent CAA activity to encourage the installation of safety equipment. In any event, the whole concept of ICNIRP in relation to general aviation aircraft and gliders is nonsensical. Aircraft already have airworthiness constraints and stringent safety requirements and pilots on the ground have a legal requirement to transmit/reply to air traffic controllers regardless of whether any ground staff are nearby.

d) Manufacturers' instructions may not be that helpful in helping licensees comply, in particular because they often state power in PEP and do not refer to ERP or EIRP. Licensees are therefore required to make assumptions about maximum output values and establish antenna gain properties which is complex. Further, some of the data required to carry out an EMF assessment in relation to aircraft radio systems is the proprietary information of the equipment or aircraft manufacturer; manufacturers may need to be made aware of the EMF licence condition and obliged to provide the necessary data on request.

e) There can be very limited space to install an antenna or increase the separation distance between the antenna and the cabin area which is particularly problematic in a light aircraft that also carries passengers. In this context, it is not clear whether compliance distances need to be measured from the tip of the antenna or the point of the antenna that was closest to a member of the general public.

f) The record keeping requirement is too vague and requires a complicated process to comply. Practical guidance including step-by-step instructions to help aircraft licensees comply, similar to that provided for amateur and maritime radio users, is required. It would be helpful for this guidance to focus on compliance distances for different equipment used on aircraft.

g) In the aviation industry, the concept of a shared site can only be construed as an airfield. As airfields are visited by an infinitely variable number of aircraft (i.e. other spectrum users) at any one time, it will be impossible to know how what equipment is installed. Airfields will also have variable numbers and types of fixed radio equipment used by air traffic control, handling agents, ground based radar, etc. plus other spectrum users (e.g. the fire service, fuel operators, security etc) using portable radio

equipment making it impossible to comply. The shared site obligation should therefore be removed from aircraft radio licensees. Further guidance is required on how licensees are expected to comply on an airfield.

h) Ofcom's concept of members of the general public and the areas in which licensees are required to ensure such individuals are not exposed to EMF in breach of the limits is unclear. It would be helpful for Ofcom to clarify:

   i) Whether the EMF licence condition only applies when an aircraft is on the ground (as no member of the general public would be present when an aircraft is airborne).

   ii) Why it is necessary to impose the EMF licence condition in relation to equipment on a helicopter as the rotor blades already ensure the general public are kept beyond the separation distance.

   iii) Why individuals (such as passengers on a plane) that are made aware of EMF risks (e.g. in a pre-flight safety briefing) fall under the definition of the general public. Risk-aware passengers should instead be subject to the higher EMF limits that workers can be exposed to.

   iv) Why the licence variation is necessary if operators of public airfields and airports are required to ensure that access to them is strictly controlled to ensure that no member of the general public will be present when transmissions are taking place. In any event, it is the site owner/operator that should be responsible for compliance.

Our response

A1.132 We acknowledge the concerns of aeronautical radio users and recognise that we did not specifically reach out to key stakeholder groups in advance of our March 2021 Notice.

A1.133 We have however issued two public consultations in relation to our proposals and have carefully considered the potential impact of our EMF licence condition on all licensees throughout our consultation processes. We have also made various amendments, clarifications and refinements to our EMF licence condition and guidance documents to minimise the potential impact on all licensees. We note that many comments raised by other licensees to date relate to similar issues to those raised by aeronautical licensees (for example, comments relating to the lack of technical knowledge of licensees, the potential burden being placed on licensees, the potential impact on safety and the potential lack of space to ensure compliance have been raised previously by maritime radio licensees).

A1.134 We have also now had discussions with the Light Aircraft Association and the Civil Aviation Authority and received various comments in response to our March 2021 Notice from aeronautical licensees. All of these comments have been taken into account and we have made further amendments, clarifications and refinements to our EMF licence condition and "Guidance on EMF Compliance and Enforcement" to address these comments and the potential impact on aeronautical licensees. We are also preparing some simplified targeted guidance for aeronautical licensees to help them comply and will continue to work with

stakeholders to ensure our guidance is and remains clear and user-friendly for aeronautical radio licensees.

A1.135 We have provided further information on the variation process in paragraphs A1.160 – A1.168 below.

A1.136 It is not our intention to impose on aeronautical radio licensees a significant regulatory burden over and above what licensees can already reasonably be expected to be doing to ensure they operate their equipment in a way which does not adversely affect peoples' health. It is also not our intention for our EMF licence condition to compromise safety on board any aircraft. We do not believe that our EMF licence condition should result in licensees needing to remove any equipment that is used for safety purposes (in particular equipment that may be required in an emergency). We consider that the further guidance that we will shortly publish will help to reassure licensees that this is the case and will help even those with very limited technical knowledge to quickly and easily check compliance.

A1.137 However, it is an important principle that the general public should be protected from EMF exposure from whatever radiocommunications source. Whilst some aeronautical radio equipment does not transmit at very high powers, it does not follow that use of that equipment can never result in the general public being exposed to EMF in breach of the limits.

A1.138 We continue to believe that all members of the general public should be protected from EMF on the basis they may have no knowledge of their exposure to EMF and in any event are not in a position to fully understand, control and/or mitigate the risk of exposure to EMF. This includes family, friends, visitors and passengers that may be present on an aircraft or helicopter or nearby e.g. in an airfield.

A1.139 Our focus therefore is on ensuring our EMF licence condition is a proportionate response to the risk of members of the general public being exposed to EMF in breach of the limits.

A1.140 As explained in paragraphs A1.67 – A1.74 above, and taking into account the further comments received, we have decided to make an additional change to our EMF licence condition and guidance documents which we expect will further reduce the impact of our licence condition on aeronautical radio licensees. This change confirms that licensees using equipment that does not transmit at an average power higher than 10 Watts EIRP or 6.1 Watts ERP (and does not transmit at a peak power higher than 100 Watts EIRP or 61 Watts ERP) do not need to carry out an EMF assessment for that equipment. Instead, they can comply with the EMF licence condition by simply calculating and keeping a record of their average power. Licensees can also use our EMF calculator to calculate their average power.

A1.141 We recognise that various radio equipment on an aircraft may only be used intermittently for safety purposes and expect this change to significantly reduce the burden of compliance on aeronautical radio licensees. We expect this change to be particularly helpful for licensees that have equipment on small or light aircraft and who may have otherwise struggled to comply with the general public EMF limits. We also expect this change to mitigate the risk that any licensee may take steps to comply with our licence condition which may compromise safety.

A1.142 Use of equipment in an emergency situation also continues to be exempt from the requirement to comply with the general public EMF limits.

A1.143 We have also made various other improvements and clarifications to our calculator, "Guidance on EMF Compliance and Enforcement" and flowchart to address comments received from aeronautical radio licensees. For example, we have:

a) Added new sub-sections to Section 6 of our "Guidance on EMF Compliance and Enforcement" to explain how licensees can calculate their EIRP/ERP and average power.

b) Added the ability in our EMF calculator to enter the power in ERP (in addition to EIRP) and calculate average power.

c) Amended Section 6 of our "Guidance on EMF Compliance and Enforcement" to identify circumstances when an EMF assessment is not required and published a revised flowchart to help licensees work out when they do not need to carry out an EMF assessment (and if they do, to help them work out how to comply).

d) Added a new sub-section to Section 12 of our "Guidance on EMF Compliance and Enforcement" to identify circumstances when licensees are not required to hold an EMF record.

A1.144 We will reflect these changes in the additional guidance for aeronautical radio licensees and continue to work with stakeholders to ensure our guidance document is and remains clear and user-friendly for aeronautical radio licensees.

A1.145 Taking into account these further amendments, clarifications and refinements, we do not believe complying with the licence condition will impose a disproportionate or costly burden on aeronautical radio licensees. In many cases, we expect compliance to be relatively straightforward.

A1.146 In relation to the other specific issues raised by aeronautical radio licensees that we have not addressed above or previously:

a) We do not have legal powers to require manufacturers to provide information to licensees.[11] We would however expect any manufacturer to cooperate with any request from a license for technical information about their equipment that will help them comply with the EMF condition licence. We have also updated our guidance documents to provide additional information on how licensees can calculate the ERP of their equipment and work out their average power.

b) Compliance distances and EMF levels should be assessed from the point of the antenna that would be closest to a member of the general public. We have clarified this point in our guidance documents.

[11] We provide further information on our legal powers in paragraphs 5.109 – 5.111 and Annex A1 of our October 2020 Statement.

c) We explain what we mean by members of the general public and areas in which the general public may be present in Sections 4 and 5 of our "Guidance on EMF Compliance and Enforcement". Further information is available in paragraphs 4.2 – 4.54 of our March 2021 Update. In relation to the specific points raised:

   i) Licensees are required to ensure compliance with the general public EMF limits in any area where a member of the general public is or can be expected to be present. A member of the general public may be a friend, family member or other passenger on a plane in which case the EMF licence condition will apply when an aircraft is airborne. Even if access to a public airfield is strictly controlled, members of the general public could still be exposed to EMF in breach of the limits if radio equipment is transmitting when an aircraft is on the ground.

   ii) However, if the only individuals on the ground in the vicinity of the aircraft are workers (e.g. ground staff) then the licensee will not need to ensure compliance with the general public EMF limits as no member of the general public will be present. Further, in a one-seater aircraft the licensee would not be required to ensure compliance because the licensee, owner or operator of the radio equipment does not need to comply in relation to their own EMF exposure.

   iii) It may be correct that the rotor blades on a helicopter ensure the general public are kept beyond the compliance distance. However, this may not necessarily be the case if equipment is transmitting when the rotor blades are not turning or where there is a passenger in the helicopter.

   iv) We do not agree that risk-aware passengers should instead be subject to the higher EMF limits that workers can be exposed to. This is because passengers that have some knowledge of their exposure to EMF are still not in a position to *fully* understand, control or mitigate the risk of exposure to EMF. On the other hand, the licensee or operator of the equipment is in a position to take steps to ensure compliance with the general public EMF limits. Further information is available in paragraphs 4.2 – 4.10 of our March 2021 Update.

d) When assessing compliance with the general public EMF limits, aeronautical radio licensees should take into account all radio equipment on their aircraft that is allowed to transmit at powers higher than 10 Watts EIRP or 6.1 Watts ERP. Licensees are also required to take into account any radio equipment on their aircraft that is owned by another licensee although we recognise that in practice this may be a rare occurrence. Our EMF licence condition (and definition of "shared site") does not require licensees to take into account EMF from radio equipment on other aircraft or on the ground. We will clarify this and the other points above in our additional guidance for aeronautical radio users.

Potential Enforcement Action

Summary of representations

A1.147 It was requested that Ofcom clarify the methods they intend to use to (i) demonstrate that a licensee may be in breach of the general public EMF limits; and (ii) assess that a historic exposure has breached the general public EMF limits. For example, we were asked how we intend to determine whether a member of the general public was actually present in a location at the time of a transmission and whether that person was exposed to EMF in breach of the limits.

A1.148 One licensee asked Ofcom to clarify whether it would be the responsibility of the licensee to prove compliance or whether it would be Ofcom's responsibility to prove the rules had been broken. It was suggested that it would be difficult for a licensee to prove that a radio log was complete and prove that they comply by limiting their transmission time.

Our response

A1.149 Our compliance activities are likely to focus on (i) whether a licensee is currently complying with the general public EMF limits; and (ii) whether the licensee has appropriate records demonstrating their compliance from the date on which the licensee was required to have appropriate records in place (i.e. 18 November 2021, 18 May 2022 or 18 November 2022 depending on the frequencies used by the licensee).

A1.150 We have explained in paragraphs A1.92 – A1.94 above what we mean by an appropriate EMF record.

A1.151 We recognise there may be circumstances when we cannot determine whether a licensee has in the past breached the general public EMF limits for the simple reason that we cannot measure previous EMF levels. However, there may still be evidence suggesting a licensee was in breach of the general public EMF limits for a past period. For example, the current EMF levels from the licensee's equipment may be in breach of the limits in an area where members of the general public are present when transmissions are taking place and the evidence may suggest the licensee has not made any changes to their operating parameters from the date our licence condition came into force.

A1.152 It is the responsibility of the licensee to keep appropriate EMF records which demonstrate that the licensee complies with the general public EMF limits. If Ofcom requests to see the licensee's EMF records then Ofcom may take enforcement action against that licensee if either (i) the licensee cannot provide records demonstrating their compliance from the date on which that licensee was required to have appropriate records in place; or (ii) if such records are not considered appropriate because, for example, they do not reflect the type of records identified in our "Guidance on EMF Compliance and Enforcement".

A1.153 As explained in paragraph A1.92 above, we have now added a new sub-section to Section 12 of our "Guidance on EMF Compliance and Enforcement" to identify various scenarios where we do not require a licensee to hold an EMF record.

A1.154 We can generally take enforcement action where we determine there are reasonable grounds for believing a licensee has breached a licence condition. However, as explained in our "Guidance on EMF Compliance and Enforcement" we intend to take a proportionate and pragmatic approach to compliance and enforcement. It is not our intention to immediately take enforcement action and impose a financial penalty or other sanctions on licensees regardless of the circumstances. Whilst we may consider such action to be appropriate in certain circumstances, our key objective is to foster and facilitate a climate of compliance across all licensees.

Drafting of EMF licence condition and related wording

A1.155 Table A1.4 below summarises the representations we have received on the specific drafting of the EMF licence condition and our responses.

Table A1.4 – Representations in relation to drafting of EMF licence condition and related wording

Representations	Our response
a) Where the main body of a licence explains that "*the establishment, installation, modification or use of the Radio Equipment is carried out in accordance with the restrictions set out in Schedule [X] of this Licence in relation to electromagnetic field (EMF) exposure"*, we should replace the word "restrictions" with "*conditions*" or "*provisions*" to more accurately reflect the EMF requirements.	We have decided to replace the word "restrictions" with "provisions" to reflect the content of the EMF licence condition (which requires licensees to comply with various provisions relating to EMF, not all of which may be considered restrictions).
b) Ofcom may want to include a reference in Clause 12 of the amateur licence to the requirement to keep appropriate EMF records; this Clause already contains a requirement for amateur licensees to keep a station log demonstrating compliance.	We have decided not to make any changes to Clause 12 of the amateur licence. Clause 12(1) of the amateur licence does not require all amateur licensees to keep a log of all their transmissions; instead it states that Ofcom may require the licensee to keep a log for the purposes of any interference investigation or any other matter relating to the enforcement of relevant legislation. Whilst the log may be a useful means of noting operational characteristics of the station and keeping an EMF record, we do not consider it

	necessary to require licensees to use the log to keep their EMF records. Licensees have the flexibility to decide the format in which they wish to hold their EMF records provided such records are appropriate in accordance with Section 12 of our "Guidance on EMF Compliance and Enforcement". We also note that licensees are not required to create a new EMF record for all changes they make to their operating parameters; they are only required to create a new EMF record when they make a change which is likely to increase the EMF exposure levels in any area where the general public may be present when transmissions are taking place.
c) Some headings and definitions in the EMF licence condition should be adapted to the specific licence class the condition is being inserted into. For example, the following terms in the EMF condition in the aeronautical licence should refer directly to aeronautical licensees and how they operate: (i) Sites which are not shared with another licensee; (ii) Sites which are shared with another licensee; (iii) Shared site; and (iv) Licensee's On-Site Radio Equipment.	To ensure consistency across all licences which are subject to the EMF licence condition, we have decided not to amend any headings or definitions to tailor them to a specific licence class. We have however explained how the different provisions of the EMF licence condition apply to certain licence classes in our additional simplified guidance documents. We are also preparing additional guidance for aeronautical radio licensees.
d) The definitions in the "Interpretation" section of the EMF licence condition should be moved to the main "Interpretation" section of the licence, in particular the definitions of dBi, EIRP and ERP. Alternatively, we should not include a definition of ERP in the schedule containing the EMF licence condition if the main body of the licence already has a definition of ERP. For example, in the amateur licence, the definition of ERP in the EMF licence condition duplicates the definition in note 3 of Schedule 1.	We have decided not to remove any definitions from the EMF licence condition where the same terms have already been defined elsewhere in the licence. It is in our view clearer and more user-friendly where all the definitions used in the EMF licence condition are contained within that condition (and the licensee does not have to try and find the relevant definitions elsewhere in the licence). We recognise that some licences may already contain definitions of certain terms (such as EIRP and ERP) that may be worded slightly differently to the definition in the EMF licence condition. However, the existing definitions are all substantively the same as those used in the

	EMF licence condition and we do not consider it necessary to amend them.
e) The definitions in the "Interpretation" section of the EMF licence condition should be numbered or lettered in accordance with the same formatting used in the main body of the licence.	The definitions in the EMF licence condition are all listed alphabetically and we do not consider it necessary to insert numbering or lettering in the definitions section, which may then differ across different licence types depending on their structure and format. It is also in our view appropriate to ensure consistency across all licences which are subject to the EMF licence condition.
f) The EMF licence condition correctly refers to EIRP. However, some licences (e.g. Schedule 1 of the amateur licence) refer to ERP. For consistency, all references to ERP in the licence should be converted to EIRP.	The EMF licence condition refers to both EIRP and ERP and we make clear the relationship between EIRP and ERP in our EMF licence condition and guidance documents. We do not consider it necessary to change any references in licences from ERP to EIRP although we may consider such as change as part of a future licensing review.
g) We should remove the detailed footnote which identifies the different versions of the ICNIRP Guidelines and explains that we will in the future issue a consultation on requiring licensees to comply with the 2020 ICNIRP Guidelines only. This footnote will become outdated and is unnecessary.	We have decided to keep this footnote in the EMF licence condition. Whilst the ICNIRP Guidelines may be updated again in the future, this footnote is intended to make it as clear as possible to licensees which version of the ICNIRP Guidelines they need to comply with and the process we will follow when in the future we propose to change the version of the ICNIRP Guidelines licensees are required to comply with. We have however decided to amend this footnote to clarify that the reference to a consultation is to a "public consultation" that will be published on our website.
h) The footnote to the definition of "Relevant Radio Equipment" in the EMF licence condition which states that "*10 Watts EIRP is the equivalent of 6.1 Watts ERP*" duplicates the footnote above and can be removed.	We have removed this footnote in accordance with the comment.
i) The EMF licence condition (which requires all equipment authorised to transmit in	As explained in paragraph A1.72 above, we have decided to amend the definition of

	excess of 10 Watts EIRP to comply with the general public EMF limits) is inconsistent with the guidance documents (which explain that where a licensee does not transmit above 10 Watts EIRP, they do not need to carry out an EMF assessment).	"Licensee's On-Site Radio Equipment" so that it now refers to the licensee's radio equipment that transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP. This change confirms that licensees do not need to carry out an EMF assessment and ensure compliance with the general public EMF limits where their equipment does not transmit at powers higher than 10 Watts EIRP or 6.1 Watts ERP. We have explained what we mean by "transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP" in Section 6 of our "Guidance on EMF Compliance and Enforcement".
j)	We should only require compliance "*in any area where a member of the general public is present*". The current wording which requires compliance "*in any area where a member of the general public is or can be expected to be present when transmissions are taking place*" is too restrictive and means an amateur could never operate from home on the basis a member of the general public could be expected to be in their house at any time.	We have decided to retain the current wording of the EMF licence condition. We have explained in Section 5 of our "Guidance on EMF Compliance and Enforcement" that licensees do not need to comply with the general public EMF limits in any area where they are sure a member of the general public is not, and will not, be present when transmissions are taking place. It is only when a licensee cannot be sure that they need to presume a member of the general public will be present in any areas where they can be expected to be present. Where the relevant compliance distance does not extend beyond an amateur's property, there are likely to be various scenarios when an amateur can be sure no member of the general public will be within the compliance distance when transmissions are taking place. For example, an amateur is likely to know if a family member or other member of the general public is in their property when they are transmitting and depending on the relevant compliance distance, there may be various places in the property where a member of the general public is still not within that compliance distance.

Summary of changes to EMF licence condition

A1.156 In summary, the changes we have made to the specific wording of the EMF licence condition are as follows:

a) In the footnote to the definition of the "general public", we have added the words "as amended from time to time" when we refer to pre-existing health and safety legislation which already requires employers to protect workers from EMF.

b) In the footnote to the definition of the "ICNIRP Guidelines", we have clarified that the reference to a consultation is to a public consultation that will be issued on our website.

c) We have amended the definition of "Licensee's On-Site Radio Equipment" so that it now refers to the licensee's radio equipment that transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP. We have also added new wording to the footnote stating that we explain what we mean by "transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP" in our "Guidance on EMF Compliance and Enforcement".

d) We have removed the footnote to the definition of "Relevant Radio Equipment".

e) We have amended Clause 6 to explain that the requirement to hold appropriate records relates to demonstrating compliance with the EMF licence condition rather than the general public EMF limits. As explained in paragraph 1.35 above, this is because there are some scenarios where licensees are not required to carry out an EMF assessment and ensure compliance with the general public EMF limits but are still required to hold an appropriate record demonstrating their compliance with the EMF licence condition.

Changes to "Guidance on EMF Compliance and Enforcement"

A1.157 Most of the comments we received in relation to our guidance documents concerned the additional simplified guidance for amateur and maritime radio licensees. These comments largely requested Ofcom to simplify the guidance with more practical examples to help licenses comply. Aeronautical radio licensees also asked Ofcom to produce a similar guidance document tailored to their specific use of radio equipment.

A1.158 We also received various general comments relating to our main "Guidance on EMF Compliance and Enforcement" which the licence condition requires licenses to take into account when evaluating their compliance. These comments have all been taken into account and summarised throughout this Annex.

A1.159 Listening to licensees' concerns, we have made various additions, clarifications and refinements to our "Guidance on EMF Compliance and Enforcement". We have explained these changes through this Annex and have summarised the key changes below:

a) We have added a new paragraph 3.6 in relation to licensees' use of either the 1998 or 2020 version of the ICNIRP Guidelines.

b) We have added a new sub-section to Section 6 to explain how licensees can calculate the EIRP or ERP of their equipment.

c) We have added a new sub-section to Section 6 to identify scenarios where licensees are not required to carry out an EMF assessment.

d) We have added a new sub-section to Section 6 to explain how licensees can calculate their average power.

e) We have made various other refinements in Section 6 including to the types of EMF assessment licensees can carry out and how licensees can ensure members of the general public cannot access areas within the compliance distance. In particular, we have confirmed that another way in which licensees can comply with the general public EMF limits is by ensuring their equipment is installed and operated in a way that is consistent with the compliance distance(s) calculated for a pre-assessed equipment configuration in the form of a practical example included in Ofcom's simplified guidance documents. We have also included additional information on how licensees can use signs on or next to radio equipment to ensure equipment is not used for longer than the licensee assumed in their compliance calculation.

f) We have amended Section 10 on temporary and mobile sites to clarify the circumstances in which licensees need to ensure compliance where radio equipment is installed on vehicles or moving platforms.

g) We have added a new sub-section to Section 12 to identify scenarios where licensees are not required to hold an appropriate EMF record.

h) We have made various other refinements to Section 12 in relation to the types of appropriate EMF records we would accept including to reflect the changes made in Section 6.

i) We have added a new sub-section to Section 12 which sets out the updated time periods licensees have to ensure they have appropriate and up-to-date records in place.

j) We have added a new paragraph 13.5 to clarify that the emergency exemption also applies to any routine/periodic testing of such equipment.

Variation process

Summary of representations

A1.160 Some licensees explained that they had not been made aware of our February or October 2020 consultations and that the first they heard about our proposed licence variation was when they received correspondence from Ofcom informing them of our proposal in early March 2021. Some licensees suggested they should not be expected to monitor Ofcom's website to check if we are proposing to make any changes which may affect them. Some licensees suggested that our proposals were not valid in relation to licensees that have not previously been consulted as we have not properly assessed the impact of our proposals

on them; they said we should consult again and delay any implementation of our proposals.

A1.161 Some licensees also queried whether we can in the future vary licensees without directly contacting licensees in advance to inform them of our proposal to vary their licensee. One inactive amateur licensee said he has no access to a computer or phone and that any correspondence should be sent to him in hard copy or we should include an advertisement in RSGB's RadCom magazine.

Our response

A1.162 Our February and October 2020 consultations were public consultations that were published on our website and in email updates. The purpose of these consultations was to seek feedback on and help shape our initial policy proposals before we proposed to vary individual licensees in accordance with the statutory procedure. We received nearly 500 responses to our February and October 2020 consultations.

A1.163 A wide range of persons may be impacted by a proposal and any person can respond to a public consultation including licensees, stakeholder bodies and members of the general public. Public consultations do not involve directly contacting all persons that may be impacted by a proposal. This is not a requirement of a public consultation and is unlikely to be manageable. We did nonetheless reach out to certain stakeholder and industry bodies that we have regular contact with or that expressed specific interest in our proposals.

A1.164 We recognise that there were certain stakeholder and industry bodies that we did not specifically reach out to in advance of our March 2021 Notice. We have however carefully considered the potential impact on of our EMF licence condition on all licensees throughout our consultation processes. We have also now had discussions with additional stakeholders. All comments on our EMF licence condition have been taken into account prior to us making our final decision and we have made additional amendments, clarifications and refinements to our EMF licence condition and guidance documents as a result.

A1.165 If any licensee or stakeholder body would like to be notified of future public consultations that may impact them then we encourage licensees to subscribe to our public consultations as well as radio spectrum updates using the following link https://www.ofcom.org.uk/about-ofcom/latest/email-updates. Licensees do not need to regularly check Ofcom's website but can instead be notified of public consultations via email.

A1.166 As explained in the footnote to the definition of the "ICNIRP Guidelines" in the licence condition, we will in the future issue a public consultation proposing to amend our "Guidance on EMF Compliance and Enforcement" to require licensees to comply with the 2020 ICNIRP Guidelines only. We intend to publish this public consultation once work on the relevant standards explaining the methodology for assessing compliance with the 2020 ICNIRP Guidelines has progressed sufficiently. If licensees wish to be notified of this public consultation and have the opportunity to comment on this proposal, we encourage

licensees to subscribe to our public consultations as well as radio spectrum updates using the above link. We have amended the footnote to the definition of the "ICNIRP Guidelines" in our EMF licence condition to confirm we are referring to a public consultation.

A1.167 In relation to how Ofcom may inform licensees of any proposed changes to their licence in the future, the terms and conditions of the licence and Schedule 1 of the Wireless Telegraphy Act 2006 set out the relevant rules. These rules explain that we can notify licensees of proposed changes to their licensee by one of two methods. Either we can publish a General Notice on our website or we can write to licensees directly. We are making licensees aware that in the future we intend to make greater use of General Notices. For this reason, we encourage licensees to subscribe to email spectrum updates using the above link and keep informed of regulatory changes that may impact on their licence. Licensees should then receive notifications of our proposals and be given the opportunity to comment on a proposal before any final decision is made. Where we do decide to use General Notices in the future, we also intend to engage with key industry and stakeholder bodies and would also encourage such bodies to make their members aware of our proposals.

A1.168 It is the responsibility of the licensee to ensure they comply with all the terms and provision of their licence (as they may be amended in accordance with the licence variation process set out in Schedule 1 of the Wireless Telegraphy Act 2006).

A2 Final version of EMF licence condition

The final version of the EMF licence condition is set out below and is effective immediately in all licence classes that have been varied to include the new EMF licence condition. We have identified in 'tracked' the changes we have made from the draft version of the EMF licence condition provided with our March 2021 Notice. The EMF licence condition is the same across all licences we have varied (subject only to paragraph, schedule and footnote numbering which will depend on the existing contents of the licence).

Definitions applicable to EMF Licence Condition

"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.*

"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.*

"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.*

*"**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.*[12]

"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.*[13]

[12] 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.

[13] 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 ~~consult~~ 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.

"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 ~~is authorised by another licence held by the Licensee to~~ transmit~~s~~ at powers higher than 10 Watts EIRP or 6.1 Watts ERP.*[14]

"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.*~~[15]~~

"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:*

- *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*[16] *that is higher than 100 Watts EIRP or 61 Watts ERP.*[17]
- *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.*[18]
- *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.*

"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.*

"site" *means a physical structure, building, vehicle or moving platform.*

"wireless telegraphy apparatus" *has the meaning given to it in section 117 of the Wireless Telegraphy Act 2006.*

"wireless telegraphy station" *has the meaning given to it in section 117 of the Wireless Telegraphy Act 2006.*

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[14] 10 Watts EIRP is equivalent to 6.1 Watts ERP. In linear units EIRP (W) = 1.64 x 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"*.

~~[15] 10 Watts EIRP is equivalent to 6.1 Watts ERP.~~

[16] 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.

[17] 100 Watts EIRP is equivalent to 61 Watts ERP.

[18] The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".

Licence Condition

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[19] in the relevant tables for general public exposure identified in the ICNIRP Guidelines[20] 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,*

   do not exceed the basic restrictions[21] in the relevant tables for general public exposure identified in the ICNIRP Guidelines[22] 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.[23]*

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[19] Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.
[20] The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".
[21] Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.
[22] The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".
[23] Further information on emergency situations in set out in Ofcom's "Guidance on EMF Compliance and Enforcement".

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 ~~the basic restrictions in the relevant tables for general public exposure identified in the ICNIRP Guidelines~~ 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.*

A3 Representations on Amateur Licence

A3.1 We also notified amateur licensees of some minor changes to the amateur licence to update references to legislation and correct some outdated text. We received various comments on specific wording in the amateur licence, many of which did not relate to our proposed changes. These comments and our responses are set out in Table A3.1 below.

Table A3.1 – Representations in relation to wording of amateur licence unrelated to EMF

Summary of representations	Our responses
a) There should be a space between "any" and "kind" in Clause 1(1)(b) of Section 2 of the licence.	We have corrected this in accordance with the comment.
b) Clauses 2(1)(a), 17(1)(u) and 17(1)(ss) of the licence are inconsistent with paragraph 2.14 of Ofcom's Guidance for Radio Amateur Licensees in relation to the relevant rules for amateur radio use by Foundation and Intermediate Licence holders in territorial seas; the Guidance says such use is permitted but the licence limits operation to below the water line to Full Licence holders.	We did not propose, and have decided it is not necessary to make, any changes to the amateur licence relating to the use of radio equipment by Foundation and Intermediate Licence holders in territorial waters. Clause 2(1)(a) of the licence explains that Full Licence Holders can operate their equipment both within and outside of the UK's territorial seas. Clause 2(1)(a) does not refer to Foundation and Intermediate Licence holders. This does not however mean such licensees cannot use their equipment at sea in any circumstances. The Wireless Telegraphy Act 2006 applies throughout the UK and its territorial seas. Consistent with this, the chapeau of Clause 2(1) states that the licensee can operate their equipment within the UK (including its territorial seas). Therefore, and as explained in paragraph 2.14 of our Guidance for Radio Amateur Licensees, the licence allows Foundational and Intermediate licence holders to use their equipment within the UK's territorial waters. Foundational and Intermediate licence holders cannot however use their equipment outside the UK's territorial waters.

c) The reference to footnote 6 in Clause 10(6) should instead be a reference to footnote 5 i.e. the footnote should refer to note (g) to the licence and not to note (h).	We have corrected this reference to the footnote in accordance with the comment.
d) Clause 11(4) of the licence (which prohibits transmissions for general reception subject to a few exemptions) is inconsistent with Clauses 10(1) and 10(2); the operation of unattended beacons is permitted under Clause 10 but neither attended nor unattended beacons are identified as an exemption in Clause 11(4). Ofcom should identify the use of beacons (attended and unattended) as an exemption in Clause 11(4).	We did not propose, and have decided it is not necessary to make, any changes to the amateur licence relating to the use of unattended beacons. We note that Clauses 10(1) and 10(2) of the amateur licence permit the operation of unattended beacons only where the operation of such beacons is consistent with the terms of the licence. Clauses 10(1) and (2) therefore need to be interpreted in light of the other terms of the licence including Clause 11(4) and Schedule 2. Schedule 2 of the licence permits the use of unattended beacons in certain circumstances. Such use is consistent with Clause 11(4). Clause 11(4) permits the use of radio equipment for sending messages for general reception provided such use is in accordance with Clause 11(4)(a), (b) or (c). It follows that beacons can be used to send messages in the form of initial calls in accordance with Clause 11(4)(a). It is not therefore necessary for Clause 11(4) to explicitly refer to beacons. We intend to update paragraph 2.105 of our Guidance for Amateur Radio Licensee to explain that the use of unattended beacons (other than as allowed in the notes to Schedule 2) is not permitted by the standard licence terms and conditions and requires a specific licence variation to authorise their 'keeper' to install and use them.
e) There is a missing space in the title of Clause 14 between "retransmitted" and "Messages".	We have corrected this in accordance with the comment.

f)	The definition of the "Secretary of State" as the "Secretary of State for Trade and Industry" in Clause 17(1)(g) is no longer correct.	We have amended this definition to refer to the "*Secretary of State referred to in section 5 of the Wireless Telegraphy Act 2006*".
g)	The definition of "User Service" in Clause 17(1)(qq) should be amended to refer to the "Royal Voluntary Service" rather than the "Women's Royal Voluntary Service".	We have amended this definition in accordance with the comment.
h)	The definition of the "United Kingdom" in Clause 17(1)(nn) should not say it includes the Channel Island and the Isle of Man. This definition is inconsistent with advice from the Ministry of Justice which states that "*Government officials must never state or imply that the Crown Dependencies are part of the United Kingdom, or Great Britain or England or act on that assumption*." Whilst the licence may also cover the Crown Dependencies, Ofcom should use the correct terminology and amend its definition of the "United Kingdom". For example, Ofcom could refer to the "British Islands" which is defined in paragraph 1 of the Interpretation Act 1978 as "*the United Kingdom, the Channel Islands and the Isle of Man*".	The current definition of the "United Kingdom" was included in the amateur licence in 2014. At the time, we explained that we were using this term as convenient shorthand to also cover the Crown Dependencies (i.e. the Channel Islands and the Isle of Man). We recognise that the United Kingdom does not include the Crown Dependencies and we note that we refer to the United Kingdom and the Crown Dependencies separately in our Guidance for Radio Amateur Licensees. We have decided to amend the amateur licence to refer to both the United Kingdom and the Crown Dependencies. We have amended the definition of the United Kingdom as follows: *""United Kingdom" means the United Kingdom of Great Britain and Northern Ireland*". We have also added the following new definition of Crown Dependencies in Clause 17(1)(nn): *""Crown Dependencies" means the Bailiwick of Jersey, the Bailiwick of Guernsey and the Isle of Man."*
i)	The definition of "Wireless Telegraphy Acts" in Clause 17(1)(uu) should be amended to reflect the fact the Wireless Telegraphy (Content of Transmission) Regulations 1988 are made under the Wireless Telegraphy Act 2006.	We have amended this definition to refer to "*the Wireless Telegraphy Act 2006 (as amended from time to time) and any regulations made thereunder".*

j) The footer on all pages reads “Page [x] of 20” but the document has 28 pages.	We have amended the references to page numbers in the footer to address this comment.